Volume 3 of 3 Appendices to EIS

ENVIRONMENTAL IMPACT STATEMENT

June 2006

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Environmental Impact Statement

Volume 3 of 3 Appendices to EIS

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| Chapter | Appendix | Title |
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| 11 | Appendix 11.1 | Geo-environmental Engineering Assessment |



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Dublin Waste to Energy Project, Ringsend, Dublin

Geo-Environmental Engineering Assessment

ISSUE



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Dublin Waste to Energy Project, Ringsend, Dublin

Geo-Environmental Engineering Assessment

June 2006

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1. INTRODUCTION

Dublin Waste to Energy Limited are the preferred bidder for the Dublin Waste to Energy Project, in association with Dublin City Council (DCC) as a public private partnership arrangement.

The site for the proposed facility is situated on the Poolbeg Penninsula, Ringsend, Dublin (See Figure 1). A number of previous site investigations had taken place on the site between 2001 and 2005 and these investigations identified a considerable thickness of made ground beneath the site and also noted observations of hydrocarbon contamination.

Arup Consulting Engineers have been appointed by Elsam A/S to complete a desk study of the site including a review of previous intrusive geotechnical and environmental ground investigations in order to produce a geo-environmental engineering assessment of the site as a response to concerns regarding the precise extent of the made ground/ fill material, its depth and the levels of contamination present. No additional site investigation or chemical testing of soil or groundwater from the site was undertaken to complete this assessment.

Section 2 of the report describes the proposed development in relation to the site. A desk study of the site is presented in Section 3. Section 4 describes the site investigations previously carried out on the site. Section 5 presents the ground conditions specific to the site. An appraisal of the available environmental data is presented in Section 6 followed by an appraisal of the geotechnical data in Section 7. Engineering studies undertaken are presented in Section 8 and conclusions and recommendations of Section 9 of the report.

2. PROPOSED DEVELOPMENT CONTROL

2.1 General Site Description

The proposed facility will comprise a waste to energy facility which will be constructed on a reclaimed site at Pigeon Fouse Road, Ringsend, Dublin (See Figure 1).

2.2 Concept Design

The proposed layout and elevations of the facility are contained on the following drawings produced by Elsam A/S. Relevant drawings include:

Drawing BE002 Layout Permanent Waste Facility
Drawing BE101 Layout Elevation and Distances
Drawing BH001 Layout Longitudinal Section
Drawing BH002 Layout Elevation East
Drawing BH003 Layout Elevation West
Drawing BH004 Layout Elevation North
Drawing BH005 Layout Elevation South

These drawings show the main elements to the facility including the waste bunker, waste reception hall, plant and turbine rooms and flues. External areas comprising roads / parking and landscaped areas are also indicated. A full description of the proposed facility is provided in the EIS.

2.3 Site Formation and Landscaping

The principal areas of cut and fill and land-uses within the site are shown on Figure 2. In the course of construction an amount of material will need to be excavated from portions of the site whilst fill material will be required in other parts of the site. Estimates of the main quantities are given below:

Table 2.1: Approximate Earthworks Quantities

| Cut areas | Un-bulked Volume (m³) |
|--------------------------------|-----------------------|
| Main Building (including Waste | 16,000 |
| Bunker) | 10,000 |
| Cooling water pipes | 2,000 |
| External Areas | 2,000 |
| Fill areas | Un-bulked Volume (m³) |
| Main Building (incl. Ramp) | 6,500 |
| Roads / Hardstanding | 7,000 |
| Soft Landscaped Areas | 6,000 |

The principal options of using excavated material opsite will be:

- Filling of soft landscaped area in the northern part of the site;
- Filling beneath the access ramp to the main building.

The implications and viability of realizing the excavated material on site or whether excavated material will be unsuitable for realize onsite and will require disposal off site are discussed in Section 8 of this report.

3. DESK STUDY

3.1 Site Location

The site is located in an area known as the Poolbeg Penninsula which forms the southern boundary to the entrance to Dublin Port. The principal part of the site itself is situated to the south of Pigeon House Road, east of the Synergen Dublin Bay Power Plant. The Ringsend Wastewater Treatment Plant is located immediately to the west. The auxiliary part of the site which will house the cooling water pipes is located to the north of Pigeon House Road.

3.2 Site Description

The site is rectangular in outline and extends for a distance of approximately 335 metres SSW from Pigeon House Road and is approximately 160 metres from WNW to ESE. The area of the site is approximately 5.5 Ha.

The northern portion of the site, adjoining Pigeon House Road, is currently used as a scrap metal storage and processing yard by the Clearway Disposal. Much of this area is covered by piles of scrap metal. A number of loading bays are present in the west-centre of this area.

A small office building and substantial sheet metal shed are situated in the south-western part of this area. An unbunded fuel oil tank is situated close to the east of this shed; there is evidence of recent fuel oil spillage beside this tank. The ground surface throughout this portion of the site appears to be rubble/gravel/soil with no hard standing evident.

The west-central portion of the site is occupied by Hibernian Molasses Limited and is dominated by one large and three smaller, circular above ground steel storage tanks which contain molasses. These tanks are bunded and there is a concrete surface inside the bunds. Two unbunded rectangular cylindrical steel tanks are present immediately to the northeast, located on a gravel surface – this area is used for loading/unloading. It is understood that these tanks contain blended molasses. Tanker trucks were also seen to be parked in this area. A light fuel oil tank is situated close to the site entrance on a gravel surface.

The east-central portion of the site, separated from the Hibernian Molasses premises by a high steel fence, is understood to be vacant and in the ownership of Dublin City Council and forms part of their waste water treatment facility.

A pipeline runs along the eastern boundary of the scrap yard premises, then along the northern boundary of the east-central portion of the site and continues into the Hibernian Molasses premises. We understand that this is a supply pipeline taking molasses material from ship into the molasses plant (Hibernian Molasses Limited).

The southern part of the site is largely surfaced in tarmac except for portions of the periphery which appear to be gravelled. A number of truck trailers are parked and there are also a considerable number of portable plastic storage tanks in the northern part. There is a substantial prefabricated office/storage building situated near the eastern perimeter and a smaller, similar building in the north-centre.

Pigeon House Road is at an elevation of between about +3.8 and +4.8mOD at the northern margin of the site. In general ground levels on the site itself are between approximately +3.6 and +4.7 mOD, with the scrap metal yard in the northern part of the site being slightly higher than the remainder of the site (see Figure 3). There is no appreciable sloping ground on the site.

3.3 Surrounding Land Use

The surrounding area is currently dominated by industrial utilities and fuel storage facilities including some derelict and disused industrial sites. There is also some public amenity/open space south of the site.

The Synergen Dublin Bay Power Plant is situated to the west of Shellybanks Road which runs along the western boundary of the site. The northern portion of this road is currently used by vehicles accessing Hibernian Molasses' plant.

The Ringsend Wastewater Treatment Plant is situated to the east of the site.

To the north of the site, immediately to the north of Pigeon House Road, there is an open channel which carries cooling water from the power plant into the Liffey Estuary.

The Irishtown Nature Park is situated to the southeast of the site whilst Sean Moore Park, Irishtown Stadium and Ringsend Park are situated to the east.

3.4 Site History

An historical review of the site and surrounding area has been undertaken for Dublin City Council by the RPS Group (ref. RPS 2005) and reported on under a separate cover (See EIS Chapter 16 – Archaeology). This assessment of the site was based on a review of historical maps and aerial photographs.

The study showed the site was largely underwater up to the 1970s except for a small amount of beach shingle in the northern portion of the site adjoining Pigeon House Road. In the late 1930's the old Poolbeg power station was built to the west of the site and was enlarged by subsequent land reclamation towards the east where a number of oil tanks were installed. An outfall from the power station discharged onto the existing site which was described as a lagoon contained by a sand and gravel bund situated to the south.

A sewage works and outfall is described as situated to the north of Pigeon House Road from the 1930s and possibly earlier. The Ringsend Wastewater Treatment Plant east of the site dates from c.1976-78.

The RPS report records that the site was infilled between 1970 and 1976 with a mixture of glass, rubble, concrete, ash waste, bricks, gravel and clay. A Dublin Port and Docks Board map shows the northern and central portions of the site as infilled in September 1972 (Figure 4). A handwritten addition to this drawing notes that this infilled material may possibly have consisted of hydraulic fill.

The RPS report noted that Hibernian Molasses established a plant on the site in 1979 and that the five above ground storage tanks which currently exist were recorded on the 1988 Ordnance Survey 1:1000 scale map for the area. The tanks were described in the RPS report as currently containing molasses except in the case of one smaller tank which contained light fuel oil.

The northern and southern portions of the site were reported to be coal storage sites in 1982. The northern portion of the site is mentioned as having been leased to Coal Distributors Limited prior to 1995 and since then it has been operated as a scrap metal yard.

3.5 Ground Conditions and Geology

General geological information or the study area was obtained from the following sources:

- GSI 1:100,000 scale Bedrock Geology map, Sheet 16 (Kildare-Wicklow)
- The GSI 1:50,000 soale Quaternary map of Dublin
- Nolan, S.C. 1986 The Carboniferous Geology of the Dublin Area. Unpubl. PhD thesis, Univ.Dub.
- Naylor, D. 1965 Pleistocene and post-Pleistocene sediments in Dublin Bay, *Sci. Proc. Roy.Dub. Soc.*, Series A, Vol. 2, 175-188
- Farrell, E. R., and Wall D., 1990 The soils of Dublin, *Trans. Instn. Engrs. Ireland*, 115, 78-97

Detailed geological information, data on ground conditions and environmental information was inferred from available ground investigation data for the site and adjoining areas, see Section 4.

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4. PREVIOUS GROUND INVESTIGATIONS ON SITE

4.1 General

Previous geotechnical and environmental investigations have been carried out by others to provide data on the ground conditions, the contamination levels of the soil and the hydrogeological conditions relating to the site. These investigations fall into two categories:

- Previous ground investigations on site, see Table 4.1 below and Figure 5;
- Archival ground investigations undertaken in the surrounding areas, see Table 4.2 below. Unless specifically stated otherwise these investigations have not been considered in this appraisal.

Table 4.1: Previous ground investigations on site

| Contractor | Description of Investigation | Number of Explorations | Date work carried out |
|-----------------------------------|--|---|-----------------------|
| Geotech Specialists Limited | Factual Report on Ground Investigation, Dublin Waste to Energy Project | 5 shell & auger 5 rotary core 9 trial pits 5 slit trenches | May-June 2003 |
| RPS | Soil and Groundwater Investigation at Dublin Waste to Energy, Site, Ringsend, Dublin | 7 shell & auger 18 trial pits | March 2005 |
| IGSL | Site Investigation at Waste to Energy Project, Ringsend, Dublin City | 4 shell & auger 2 rotary core 2 CPT | October 2005 |

Table 4.2: Archival ground investigations in the surrounding area

| Contractor | Description of Investigation | Number of Explorations | Issue date |
|---------------|--|--|------------|
| IGSL | Poolbeg Generating Station Site Investigation (Report available but no borehole logs or maps included) | 14 shell & auger with rotary coring 4 trial pits | 1992 |
| Norwest Holst | Ringsend Wastewater Treatment Works Investigation | 125 trial pits, 114 percussive boreholes, 35 rotary cored holes, 59 dynamic and 36 static cone probe holes | 1997 |

4.2 Fieldworks

4.2.1 Cable Percussive Boreholes

In total, 16 no. cable percussive boreholes were undertaken at the site (Figure 5). They typically extended to a depth of up to 34m bgl. Disturbed samples were taken at typically 1-2m intervals from the drill holes undertaken. Standard Penetration Tests (SPT's) were typically undertaken at 1.5-2m intervals from ground level in all of the cable percussive boreholes, except in the RPS 2005 investigations.

4.2.2 Rotary Core Drill-Holes

A total of 7 no. rotary core drill-holes were completed at the site (Figure 5). They generally were drilled to depths of 40-52m bgl. The holes undertaken during the 2003 Geotech investigation were open hole drilled to bedrock; Standard Penetration Tests (SPT's) were typically carried out at 1.5 m intervals between ground level and bedrock in the 2003 drill-holes.

4.2.3 Trial Pits

27 no. trial pits were completed within the site, see Figure 5. Disturbed bulk samples were taken from each pit.

4.2.4 Slit Trenches

5 no. slit trenches were excavated during the Geotech investigation in 2003 (Figure 5). The slit trenches were situated along the perimeter in the western and south-western portions of the site. The trenches were dug to a depth of 1.2m bgl and were 10.0 - 10.5 m in length. The slit trenches where undertaken primarily to locate services.

4.2.5 Cone Penetration Testing

Cone penetrometer (CPT) tests were carried out at two locations in the southern portion of the site during the 2005 IGSL investigation. The tests were subcontracted to the Civil Engineering Department of Trinity College, Dubling

4.2.6 Groundwater Monitoring

Standpipes were installed in 15 no. of the drillholes, as follows (see Figure 5):

- BH1, BH4, BH5, BR6, BR8, BR9 (2003);
- BH3, BH4 (2005)
- MW01, MW02, MW03, MW04a, MW05, MW06A and MW07 (2005).

Water level monitoring was carried out in 2003 in all of the 2003 installations, and in 2005 for 4 of the 2003 installations (BH1, BH4, BR6 and BR8) and all of the 2005 installations (MW01 - MW07).

4.2.7 Gas Monitoring

Gas barrel headworks were installed on the following drill holes: BH1, BH4, BH5, BR6, BR8 and BR9 (Figure 5). Gases measured included O₂, CO₂ and CH₄ and barometric pressure on one occasion only.

4.3 Environmental Laboratory Testing

Laboratory testing of selected soil and groundwater samples recovered was undertaken as follows:

4.3.1 2003 Geotech Investigations (Environmental Testing)

6 no. soil samples were tested for metals (As, Ba, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se, Zn), free/total cyanide, thiocyanate, elemental sulphur, sulphate, sulphide, hexavalent chromium, pH, TPH, PAHs and phenol index. 2 no. samples were tested for dioxins and 28 no. samples for pH/sulphates.

It should be noted that no groundwater samples were tested as part of this investigation.

4.3.2 2005 RPS Investigations (Environmental Testing)

64 no. soil samples were tested for TPH, PAHs, VOCs, metals, asbestos, pH, ammonia, total/faecal coliforms and phenols.

11 No. groundwater samples (7 from new installations /4 from 2003 installations) were tested for TPH, PAHs, VOCs, metals, pH, total/faecal coliforms and phenols.

4.4 Geotechnical Laboratory Testing

Particle size distribution and classification tests were carried out on selected disturbed samples of soil recovered from the cable percussive drill holes. Unconsolidated undrained triaxial tests and 1-D consolidation tests were carried out on selected samples recovered. Point load index tests and uniaxial compressive strength tests were carried out on rock cores recovered during rotary coring.

5. GROUND CONDITIONS

5.1 Overview

5.1.1 Geotechnical setting

A detailed geological cross section and layout of the existing boreholes at the site are presented in Figures 5 and 6. The general strattgraphy is summarised in tabular form below:

Table 5.1: Summary of General Stratigraphy

| Stratigraphic Divisions | | Lithostratigraphy and Genetic Classification | Principal Materials |
|----------------------------|------------------------|---|--|
| | Recent | Made ground (fill) | Natural earth and man made waste / made ground. |
| | Recent Conses | Marine (beach, estuarine and seabed) deposits | Generally mixed silts/clays and fine sands with shell fragments |
| Quaternary | Pleistocene- Recent | Glacial and Fluvioglacial deposits | Generally well sorted sand and gravels, typically with some cobbles, and boulders in places. Some boulder clay layers reported in places |
| Pleistocene | | Outwash/ glacio-marine clay deposit | Slightly sandy clays with some silt and sand layers. Thicker sandy silt/clay at top in places |
| | | Lodgement till/ weathered rock | Boulders, cobbles, gravel, clay, silt |
| Lower Carboniferous | | Calp Formation | Dark grey, fine grained limestone with interbedded black shale, and locally common chert |

Reviews of site investigation data in the Dublin port area (Naylor, 1965; Farrell and Wall, 1990) indicate local thickening of the Quaternary deposits in a deep channel in the bedrock surface, from -20mOD in the Ringsend/Irishtown area to -40mOD in the in the area of the site. This channel extends north-westwards through the Alexandra Basin on the northern side of the Liffey.

5.2 Geotechnical Materials

5.2.1 Made Ground

During site investigations undertaken on the site the made ground was logged as being between 1.6 m and 5.6 m in thickness across the site. It consists of a mixture of gravels, sands, silts and clays and includes rubble, bricks, concrete, glass, timber and cinder. By its nature the composition of the material is variable as can be seen from the drill-hole logs and photographs taken.

The inferred extent and thickness of the fill material at the site is shown graphically on Figure 6

5.2.2 Recent Marine Deposits

This material generally consists of loose to medium dense sandy silt and slightly clayey/silty fine sand with shells and, where logged, ranged in thickness from 0.3m to 2.5m in thickness.

5.2.3 Glacial and Fluvioglacial Deposits

This material consists of sands and gravels (generally medium dense to dense sandy gravel with shell fragments and occasional cobbles and boulders). Occasionally the material is silty in nature. Where proven, thicknesses logged varied between 10.5m and 13.3m.

5.2.4 Outwash/Glacio-Marine Clay Deposits

The upper layer of this stratum has been described as a silt with sand laminations. Where logged this material varied between 5.5 m and 6.4 m in thickness. The sand laminations of this material make it susceptible to between without good control of groundwater during drilling, as is evident from the low SPT values reported for the IGSL 2005 investigations. This material may be a glacial outwash deposit.

Below this layer a thick, possibly glacio-marine deposit is encountered. This is generally described as stiff to very stiff dark grey or black slightly sandy clay with layers and laminations of silt and silty sand. Where proven, thicknesses ranged between 15.4 m and 16.5m.

5.2.5 Limestone Bedrock

The bedrock underlying the site is described as strong, mostly thinly bedded, fine grained Limestone. Rockhead was confirmed at a number of locations within the site. Depths to rockhead varied between 36 and 45mbgl (-32mOD and -40mOD).

Closely to medium spaced fractures were described as occurring in this limestone. Some weathering of the limestone was recorded, with localised zones of brown clay, and infill along fracture planes.

5.3 Groundwater

The main aquifer beneath the site is the sand/gravel unit below the made ground (i.e. fluvioglacial sands/gravels). The made ground and underlying sands/gravels are expected to be in hydraulic continuity. The clays underlying the sands/gravels act as aquitards, restricting the downward movement of groundwater.

The water table was monitored at a depth of approximately 3-4 m bgl towards the base of the fill material across the site, close to mean sea level. The elevation of the water table at the site is expected to be heavily influenced by tidal effects given the close proximity to Dublin Bay.

7 no. monitoring wells were installed across the site during the RPS site investigation in 2005. The monitoring wells were installed to shallow depths, mostly screened across the fill material/natural ground boundary. Groundwater levels reported by RPS in March 2005 indicate a hydraulic gradient to the east towards Dublin Bay. Deeper groundwater in the limestone bedrock has not been monitored however it would be expected to be brackish to saline, discharging to Dublin Bay.

The sands/gravels although permeable do not represent a potable supply of groundwater given the close proximity to the sea and the recent history of landfilling in the area. The Ringsend area is served by a mains water supply and it is unlikely that there are any private groundwater abstractions in the area. The limestone bedrock (Calp) is classified regionally as a Locally Important Aquifer, moderately productive only in local zones (Ll).

6. APPRAISAL OF ENVIRONMENTAL DATA

6.1 Overview of Legislative Context

6.1.1 Soils

Ireland lacks specific legislation for dealing with contaminated land, however current legislation provides certain powers for dealing with contaminated land such as the Waste Management Acts 1996 – 2003 (and arising Regulations), the Local Government (Water Pollution) Acts 1977-1990, the Building Control Act 1990 (and arising 'Building Regulations'), and the Protection of Environment Act 2003.

In the absence of any national guidelines regulating levels of contamination in soils and groundwater in Ireland, it has been common industry practice to compare contaminant levels with the Dutch guideline values for soil remediation (RIVM 2000). The Dutch guidelines do not have any statutory basis in Ireland however they are widely accepted by the Irish environmental industry and by Irish regulatory authorities. This approach was applied to the sample results to initially assess the levels of possible contamination within the site. This is considered a qualitative assessment as it involves screening the results against guideline values such as the Dutch guideline values.

The Dutch soil remediation guidelines provide "Target" and "Intervention" values for a wide range of soil and groundwater contaminants. "Target" values generally represent clean up levels for soil remediation and are based on the principal of multi-functionality, where remediation must fully recover the functional properties of the soil for humans, plant and animal life. "Intervention" values represent the level of contamination above which there is a serious case of soil contamination. If the Intervention values are exceeded, clean up should be considered (unless a subsequent site specific risk assessment proves otherwise). In Ireland the "suitable for use" principle is adopted for soil remediation, where remedial action is only necessary if there are unacceptable risks to human health or the environment.

If material were to be reused or stored on site, or left in situ, a site-specific risk assessment may be required depending on the level of contamination. Site-specific risk assessment is quantitative, in that a given site (with unique characteristics) is quantitatively assessed as to the potential for hazards to impact on specific receptors, either human or environmental.

However, if soil is excavated and taken offsite it becomes a waste and there are regulations determining the levels of contamination in waste materials. The EU Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills, which formed an annex to the Landfill Directive (1999/31/EC), took effect in Ireland on 12 July 2005. This Council Decision sets limit values on waste for each landfill type based on total pollutant contents and leachate concentrations.

The transport of contaminated soils of a hazardous nature for onward disposal/recovery requires compliance with the 'C1' Waste Management (Movement of Hazardous Waste) Regulations 1998 for movement between counties, or the 'TFS' Waste Management (Transfrontier Shipment of Waste) Regulations 1998 for movement between countries in the EU. Where soil has non-hazardous concentrations of contaminants, its movement off-site is subject to the Waste Management (Collection Permit) Regulations 2001, which require the haulier to hold a waste collection permit issued by a Local Authority. The waste collection permit specifies which facilities a haulier is permitted to transport waste to and lists the registration numbers of the vehicles to be used. Hauliers are liable to prosecution if they transfer waste to a site not listed on their waste collection permit.

It is our experience that the Environmental Protection Authority (EPA) will prefer an approach whereby the excavated materials are not moved off site and the material is kept in the proximity of where it is currently situated (i.e. material is retained with the site boundary), unless the level of contamination dictates that the material is causing a significant environmental risk.

6.1.2 Groundwater

The discharge of groundwater off site to sewer or to surface water requires a trade effluent discharge license from Dublin City Council, as per Section 4 of the Water Pollution Act 1977.

Recirculating groundwater within the site is subject to prior investigation and permitting by Dublin City Council under the Protection of Groundwater Regulations, 1999 (S.I. 41 of 1999) which give effect to the Groundwater Directive 80/68/EEC. The purpose of the Regulations is to prevent pollution of groundwater by substances in List I and List II in the Annex to the Directive. The substances listed as either List I or List II are harmful to the environment because of their properties, i.e. toxic, persistent or bioaccumulable. Hydrocarbon compounds are considered List I substances under the Directive.

6.2 Site History – Potential Contaminants

The history of the site has been discussed in detail in Section 3.4 and is summarised below in relation to potential contaminants that may be present in soils and groundwater.

The site was reclaimed in the 1970's possibly with hydraulic fill. Depending on where this hydraulic fill was sourced potential contaminants present in these soils could include heavy metals and hydrocarbon compounds, as well as increased organic matter content.

The northern and southern portions of the site were historically used as a coal storage yards. The principle releases to the environment from coal storage are dust to air/soils and leachate to groundwater. Coal particles in shallow soils may give rise to elevated PAHs and TOC. Leachate from coal is governed by coal composition, in particular the presence of pyrite, and can be acidic containing PAHs and heavy metals.

The northern portion of the site is currently used as a scrap metal storage yard which may lead to elevated metals in shallow soils due to weathering of stockpiled waste metals.

The middle portion of the site is used as a storage facility for Molasses. Spillages during loading operations may lead to shallow soil and groundwater contamination with molasses. Molasses is not hazardous to human health and is naturally biodegradable, therefore is not of concern if present in shallow soils on site. Molasses may lead to reduced groundwater conditions (low dissolved oxygen) if present in groundwater.

The containment of fuels for vehicles and on site machinery across the site may give rise to additional hydrocarbon contamination of shallow soils and groundwater.

6.3 Screening of Data

In the absence of any Irish soil quality standards, the analytical results for soils have been screened against the Dutch Intervention values (RIVM 2000). Dutch Intervention values are only used for guideline purpose in Ireland as they have no statutory basis outside the Netherlands however they are widely accepted by the environmental industry and by Irish regulatory authorities. Therefore it provides an opportunity to assess the levels of possible contamination onsite against an internationally accepted set of assessment criteria. Sulphate concentrations in soil are compared to the Irish concrete standard I.S.EN 206-1:2002.

Groundwater results have been screened against the Environmental Protection Agency (EPA) Interim Guideline Values for groundwater ("Towards Setting Guideline Values for the Protection of Groundwater in Ireland", 2002). Groundwater beneath the site does not represent a drinking water source, given the history of the area and the close proximity to the sea.

Landfill gas results have been screened against guidelines published by the Department of the Environment, "Protection of New Buildings and Occupants from Landfill Gas", 1994.

6.4 Environmental Laboratory Testing

6.4.1 Soils

2003 Geotech Investigations

All soil samples were collected from the fill material and show elevated Polycyclic Aromatic Hydrocarbons (PAHs), ranging from 20,5020mg/kg.

Elevated concentrations of sulphate were detected in the fill material (811-8350mg/kg). A single high concentration (13100g/kg) was detected in one sample of estuarine sand below the fill material (borehole BH2 at 4m depth). The lowest protective threshold for sulphate for ordinary concrete is 2000mg/kg (Irish Concrete Standard I.S.EN 206-1:2002).

Total concentrations of certain metals in the fill (lead, zinc and copper) are slightly elevated but are below Dutch Intervention Values.

2005 RPS Investigations

Total Petroleum Hydrocarbons (TPH) was elevated in most soil samples analysed, ranging from 0.721-44,374mg/kg, concentrated in the fill material. There is no Dutch Intervention value for TPH however 2 no. of these samples exceed the Dutch Intervention value for Mineral Oil (5000mg/kg) – MW2 at depths of 1 m and 7 m. Speciated TPH analyses show that the elevated TPH results in the soils are predominantly concentrated within the heavier, less mobile C16-C35 carbon ranges. TPH generally decreases with depth through the fill in most locations sampled.

Elevated concentrations of PAHs (Sum of 16 compounds) were detected in the majority of samples, ranging from 0.042-120.6mg/kg. The Dutch Intervention value for PAHs (40mg/kg, based on 10 compounds) is exceeded in 8 no. samples of the fill material, probably representing local hotspots.

Trace concentrations of Benzene, Toluene, Ethylbenzene and Xylene (BTEX compounds) were detected at various depths in the fill material, the concentrations of which are well below Dutch Intervention values. Trace concentrations of Trichloroethene (TCE) up to 0.067mg/kg and Tetrachloroethene (PCE) up to 3.2mg/kg were detected in the fill material at various depths, below the Dutch Intervention values.

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Total concentrations of certain metals (lead, zinc and copper) were elevated above Dutch Intervention values in the fill material in a number of samples.

No asbestos fibres were detected in the soil samples analysed.

6.4.2 Groundwater Monitoring

2005 RPS Investigations

Physical evidence of hydrocarbon contamination was noted in the soils across the water table in all 7 No. monitoring wells installed by GES in 2005, suggesting historic free-phase product. No free-phase product was detected floating on the water surface in the monitoring wells, however some hydrocarbon product was observed in purged groundwater from 3 No. monitoring wells (MW01, MW04A, MW06A). In addition, a deep orange odourless liquid was recovered from one monitoring well during purging within the Hibernian Molasses site (BH4).

Groundwater conductivity is elevated, ranging from 2.3-34.6mS/cm indicating a high dissolved load and probable brackish-saline conditions. Groundwater temperatures were elevated up to 17.4 degrees which would suggest that degradation of waste in the fill material is still continuing.

Trace concentrations of hydrocarbons were detected in shallow groundwater from monitoring wells MW1 (TPH 14ug/l), MW2 (TPH 269ug/l), MW6a (TPH 15ug/l) and MW7 (TPH 14ug/l), as well as the deep monitoring well BR8 installed in 2003 (TPH 147ug/l). These concentrations exceed the EPA's interim guideline value for TPH in groundwater of 10ug/l.

PAHs (Sum of 16 compounds) were only detected in 2 no. wells, MW3 (0.89ug/l – lighter, more soluble PAHs) and BH1 (32.40g/l). These concentrations exceed the EPA's interim guideline value of 0.1ug/l for total PAHs in groundwater.

Boron was the only dissolved metal in groundwater that was significantly elevated above the EPA's interim guideline value of 1mg/l (maximum concentration 3.1mg/l), probably as a result of mixing with seawater, the highest concentrations are found in the samples with the highest electrical conductivities. Detected concentrations of arsenic, lead, nickel and zinc in groundwater are also slightly elevated above their respective interim guideline values, probably as a result of mixing with seawater.

No VOCs/phenols were detected in groundwater, apart from a trace concentration of Toluene (3ug/l) detected in one of the deeper wells (BH1) installed in 2003. This is below the EPA's interim guideline value for Toluene of 10ug/l.

6.4.3 Gas Monitoring

Landfill gases were measured on one occasion only (5 July 2003) for the 6 no. shallow monitoring wells fitted with gas heads. Oxygen was lower than typical atmospheric concentrations in one well (BH1 - 4.1%), suggesting ongoing degradation of organic matter. Carbon dioxide was above the 0.5% long-term exposure limit in 4 no. of the monitoring wells, indicating some continuing gas production within the fill. Methane was not detected. Note: the gas measurements were taken on a day of relatively high barometric pressure (1021mb), therefore higher concentrations/flow rates may be detected on days of lower atmospheric pressure.

Landfill gases were measured in a number of monitoring wells as part of the site investigation of the adjacent Ringsend Wastewater Treatment Plant site in 1997. Three monitoring wells were monitored adjacent to the Waste to Energy Project site: BH63, BH64 and BH67. These wells were monitored for CH₄, CO₂, O₂, and barometric pressure on 8 no. occasions in July 1997.

Carbon dioxide was detected at concentrations above the 0.5% long-term exposure limit in all three wells (maximum 13.2%). Methane was occasionally detected at trace concentrations (0.1%), below the Lower Explosive Limit of 5%. The range of variation in the concentrations detected would suggest that concentrations/flow rates vary with the tidal response of the water table. Higher concentrations of carbon dioxide and methane were detected to the southeast of the waste water treatment plant site (maximum CO₂ 21%, maximum CH₄ 19%).

Elevated landfill gases were detected to the south/southwest of the Waste to Energy Project site as part of the Ringsend Wastewater Treatment Plant site investigation in 1997. Three monitoring wells were monitored: BH72 (200m southwest of site), BH73 (100m southwest of site), and BH74 (50m south of site). These wells were monitored for CH₄, CO₂, O₂, and barometric pressure on 5 no. occasions in July 1997, and 2 no. occasions in September 1997. Methane was detected at elevated concentrations of between 27-59%, carbon dioxide was detected at concentrations between 22-32% and oxygen was either absent or detected at trace concentrations. A reclamation map by Dublin Port and Docks Board indicates that the area to the south of the site was infilled at an earlier date from 1969-1970 (see Figure 4), and a handwritten addition to this drawing notes that the infilled material consisted predominantly of domestic waste.

6.5 Summary of Results

The fill material across the site generally shows evidence of hydrocarbon contamination however concentrations of TPH and PAHs are mostly below the Dutch Intervention values. Concentrations that exceed Dutch Intervention values are likely to be associated with localised hotspots of contaminated soils. Trace concentrations of BTEX, PCE, and TCE were also detected in the fill material at concentrations below the Dutch Intervention values.

Elevated concentrations of metals (lead, copper and zinc) were detected within the fill material in a number of locations above the Dutch Intervention values, possibly related to the waste included in the fill (waste metals, etc.). Some high sulphate concentrations have also been measured in the fill material above the threshold for the protection of ordinary concrete.

There was evidence of free product in groundwater during sampling of the monitoring wells in March 2005 (i.e. an oily film), as well as a deep orange liquid in one well within the Hibernian Molasses site. Groundwater results show trace concentrations of TPH and PAHs, which slightly exceed the EPA's interim guideline values for groundwater, as well as elevated Boron probably as a result of mixing with seawater.

Limited landfill gas data for the site shows elevated concentrations of Carbon Dioxide within the fill material above the long-term exposure limit, indicating some continuing gas production. More comprehensive gas monitoring on the adjacent Ringsend Wastewater Treatment Plant site indicates highly variable concentrations of carbon dioxide, probably as a result of tidal variation of the water table. Significantly elevated concentrations of methane and carbon dioxide have been detected further to the southeast of the Ringsend Wastewater Treatment Plant site, as well as 50-100 m south/southwest of the Waste to Energy Project site.

6.6 Conclusions

6.6.1 Option: Disposal of Excavated Soils off site

6.6.1.1 Excavation Areas

For the proposed Plant Area the ground level will be reduced to a formation level of about +3mOD therefore the top 0.5-1 m of the existing ground will be excavated. This area includes the gravel-covered Hibernian Molasses yard, part of a bunded molasses tank, a fuel oil tank in the Clearway site with obvious surface oil contamination, and a storage area to the east of the Hibernian Molasses site.

Therefore the potential for hotspots of soil contamination within this area is high. The existing shallow soil results for this area (<1m) indicate TPH concentrations ranging from 3-386mg/kg and PAHs ranging from 14-100mg/kg (Sum of 16 compounds).

The proposed Waste Bunker location will be reduced to a formation level of approximately -1.5mOD which will involve an excavation of approximately 5.5m. The present ground surface in this area is mostly tarmac-covered and currently used for storage. The fill material is approximately 3.5-4 m thick in this area therefore most of the excavated spoil will be fill material. The existing soil results for this area (<5.5m) indicate TPH concentrations ranging from 4-572mg/kg and PAHs ranging from 0.1-147mg/kg. (Sum of 16 compounds).

The proposed route for the cooling pipes will be reduced to a formation level of approximately 2mOD therefore the top 2.5-3m will be excavated. The route of the proposed cooling pipes lies within the Clearway site of the existing soil results for this area (<3m) indicate TPH concentrations ranging from 2-21051mg/kg and PAHs ranging from 0-27mg/kg Sum of 16 compounds).

6.6.1.2 Classification of Excavated Soils

It is not possible to determine the exact classification of the soils for disposal to landfill without carrying out a detailed targeted environmental investigation.

However, based on the existing results the soils in the proposed Plant Area and Waste Bunker area would be considered non-hazardous waste for disposal. The concentrations of metals in these soils are not elevated to hazardous concentrations. Hydrocarbon (TPH) concentrations are below the generic hazardous threshold for oil (0.1% by weight – 1000mg/kg) where the specific nature of the oil contaminating the soil is unknown. Shallow hydrocarbon contamination in the vicinity of the proposed cooling pipes route exceeds this generic threshold and may be considered hazardous for disposal, depending on the nature of the contaminating oil. Note: the probability of local hotspots of contamination within the excavation areas is high based on the nature of the fill and current site usage.

6.6.2 Option: Retention of Excavated Soils on site

6.6.2.1 Retention as Landscaping

It would be possible to retain the excavated soils on site as landscaping, however to do this a detailed quantitative risk assessment will be required for the final retention design to prove that the retention does not pose a risk to human health or the environment.

A detailed quantitative risk assessment would consider all source-pathway-receptor linkages (i.e. pollutant linkages) associated with the retained soils, and estimate the risk associated with each pollutant linkage. Site-specific target levels (SSTLs) could then be calculated for the final retention design which would be protective of all identified human and environmental receptors.

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Only soils with contaminant concentrations below the SSTLs would be retained on site; soils that exceed the SSTLs would be disposed off site to an appropriately licenced facility. Hotspots of contaminated soils encountered during excavation would be segregated and sampled; if the concentrations detected were above the SSTLs the soils would be disposed off site.

A key consideration if the soils are re-used as landscaping would be the effect of leaching rainwater on groundwater quality. The landscaped feature could be capped with a low permeability soil cap beneath the topsoil to limit infiltration of rainwater and minimize leaching of the soils to groundwater. Consideration would have to be given in the design to venting any landfill gases that may be produced.

The potential leaching to groundwater would depend on the size, shape and slope of the designed landscaping, as well as the permeability of the soil cap. At the detailed design phase a representative number of soil samples will be collected from the areas to be excavated in order to assess the potential leaching from these soils in a landscaped feature.

There are several precedents in the Dublin area of old local authority landfills being excavated/re-deposited within a development site as landscaping without the need for waste permitting by the local authority or waste licencing by the EPA (e.g. Dublin Port Tunnel, Pfizer Deansgrange, etc.). In these cases, it had to be shown that the proposed re-use would not create a risk to human health or the environment either during construction or in the final development. Hotspots encountered during these excavations were isolated and assessed separately.

6.6.2.2 Retention beneath Main Building

The excavated soils could be re-used as an engineering fill beneath the main building.

The geotechnical properties of the excavated soils would have to be shown to be suitable as a fill material for use beneath the main building (e.g. beneath the access ramp). Such a design would need to incorporate venting for any landfill gases generated by the retained fill material. It is unlikely however that the fill material could be used as an engineering fill without treatment to improve its geotechnical properties.

6.6.3 Disposatof Groundwater off site

6.6.3.1 Option: Discharge directly into Dublin Bay

Laboratory analyses of groundwater carried out to date have only shown trace concentrations of hydrocarbons in the shallow groundwater below levels protective of seawater aquatic life (e.g. UK Saltwater EQSs). The number of parameters analysed are limited however and a number of other parameters would be required to fully assess the potential impact of abstracted groundwater on seawater quality (e.g. BOD, ammonical nitrogen, suspended solids, etc.).

Evidence of free-product was noted during groundwater sampling in March 2005 but is not apparent from the laboratory analyses. If free-product is present on site then Dublin City Council would require groundwater to be treated prior to discharge to Dublin Bay.

An example of such treatment would be an oil/water separator to remove any free-product, a bunded fuel tank for the storage of recovered product, followed by passage through an activated carbon filter to remove any dissolved hydrocarbons. For a flow rate of 80m3/hour 3 no. oil/water separators would be needed in parallel (each handling approximately 30m3/hr.) followed by 4 no. carbon filter units (each handling approximately 20m3/hr.). If there are high suspended solids in groundwater then either sand filters or a settlement unit would be required dependent on loading.

It is unlikely that Dublin City Council would grant a discharge licence to discharge directly to Dublin Bay without treatment based on the existing groundwater information.

6.6.3.2 Option: Discharge into Dublin City Council Sewerage System

Abstracted groundwater from the construction dewatering could be discharged directly to the foul sewer, subject to a trade effluent discharge licence from Dublin City Council. Dublin City Council may accept the existing groundwater results as sufficient for a discharge licence however it is likely that further analyses would be required.

Prior to applying for a discharge licence, it would need to be confirmed with Dublin City Council that the existing foul sewer/treatment facility has the capacity to take the estimated 80m3/hour of water for 6 months and whether or not pre-treatment is required (i.e. removal of any free-product prior to discharge to sewer).

This option is the preferred option and may prove to be the simplest, most cost effective solution if the existing foul sewer/treatment facility has the capacity.

6.6.4 Option: Recirculation of Groundwater within the site

The legislative context of re-circulating groundwater within the site is discussed in Section 6.1.2.

The fact that evidence of free-product was detected during sampling would mean that Dublin City Council may require groundwater to be treated prior to recirculation on site so as not to pollute groundwater in previously uncontaminated areas. The level of treatment required would similar to that required to discharge directly to Dublin Bay. In addition, this option would require an assessment as to how sest to recharge 80m3/hour of water to ground and would require the installation of injection wells or infiltration trenches on site prior to excavation.

Recharging the abstracted groundwater within the site would not be as simple as discharging to sewer, or treating groundwater and discharging directly to Dublin Bay. We do not favour this option at this stage.

7. APPRAISAL OF GEOTECHNICAL DATA

7.1 General

This section presents geotechnical information obtained during the site investigations relating to the soil and rock encountered on the site.

7.2 In-situ testing

Standard Penetration tests were typically undertaken at 1.5-2 m intervals from ground level in all of the cable percussive drillholes. The SPT 'N' values obtained in made ground, sands and gravels and glacial tills are shown plotted against depth in Figures 7 to 9 respectively.

7.2.1 Made Ground

Figure 7 shows the SPT values within this material vary between 2 and 50. Values are variable reflecting the uncontrolled nature of the filling.

7.2.2 Marine/Fluvio-Glacial Sands and Gravels

Figure 8 shows the SPT values within these materials vary between 3 and 60, most of the values being between 11 and 50. SPT values of less than 15 occur above 6m bgl indicating that the upper parts may be recent marine deposits.

7.2.3 Glacio-Marine/Glacial Tills

Figure 9 shows the SPT values within this material vary between 1 and 57; however most of the values are between 17 and 50. As referred to in Section 5.2.4, low SPT values recorded during the 2005 IGSL investigation for the upper laminated silts have been interpreted as relating to blowing in the sand laminations in this unit.

7.3 Geotechnical Laboratory Soil Testing

Geotechnical testing was carried out on selected samples taken from drillholes and trail pits in all soils. The following tests were performed:

- Atterberg limits;
- Particle Size Distribution testing;
- Undrained unconsolidated triaxial testing;
- Consolidation testing.

7.3.1 Made Ground

Classification testing carried out on the made ground is summarised below.

| Material | Moisture Content (%) | Plastic Limit | Liquid Limit | Plasticity Index |
|----------------|-------------------------|---------------|--------------|---------------------|
| Made Ground | 13% - 28% Fight | 18% - 30% | 30% - 39% | 7% - 13% |

Using Casagrande's Plasticity charts the fill material sampled can be classified as inorganic silts and clays of low to intermediate plasticity.

Bulk densities and dry densities were not measured.

MCV values on selected clayey samples ranged between 5.6 and 14.1.

7.3.2 Fluvio-Glacial Sands and Gravels

No laboratory testing of this material was undertaken.

7.3.3 Glacio-Marine/Glacial Tills

Classification testing carried out on these materials are summarised below.

| Material | Moisture Content (%) | Plastic Limit | Liquid Limit | Plasticity Index |
|--------------------|-------------------------|---------------|--------------|---------------------|
| Laminated Silts | 21% - 30% | NP | 22% - 25% | NP |
| Glacial Tills | 16% - 23% | 16%- 18% | 28% - 36% | 12% - 18% |

Using Casagrande's Plasticity charts the glacial tills can be classified as inorganic clays of low plasticity.

Bulk densities and dry densities were not measured.

6 no. unconsolidated undrained triaxial tests were undertaken on glacial till samples recovered. The shear strengths recorded in these tests were all less than 100kPa. These results are considered unrealistically low given the SPT's values recorded and information known about this material from elsewhere in Dublin. Sample disturbance and inappropriate test method are considered to be the reasons for the low results recorded.

Consolidation testing was carried out on 6 no. of the glacial till samples recovered. Over the highest stress ranges applied (400kPa) c_v values recorded varied between $6.5\text{m}^2/\text{year}$ and $50\text{m}^2/\text{year}$. Published information on tills in Dublin quote c_v values in the range of $20\text{m}^2/\text{year}$ and $60\text{m}^2/\text{year}$. Sample disturbance and low stresses applied to the samples could account for the low values recorded.

7.4 Laboratory Rock Testing

The site is underlain by Limestone. The strength of intact bedrock was obtained using two conventional test methods, the unconfined compressive strength (UCS) test; and the point load index test (PLI) expressed in Is50. UCS and PLI tests were carried out on samples recovered. The factor adopted between UCS/Is50 has been assumed to be 20 (IGSL, unpublished).

The adjusted UCS of intact rock samples tested varied from 66MPa to 172MPa.

8. ENGINEERING STUDIES

8.1 General

This section describes some of the key design issues and preliminary engineering studies, undertaken for the substructure works for the proposed facility. Brief descriptions of works are included along with envisaged construction methods. The subsurface profiles used have been based on the ground conditions and groundwater regime inferred from the ground investigations. Geotechnical design parameters have not been selected at this stage.

8.2 Substructure works and envisaged construction methods

8.2.1 Main Building

Within the main building a subsurface waste storage bunker is proposed which will require an excavation to a level of approximately – 1.5mOD (~5mbgl). As this excavation will be carried out to a depth of about 2m below groundwater level it is envisaged that the bunker will be constructed within a sheetpile cofferdam. The sheetpiles will be founded at a depth to ensure stability. Lateral support in the form of internal bracing or possibly anchors will be provided. Spoil and groundwater will be generated during the excavation.

It is proposed to support the main building and venting flues on deep foundations. Where possible it is proposed to support the structure on driven piles founded in soils above bedrock. For heavily loaded areas or areas with sensitive equipment bored piles end bearing on bedrock may be necessary. Spoil will be generated from bored piling works.

8.2.2 Cooling water facilities

The laying of part of the cooling water inlet and outlet pipes will require an excavation to a level of approximately +0.5mOD (~3mbgl).

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The excavation will be carried out in open cut where possible although sheet piled support may be necessary close to existing structures or if groundwater levels are higher than expected. Spoil and possibly groundwater will be generated during the excavation.

8.2.3 External areas

External areas will comprise roadways, parking and areas of soft landscaping.

Conventional materials used in road construction will be imported for the construction of the roads and parking areas.

The main area of soft landscaping is in the northern part of the site. Where possible it is intended to re-deposit excavated material from within the site to make up levels for the landscaped areas. Refer to Section 8.3 below.

8.3 Disposal off site/ Retention of excavated soil material

8.3.1 Appraisal of Contamination

The soil results have been discussed in Section 6.4 and summarised in Section 6.5. Conclusions regarding disposal off site/retention on site have been made in Sections 6.6.1 and 6.6.2 respectively.

8.3.2 Engineering Options

Refer to Section 2.3 for approximate un-bulked quantities of excavated material that will be generated. Engineering options for using this material are as follows:

8.3.2.1 Option 1 – Dispose of Material off site

Based on the existing results the soils in the proposed Plant Area and Waste Bunker area would generally be considered non-hazardous waste for disposal. Shallow hydrocarbon contaminated soils in the vicinity of the proposed cooling pipes route may possibly be considered hazardous for disposal. Note: the probability of local hotspots of contamination within the excavation areas is high (See Section 6.6.1).

8.3.2.2 Option 2 – Retain material on site in Landscaped Area

It would be possible to retain the excavated soils on site as landscaping, subject to the findings of a detailed quantitative risk assessment which would be required for the retention design to ensure that the excavated soils do not pose a risk to human health or the environment (See Section 6.6.2.1).

8.3.2.3 Option 3 – Retain material on site beneath Main Building

Excavated soils could only be re-used as an engineering fill beneath the main building (See Section 6.6.2.2), subject to the findings of a risk assessment and the improvement of the soil.

8.3.3 Construction Issues

Not withstanding the above options, procedures will need to be implemented / considered when undertaking the works:

1. Establishment of a materials handling protocol: This should ensure that excavated material is moved around the site in a controlled manner. Excavations would proceed according to a grid system to allow for traceability of all materials. The protocol should also ensure that all health and safety requirements are adhered to. This will include occupational exposure monitoring of site workers and at the perimeter of the site.

2. Since elevated levels of hydrocarbons were found in most soil samples and the potential for finding hotspots of contaminated soils is considered high, any excavation work should be supervised by an environmental engineer to observe for hydrocarbon hot spots within the fill material. If encountered, hotspots of hydrocarbon contamination would have to be segregated and stockpiled in a controlled manner temporarily. Analysis of the materials stockpiled would be required and depending on the results these materials may have to be removed from site for disposal, with the landfill acceptance criteria determining where the material could be disposed.

8.4 Disposal off site/ Retention of groundwater

8.4.1 Appraisal of Groundwater Contamination

The groundwater results have been discussed in Section 6.4 and summarised in Section 6.5. Conclusions regarding disposal off site/recirculation of groundwater on site have been made in Sections 6.6.3 and 6.6.4 respectively.

8.4.2 Engineering Options

During the construction phase the water table will have to be lowered during the construction of the waste bunker and possibly during the laying of the cooling pipelines below ground. For the excavation for the waste bunker we have carried out a seepage analysis and estimated the maximum unfactored steady state seepage generated during this excavation would be approximately 80m3 / hour. Approximate duration of construction has been assumed to be six months.

8.4.2.1 Option 1 – Discharge directly into Dublin Bay

It is unlikely that Dublin City Council would grant a discharge licence to discharge directly to Dublin Bay without treatment based on the existing groundwater information (See Section 6.6.3.1).

8.4.2.2 Option 2 – Discharge into Dublin City Council Sewerage System

Abstracted groundwater from the construction dewatering could be discharged directly to the foul sewer, subject to a trade effluent discharge licence from Dublin City Council. This option is the preferred option and may prove to be the simplest, most cost effective solution (See Section 6.6.3.2).

8.4.2.3 Option 3 – Recharge back into the ground within the site

Abstracted groundwater could be recirculated within the site however this option would not be as simple as discharging to sewer, or treating groundwater and discharging directly to Dublin Bay (See Section 6.6.4).

8.5 Bearing capacity of shallow footings

The bearing capacity for a soil is not a unique value. It depends on the following:

- foundation depth below ground;
- foundation dimensions;
- proximity to the crest of sloping ground;
- presence of groundwater above the foundation base

Ignoring the site topography issues, we have estimated minimum allowable bearing capacity as follows:

| Soil Type | Allowable Bearing Capacity (kPa) |
|--|----------------------------------|
| Cohesionless Fluvio- Glacial Soils | 175 |
| Cohesive Glacial Till | 250 |

Note that the values given above are presumed values. The capacity for each foundation type will need to be reviewed in the content of its depth, dimensions etc. to establish a specific capacity for individual foundation.

8.6 Deep Foundation Design

The design methodology is highly dependent on the pile type adopted and the founding levels of the foundations. This will covered in detail during detailed design.

9. CONCLUSIONS AND RECOMMENDATIONS

The ground investigations carried out at the site indicate the site is covered by up to 5 m of fill below which are extensive deposits of sand and gravels and glacial soils overlying limestone bedrock. Groundwater levels are typically im below ground level.

Geotechnical

- 1. Excavations required to construct the waste bunker within the waste building will extend into the water bearing sands and gravels. It is envisaged that the excavation will be carried out within braced retaining walls founded sufficiently deep to ensure stability of the excavation and groundwater control.
- 2. Excavated material generated from within the site would not be suitable for use as engineering fill without treatment to improve its geotechnical properties (beneath the main building / ramp).
- 3. Deep foundations required to support the main facility building will have to be installed through the water bearing sands and gravels and potentially through the underlying laminated silts which can become unstable without control of water pressures.
- 4. In external areas where roads / parking are proposed the constituents of the hard surfacing and the formation material provided will need to account for the variable composition of the existing fill material beneath.

Environmental

1. Elevated hydrocarbons are the main contaminants detected within the fill material on site. These soils would mostly be considered non-hazardous for disposal purposes however hotspots of contaminated soils are likely given the history of infilling and current site use.

- 2. The cost of disposing of the excavated soils off-site would be considerable and is the least attractive option. The preferred option would be to retain the excavated soils on site as beneath the soft landscaped areas. This will only be carried out if proven safe to both human health and the environmental through a site specific risk assessment. If the landscaping option is considered we recommend further sampling of the soils to be excavated in order to assess the potential for leaching and associated risk to the receiving environment.
- 3. Elevated sulphate concentrations were detected within the fill material at a number of locations above the threshold for the protection of ordinary concrete. We recommend that further soil sampling for sulphate is carried out during detailed design to better characterise sulphates in areas where concrete will be placed. The results of these analyses would determine whether a more chemically resistant concrete would need to be specified.
- 4. Elevated carbon dioxide was detected within the fill material above the long-term exposure limit, indicating some continuing gas production. We recommend that further gas monitoring is carried out on the existing monitoring wells at different atmospheric pressures to determine the range of gas concentrations and flow rates on site. The range of gas concentrations/flow rates with the tidal response of the water table should also be investigated. This information will be necessary to determine if any gas protection measures will be required beneath the buildings and in service trenches.
- 5. It is unlikely that Dublin City Council would grant a discharge licence to discharge groundwater directly to Dublin Bay without treatment based on the existing groundwater results. Confirmatory groundwater samples should be collected and analysed for the full suite of parameters required to support an application for a discharge licence to discharge groundwater off-site. The preferred option would be to discharge the abstracted groundwater directly to the foul sewer, otherwise costly treatment will most likely be required prior to discharge to Dublin Bay or recirculation within the site.

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GLOSSARY OF TERMS

| As | Arsenic |
|----|---------|
| Ba | Barium |

BTEX Benzene, Toluene, Ethylbenzene, Xylene

Cd Cadmium Cr Chromium Cu Copper Hg mb

mbgl

Mo

mOD

Ni

PAH

Pb

PCE

pН

Nickel
Polycyclic Aromatic Hydrocarbons
Lead
Perchloroethylene
hydrogen ion concer
Antimony Sb Se Selenium **TCE** Trichloroethylene TOC **Total Organic Carbon**

TPH Total Petroleum Hydrocarbons VOC Volatile Organic Compounds

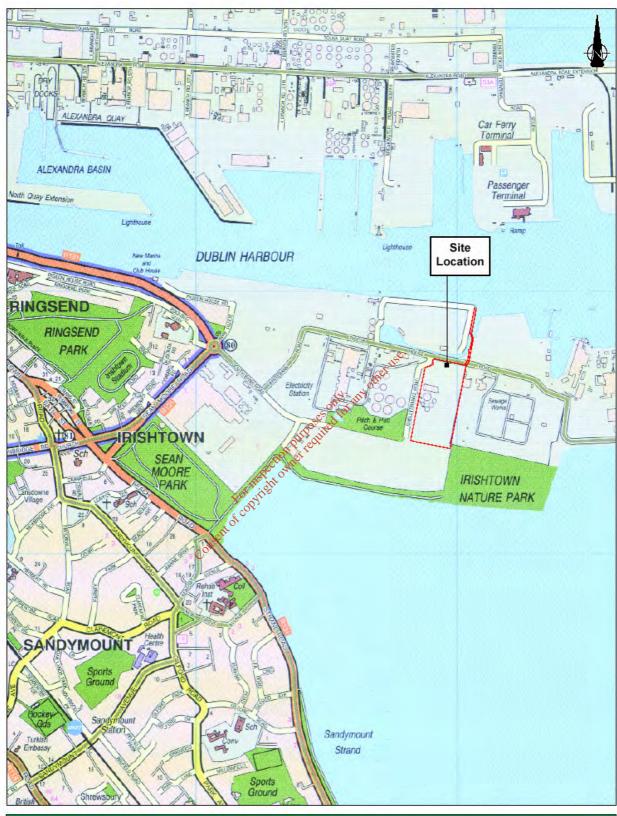
Zinc Zn

FIGURES

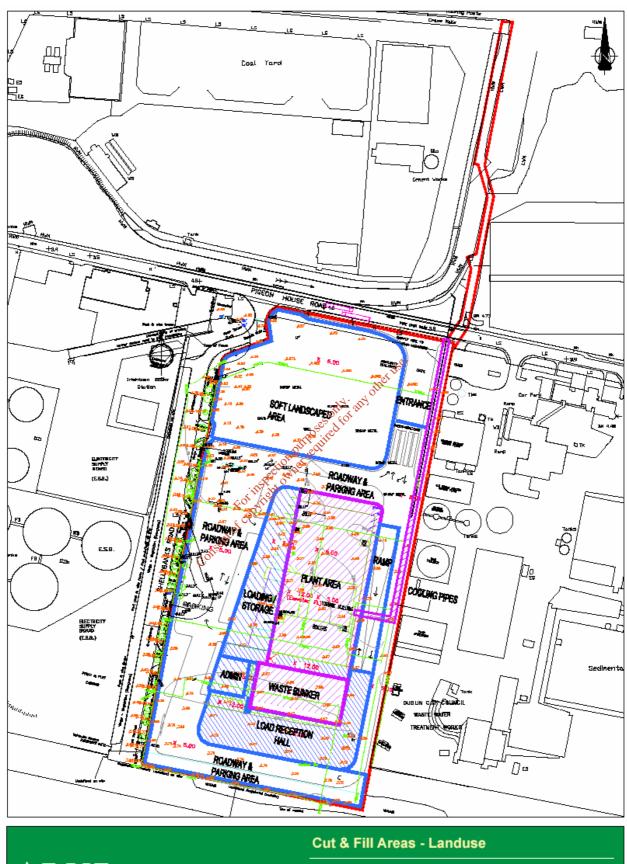


- Figure 1 Site Location Map
- Figure 2 Cut and Fill Areas
- Figure 3 Site Topography
- Figure 4 Landfill History
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- Figure 6 Geotechnical Cross Section
- Figure 7 Standard Penetration Test (SPT) Values for Fill
- Figure 8 Standard Penetration for Test (SPT) Values for Gravels
- Figure 9 Standard Penetration Test (SPT) Values for Glacio-Marine Clay / Till

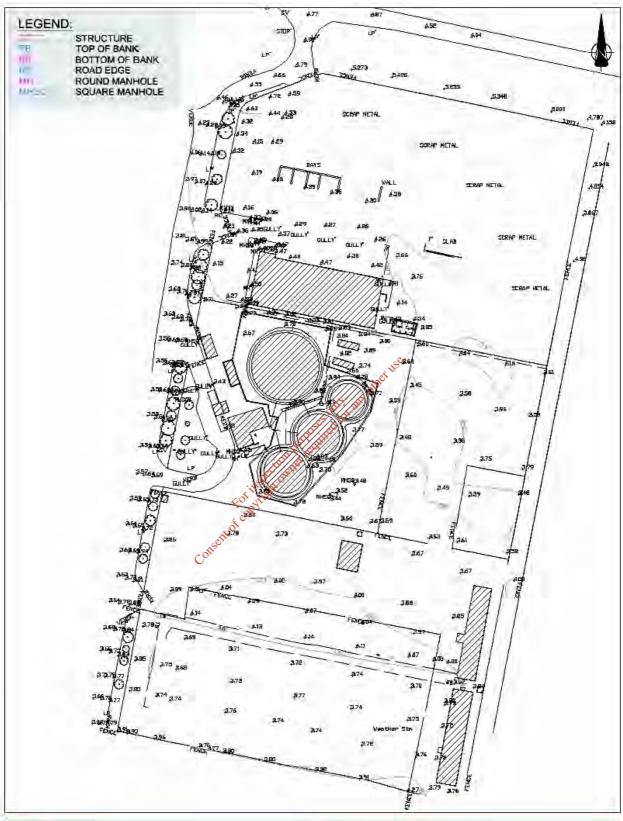




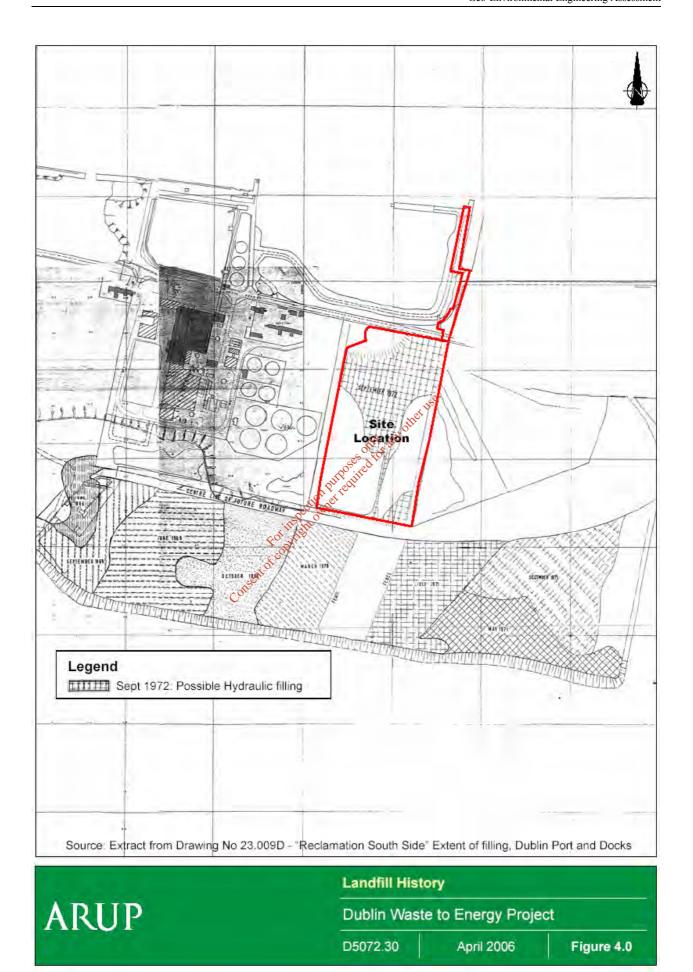


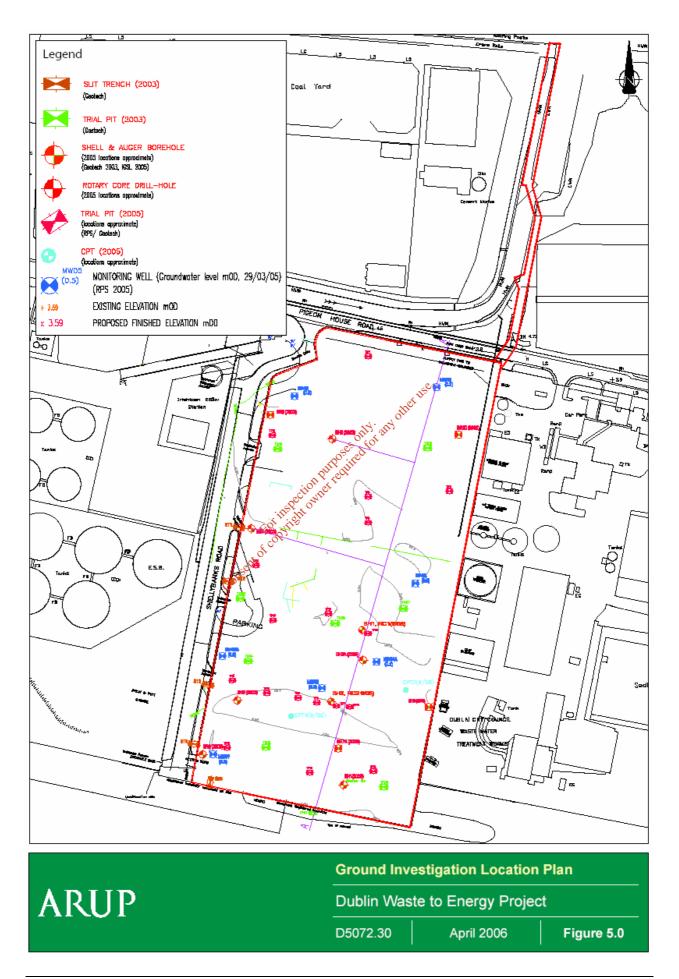


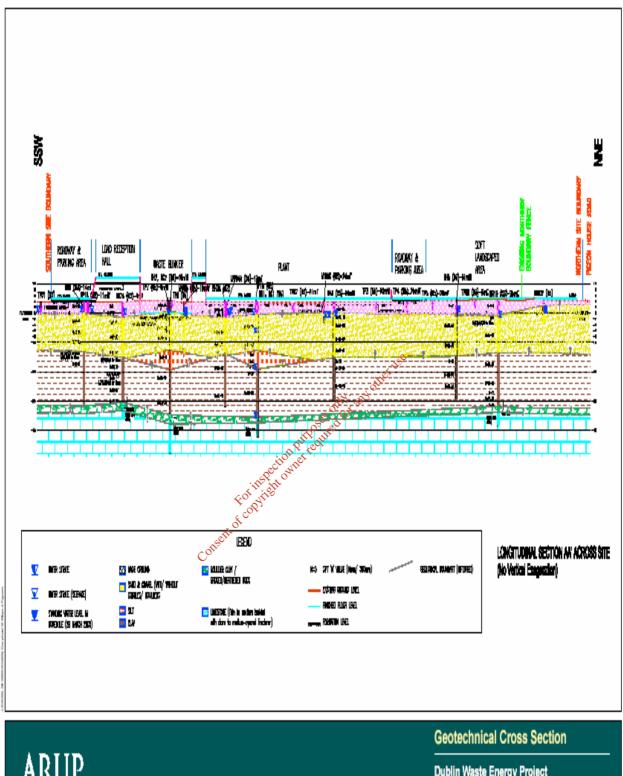
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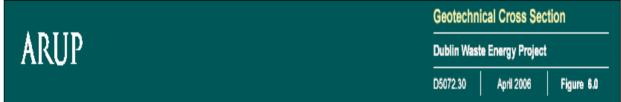


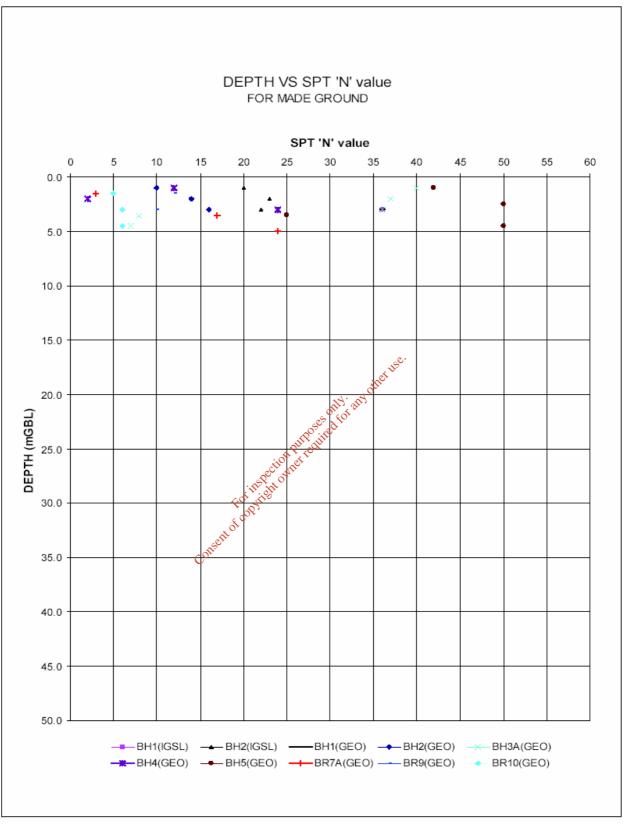


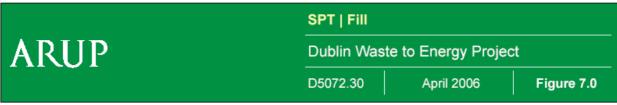


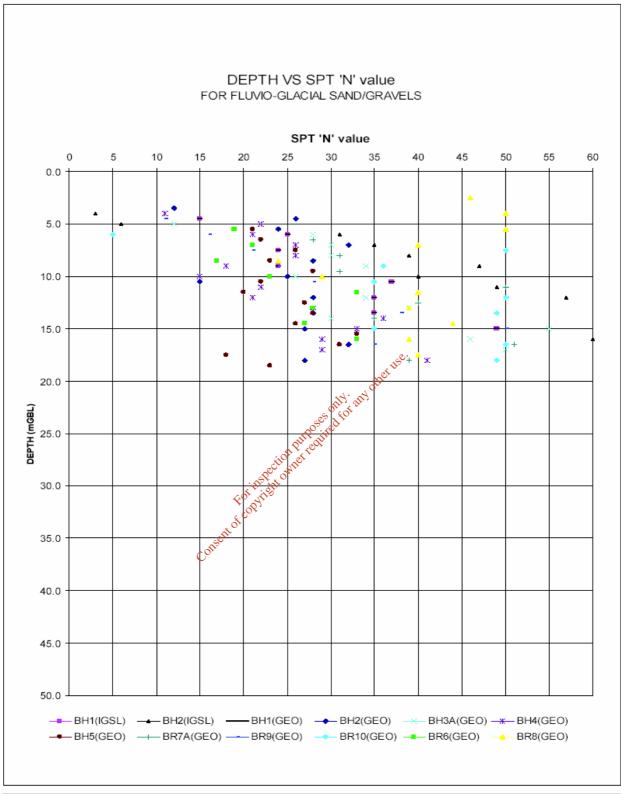


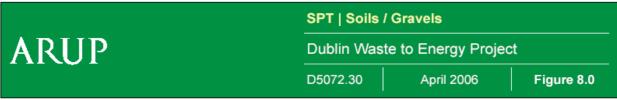


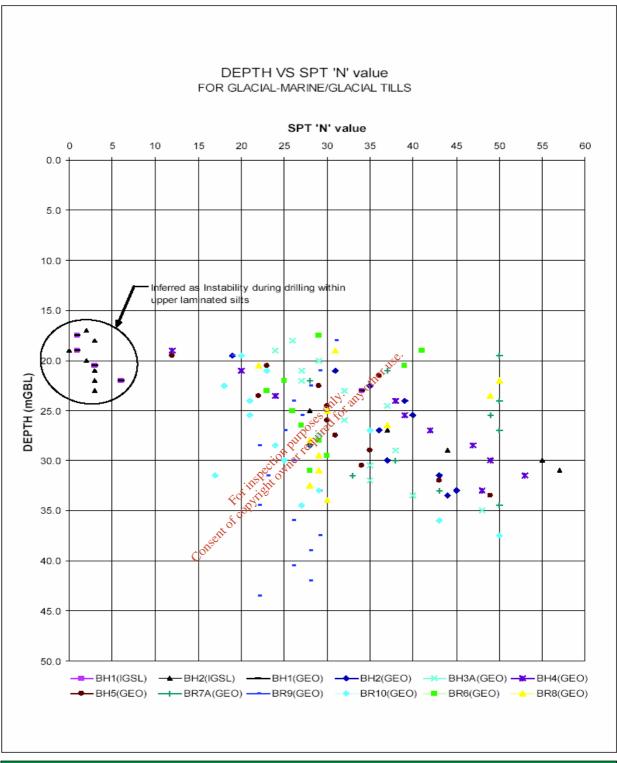


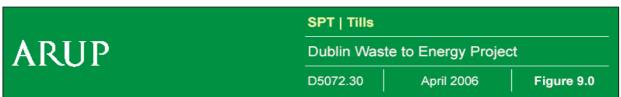






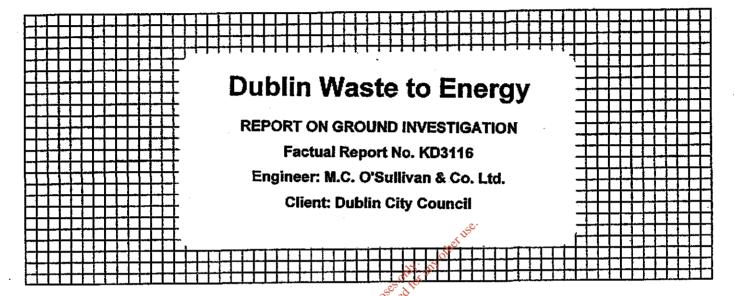








Geotech Specialists Limited



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Our Ref: EFS/034319 Your Ref: 7 November, 2003

Mr M Kelly Geotech Specialists Ltd Hartwell Upper County Kildare Eire



TES Bretby

E-mail:

PO Box 100 Ashby Road Burton-upon-Trent Staffordshire **DE15 0XD**

Telephone: 01283 554400 Facsimile: 01283 554422

enquiries@tes-bretby.co.uk

Dear Mr Kelly

Soil Sample Analysis - Dublin Waste

Please find attached an amended Table 1 for the samples from the above site with the Elemental Sulphur results that were missing from the original report.

The work was carried out in accordance with Mowlem Egvironmental Sciences Group Standard Terms and Conditions of Contract.

Consent of copyright owner Please contact me if you require any further information.

Yours sincerely

-1 Hans

J Hannah **Project Co-ordinator** 01283 554403

Proj. Directo: Proj Manager Recipient Register No. Project No. File Reference Scanned Date Recd

TEST REPORT SOIL SAMPLE ANALYSIS



Amended Report TES Report No. EFS/034319

Site: Dublin Waste

Geotech Specialists Ltd Hartwell Upper Kill County Kildare Eire

The 2 samples described in this report were scheduled for analysis by TES Bretby on Friday, 17 October 2003. This is an amended report that replaces the report issued on 31 October 2003. The analysis was completed by Friday, 7 November 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results Table of Report Notes (1 Page)

behalf of

Bretby : _ J How

annah

Project Co-ordinator

Date of Issue: 07/11/03

rked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory. Bretby accepts no responsibility for the sampling related to the above results

'ES Bretby, P.O. Box 100, Burton-on-trent, DE15 0XD Tel: 01283 554400 Fax: 01283 554422 etby is a division of Mowlem Environmental Sciences Group Registered in England Number 77628

TES Bretby = Report 034315 Control Page 1/1 Sheet

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| | Method Codes : | mg/kg BGCN22 | mg/kg ELESULP | 1_1_1_ | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICPMSS | mg/kg ICTSCN28 | mg/kg ICTSCN28 | PAHSCUV 10 | SCNCR 54 |
| | UKAS Accredited : | ves | | | \rightarrow | yes | se/ | yes | ╁╂ | +-+ | ╁╼╂ | ╀ | , Age | yes. | yes | _ | ves. |
| TES ID Number CL/ | Client Sample Description | Cyanide (Free) | Elemental Sulphur | SQ4— (acid sol) | Arsenic (MS) | Cadmium (MS) | Chromium (MS) | Copper (MS) | Lead (MS) | Mercury (MS) | Nickel (MS) | Selenium (MS) | Zinc (MS) | CN- (total) | Suiphide | PAH (screening) | Chromium vi. |
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| 21/ | TES Bretby PO Box 100, Bretby Business Park, | Contact | | Mr M Kelley | - | | | | | : " | | Ame | Amended Report | , Ķ | | 3 | اسا د کھ |
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GEOTECH SPECIALISTS LIMITED

Hartwell Upper, Kill, Co. Kildare, Ireland Tel: (045) 877201 Fax (045) 877510 Email: geotech.dublin@mesg.co.uk

Dublin Waste to Energy

REPORT ON GROUND INVESTIGATION Factual Report No. KD3116 Engineer: M.C. O'Sullivan & Co. Ltd.

Client: Dublin City Council

ancil

Consent of copyright owner required for any other use.

Client:

Dublin City Council Waste Management Services Dept. 68/70 Marrowbone Lane **Dublin 8**

Engineer:

M.C. O'Sullivan & Co. Ltd. **Consulting Engineers** Ashurst **Mount Merrion Avenue** Blackrock Co. Dublin



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| | ENCLOSURES A EXPLORATORY HOLE RECORDS B INSTRUMENTATION MONITORING C SLIT TRENCH DRAWINGS D GEOTECHNICAL LABORATORY TEST RESULTS E GEOENVIRONMENTAL LABORATORY TEST RESULTS F DRAWINGS | |



1 INTRODUCTION

In May 2003 Geotech Specialists Limited (GSL) were commissioned by M.C. O'Sullivan & Co. Ltd., (MCOS), on behalf of Dublin City Council (DCC), to carry out a ground investigation at a site in the Ringsend area of Dublin. The investigation was required to obtain geotechnical and geoenvironmental information for the proposed Waste to Energy plant.

The scope of the investigation, which was specified by MCOS, comprised cable percussion and rotary drilled boreholes, excavation of trial pits and slit trenches, and laboratory testing. The investigation was carried out in accordance with the contract specification and relevant standards (see References). The fieldwork was carried out between 14 May and 27 June 2003. This report presents the factual records of the fieldwork and laboratory testing.

2 THE SITE AND GEOLOGY

2.1 The Site

The proposed site is situated to the south of Dublin Harbour and to the west of the of the existing Poolbeg Power Station. The site is at Irish National Grid reference O 196 335, see Site Location Plan in Enclosure F.

The proposed site covers approximately 7 hectares and is generally rectangular in shape with hardstanding surfaces. The site comprises three relatively flat sections including a scrap yard, an area with above ground storage tanks and a car park. The site is bounded by Pigeon House Road to the north, Shellybanks Road and an electrical station to the west and the Ringsend Sewage Treatment Plant to the east. As indicated in the tender documents, the site may have been used as a municipal waste disposal site in the past.

2.2 Published Geology

The published geological map covering the site, GSI Sheet 16 (1995), shows the solid geology in the areas comprises dark grey to black limestone and shale of the Calp Formation (Carboniferous Age)



As reported in the project tender documents (Dublin Waste to Energy, Ground Investigation Contract, October 2002) previous investigations in the vicinity of the site indicate that the area is underlain by <u>made ground</u> overlying a sequence of sands and gravels, soft estuarine clays and silts, laminated clays, glacial till and dense coarse to very coarse granular soils, overlying Lower Carboniferous deposits of limestone.

-offsed.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930 (1999) and Part 9 of BS 1377 (1990). The exploratory hole locations were selected by MCOS as shown on the Exploratory Hole Location Plan in Enclosure F. The locations were set out by taping from local features. The final co-ordinates and reduced levels were surveyed by GSL to Irish National Grid and Ordnance Datum (Malin Head) and are shown on the logs in Enclosure A.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

| Туре | Quantity | Maximum Depth (m) | Remarks |
|----------------------------------|----------|----------------------|----------------------------------|
| Cable Percussion Boring | 5 | 36.50 | BH1, 2, 3A, 4 & 5 |
| Rotary Open Hole / Core Drilling | 4 | 49.50 | BR6, 7A, 8, 9 & 10 |
| Trial Pits | 9 | 4.40 | machine dug, TP1 to TP9 |
| Slit Trenches | 5 | 1.20 | machine and hand dug, ST1 to ST5 |

The exploratory hole records are presented in Enclosure A and should be read in conjunction with the Key included therein. The records provide descriptions, in accordance with BS 5930 (1999), of the materials encountered and details of the samples taken, together with observations made during boring, drilling, pitting and trenching. Slit trench sketches and logs are shown in Enclosure C. Photographs of the trial pits and recovered cores are presented separately.



3.3 Instrumentation and Monitoring

Standpipe piezometers were installed in borings BH1, BH4, BH5, BR6, BR8 and BR9 as shown on the logs in Enclosure A and detailed in Enclosure B. Records of groundwater and gas monitoring carried out by GSL during and after the fieldwork period are also presented in Enclosure B.

3.4 In-Situ Testing

In-situ testing was carried in accordance with BS5930 (1999) and Part 9 of BS1377 (1990) unless otherwise stated. The testing is summarised below and the results are presented on the logs in Enclosure A.

SUMMARY OF IN-SITU TESTING

| Туре | Quantity | Remarks |
|----------------------------|----------|--------------------------------------|
| Standard Penetration Tests | 269 | conducted during boring and drilling |

Standard Penetration Test (SPT) N-values ranged from less than 10 to greater than 50 (blows per 0.30 m). Tests conducted in made ground where the N-values are greater than approximately 35 is likely due to the presence of cobbles, boulders and obstructions. These values are not regarded as representative of the relative density, consistency or strength of the soil at that depth. The visual description of the consistency or density of the recovered soil samples in these layers is reported on the logs.



4 LABORATORY TESTING

4.1 Geotechnical Testing

On completion of the fieldwork all samples were transported to the Castlemartyr, Co. Cork laboratory of GSL for temporary retention and testing. The laboratory testing was scheduled by MCOS. The geotechnical testing was carried out in accordance with BS 1377 (1990) and ISRM (1981) and ISRM (1985). The testing is summarised below and the results are presented in Enclosure D.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

| Туре | Remarks |
|---|---|
| Moisture Content Determination | 20no., conducted on sealed jar (D) samples |
| Atterberg Limit Determination | 18no. |
| Particle Size Distribution Analysis | 32no. including 5no. hydrometer tests |
| pH Level and Sulphate Content of Soils | 28no. gliter |
| Moisture Condition Value (MCV) Tests | 12no conducted on bulk (B) samples |
| California Bearing Ratio (CBR) Tests | no. conducted on bulk (B) samples |
| Determination of Point Load Index Values | 10no., conducted on selected rock core samples |
| Unconfined Compressive Strength (UCS) Tests | 1no., conducted on a selected rock core sample from BR8 |

4.2 Geoenvironmental Testing

On completion of the fieldwork, samples for geoenvironmental testing were transported to the TES Bretby laboratory in Burton-on-Trent, UK and the ALControl Geochem laboratory in Dublin. The laboratory testing was scheduled by MCOS. The testing is summarised below and the results are presented in Enclosure E.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

| Туре | Remarks |
|---|--|
| ICRCL Full Suite (common contaminants) | 6no., conducted on samples from BH2, BH5 & BH8 and TP1, TP4 & TP7. |
| Total Petroleum Hydrocarbons (by GCFID) | 6no., conducted on samples from BH1, BH3A, & BH5 and TP8 |
| Dioxins | 2no., conducted on samples from TP2 & TP9 |



REFERENCES

British Standards and Codes of Practice

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 1999: Code of practice for site investigations. British Standards Institution.

Maps

GSI Sheet 16: 1995: "Kildare-Wicklow". 1:100000 geological map (solid). Geological Survey of Ireland.

Ordnance Survey Landranger Series. Sheet 50 : 2001 : Dublin Kildare Meath Wicklow. 1:50000. Ordnance Survey of Ireland.

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Dublin Waste to Energy Project, Ground Investigation Contract, October 2002.

ISRM: 1981: Rock Characterisation, Testing and Monitoring - ISRM Suggested Methods (Ed E T Brown). Commission on Testing Methods, International Society for Rock Mechanics, Pergamon Press.

ISRM: 1985: Suggested method for determining point load strength. Commission on Testing Methods, International Society for Rock Mechanics, International Journal of Rock Mechanics, Mining Sciences and Geomechanics Abstracts, Vol 22.

ICRCL 59/83: 1987: Guidance on the assessment and redevelopment of contaminated land, Department of Environment.

| Prepared By | Mike Kelley, B.Sc., M.Sc. |
|-----------------------|---------------------------|
| Approved for Issue By | Mike Kelley, B.Sc., M.Sc. |



ENCLOSURE A EXPLORATORY HOLE RECORDS

Key to Exploratory Hole Records

Borehole Logs

Trial Pit Logs

REC

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Key to Exploratory Hole Records



SAMPLES

Undisturbed

) Driven tube sample

TW Pushed thin wall tube sample

nominally 100 mm diameter and full recovery unless otherwise stated

Pushed piston sample

Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated

CBR CBR mould sample BLK Block sample

CS Core sample (from rotary core) taken for laboratory testing

Disturbed

D Small sample
Bulk sample

Other

W Water sample G Gas sample

Environmental chemistry samples (in more than one container where appropriate)

ES Soil sample EW Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was

made to take a tube sample, however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS 1377: Part 9 (1990). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow

count beyond the seating drive is given (without the N = prefix).

[V In situ vane test, peak (p) and remoulded (r)

HV Hand vane test, peak (p) and remoulded (r)
PP Pocket penetrometer test, strength value

KFH, KRH, KPI Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value

Test results provided in Field Records column

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930 (1999)

TCR Total Core Recovery, % SCR Solid Core Recovery, %

SCR Solid Core Recovery, %
RQD Rock Quality Designation, %

If Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term

non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF Core recovered (length in m) in the following run

AZCL Assessed zone of core loss N/A Not applicable

GROUNDWATER

▼ Groundwater strike

∇ Groundwater level after standing period

Notes:

Project Dublin Waste to Energy Project

Project No. KD3116
Carried out for Dublin City Council

Sheet 1

Key to Exploratory Hole Records



INSTALLATION

Standpipe/ piezometer Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

The types of instrument installed is indicated by a code in the Legend column at the depth of the response zone: Standpipe

SPIE PPIE

EPIE

Standpipe piezometer Pneumatic piezometer Electronic piezometer

INSTALLATION **LEGENDS**

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.

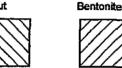
Arisings



Concrete



Grout



Sand



Gravel



NOTES

Strata legends are in accordance with BS 5930 (1999).

2

Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930: 1999, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

Evidence of the occurrence of very coarse sarticles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

Notes

The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures

REFERENCES

BS 1377: 1990: British Standard Methods of test for soils for civil engineering purposes. British Standards Institution

BS 5930: 1999: Code of Practice for site investigations. British Standards Institution

KD3116 Dublin City Council

Dublin Waste to Energy Project

Key

Sheet 2 of 2



| | Drilled by M Logged by P Checked by M | 20/05/2003 End | Equipment, Method Dando 175 cable too Hand dug inspection p Cable percussive bon Installed 50mm dia, st | drill rin | rks | | Depth from to 0.00m 13.50m 13.50m 36.50m | Diameter Casing Depth 250mm 13.50m 200mm 38.50m | Ground Level Coordinates National Grid | E 319923 02 |
|----------|--|--|---|----------------------------|---------------|--|--|---|---|--|
| l | Sample | and Test | 5 | | | Strata | | | 1 | |
| I | Depth | Type & No | Records | Date Casing | Time Water | | Description | | Depth,Level | Legend Backs |
| | 0.00-0.50 0.50-1.00 | B1 B2 | | | | Soft brown to black sand and sandy GRAVEL FILL cobbles and fragments o concrete, wood and plast subangular to subrounde (MADE GROUND) | . with subangular I brick, ic. Gravel is | | (Thickness) | |
| ļ | 1.00-1.50 | 83 | - |] | | · | | 1,00-2.50 m | Ī | \bigotimes N |
| | 120-1.85 | SPT C | N≃48 (4,46,10,14,18) | 1.20 | dry | | | Occasional boulder-sized concrete fragment | (4.00) | |
| | 3.00-3.45 3.00-3.50 3.00 | SPT C 85 W9 | N=16 (2,3/3,4,4,5) | 3.00 | dry | | | | | |
| E | 3.50 3.60-4.05 3.60-4.00 | D6 SPTS B7 | N=11 (1,2/2,3,2,4) | 3.60 | фy | | Jege. | | | |
| | - 4.00-4.45 4.00-4.50 | SPT C B8 | N=23 (3,4/4,5,6,8) | 4.00 | dry | Medium dense to dense g with shell fragments and | rev sandy GRAVEL | cemented sand | 4.00 -0.37 | |
| | 4.50 | W48 | | | | subrounded cobbles. San medium, gravel is subang fine to coarse (ESTUARI | ular to rounded | clods 7 | | |
| | 5.00-5.45 5.00-5.50 | SPT C B 10 | N=41 (6,9/9,10,11,11) | 5.00 20/05/2003 5,00 | 3.00 | fine to coarse (ESTUARI | | - - - - - | | |
| | - 6.00-6.45 6.00-6.50 | SPT C B 11 | N=33 (4,646,8,8,11) | 6.00 | FOT 200 | | | - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 | | |
| | - 7.00-7.45 7.00-7.50 | SPT C B 12 | N=25 (4,4/7,8,10,10) | 7.00 | 3,00 | · | | | | |
| | - 8.00-8.45 8.00-8.50 | SPT C B 13 | Medinist salas i viĝ | G180 | 3,00 | | | 4111111111 | ķ | |
| | 9.00-9.45 8.00-9.50 | SPT C B 14 | N=46 (6,5/9,11,12,14) | 9.00 | 3.00 | Stratum continued r | next shoet | | | |
| Ĺ | Depth | Type & No | Records | Date Casing 1 | Time Water | | | | |) · e • e |
| | (m) 1 4.50 i | Post strike behav Rose to 3,00 m a | fter 20 minutes. Stron | | (m) | Depth Related Remarks From to (m) | | | Chiselling Depths (m) Tin 1.50 - 2.90 30 7.80 - 7.80 45 | ne Tools used mins Chisel mins Chisel mins Chisel |
| at io | nes, ror explana obreviations see (vels in metres © | tion of symbols and bey sheet. All depth ratum thickness giv | s and reduced | Project | | Dublin Waste to Energy | | T | Borehole | |
| Ð | depth column. | | 2010/2003 124451 ABS | Project No. Carried ou | | (D3116 Dublin City Council | · | | | H1 et 1 of 4 |



| • | Drilled by MC Logged by PG Checked by MK | 20/05/2003 End | ì | s and Rema | rks | | Depth from to Diamete 0.00m 13.50m 250mm 13.50m 38.50m 200mm | r Casing Depth 13.50m 36.50m | Ground Level Coordinates National Grid | +3.64 E 3199 N 2334 | |
|-----------------|---|---|------------------------------------|---|-------------------|--|--|------------------------------------|---|--|-----------|
| | Samples | and Test | <u>'</u> | | | Strata | | | | | |
| | Depth | Type & No | | Date | Time | | Description | | Depth, Level | | Backfill/ |
| | 10.00-10.29 | SPTC | 50 (6,11/25,25 for 65mm) | Casing 10,00 | Water 3.00 | | | ` | (Thickness) | institution institution | trumen |
| | 10.00-10.50 | \$PT C B 16 | N=42 (7,7/8,8,14,12) | 11.00 22/05/2000 11.00 | 3.00 3 3.00 | with shell tragments and subrounded cobbles. Sar medium, gravel is subary fine to coarse. (ESTUAR) | occasional nd is fine to cular to counded | | | 000000000000000000000000000000000000000 | |
| | - 12.00-12.45 - 12.00-12.50 | SPTC B17 | N=17 (1.24.4.4.5) | 12.00 | 3.20 | | | | | 00000 | □b |
| | 13.00-13.45 13.00-13.50 | SPT C B 18 | N=28 (4,4/6,6,7,9) | 13.00 | 3.20 | | | 1111111 | | 000 | |
| | - 14.00-14.45 14.00-14.50 | SPT C B 19 | N=27 (5,5/6,7,6,8) | 14.00 | 3.20 | For its pedion purps sealized for its pedion of the pedion | Traffy lifet like. | 14.00 m | | | |
| | - 15.00-15.45 15.00-15.50 | SPT C B 20 | N=32 (4,445,6,9,11) | 15.00 | 3.20 | is ection purposes and the | | 1111111 | | | |
| | - 15.00-16.45 15.00-16.50 | SPT C B 21 | N=35 (5,5/5,8,10,12) | 18.00 | 3.20 S | For High | | | | 0.0 | |
| | - 17.00-17.19 17.10-17.53 17.10-17.60 | 0.22 SPT S B 23 | 60 (3,8/10,14,11 for 55mm) | 17.10 | | Stiff to very stiff dark grey be slightly sandy CLAY with re lenses. (ESTUARINE DEP | tre fine cand | | 7.00 -13.36 | | |
| بالديديديديدات | - 18.00-18.44 18.00-18.50 | SPT S B 24 | 55 (S.9/9,13,12 for s0mm) | 18.00 23/05/2003 18.00 | 3.20 | | | | · · | | |
| اربيبين | 19.50-19.95 19.50-19.95 | SPT S D 25 | N=30 (4,4/5,7,9,9) | 19.50 | 3.20 | Stratum continued ne | out sheet | 7777777 | | | |
| L | Depth | Type & No | Records | Date T Casing W | ime later | | | | | }> | |
| | (m) | st strike behav | ilour fter 20 minutes, Strong i | Depth seal | led (m) | Depth Related Remarks From to (m) | | ם | hisetling epths (m) Time 0.80 -10.95 45 m 2.80 -12.90 30 m 3.70 -13.95 45 m | e Tools user ins Chisel ins Chisel ins Chisel | d |
| ab lev in | tes: For explanation breviations see lea- els in metres. Strat depth column. ale 1:50 | sheet. All depths rum thickness give | s and reduced en in brackets | Project Project No. Carried out (| KE | ublin Waste to Energy 03116 ublin City Council | | E | | H1 12 of 4 | |



| Drilled by MD Logged by PG Checked by MK | Start 20/05/2003 End 26/05/2003 | Equipment, Method | s and Rema | rics | | Depth from to Diam 0.00m 13.50m 250 13.50m 36.50m 200 | neter Casing Depth Imm 13.50m Imm 36.50m | Ground Level Coordinates National Grid | Æ | 3.64 mO(319923.0 233437.3 |
|---|--|---|-------------------------------------|---------------------------------|---|---|--|--|----------------------|----------------------------------|
| Samples a | ınd Tests | | | | Strata | | | i. | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Description | | Depth, Level (Thickness) | Legend | Backfi |
| 20.00-20.50 | B 26 | N=29 (3,44,8,8,8) | 21.00 | 3.20 | Stiff to very stiff dark gre slightly sandy CLAY with ienses. (ESTUARINE DE | y brown rare fine sand POSIT). | | (This week to was) | : | Purstrum |
| 22.00-22.50 | B 28 | N=30 (4.4/6,8,8,10) | 22.50 | 3.20 | | | 1 | | | |
| 22.50-22.95 | D 29 | | | | | a. | 1111 | | | |
| 24.00-24.45 24.00-24.45 - 24.50-25.00 | SPTS D31 B32 | N=28 (5,5/5,7,7,9) | 24.00 | 3.20 | Specific Purposes only and | office the | | | | |
| 25.50-25.95 25.50-25.95 — 26.00-26.50 | SPT S D33 834 | N=31 (4,4/6,8,8,9) | 25.50 24/05/2003 25.50 | 3.20 40 ¹ 3.20 | Record | | | (18.50) | | |
| 27.00-27.45 - 27.00-27.45 - 28.00-28.50 | SPT S D 35 | N=29 (3,444,8,8,9) | 27.00 | 3.20 | | | | | | |
| - 28.50-28.95 - 28.50-28.95 | SPTS D37 | N=28 (5.5/6,6,8,6) | 28.50 | 3.20 | | | 1 | | | |
| - 29.00-29.50 | B 38 | | | | | | بالبينيس | | —; ; —; ; —; ; | |
| Depth | Type & No | Records | Date | Time | Stratum continued | next sheet | | | | 7 |
| Groundwater Entr No. Struck Pos (m) | ries st strike behav | | Depth se | aled (m) | Depth Related Remarks From to (m) | | | Chiselling Depths (m) Til | me Took | s used |
| Notes: For explanation abbreviations see key levels in metres. Stratu in depth column. Scale 1:50 | | s and reduced en in brackets sorosom spesse ABS | Project Project No Carried ou | . 1 | Dublin Waste to Energy KD3116 Dublin City Council | | | Borehole E She | 3H1 et 3 of 4 | |



| Drilled by MD Logged by PG Checked by MK | Start 20/05/2003 End 26/05/2003 | Equipment, Methods | and Remar | ks | | Depth from to Diameter 0.00m 13.50m 250mm 13.50m 36.50m 200mm | Casing Depth 13,50m 36,50m | Ground Leve Coordinates National Grid | Έ: | 3.64 mOD 319923.03 233437.37 |
|--|--|---------------------------------|---------------------------------------|---------------|---|---|---------------------------------------|---|---|------------------------------------|
| Samples | and Test | 1 | | | Strata | | | | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Description | | Depth_Level (Thickness) | Legend | Backfill |
| 30.00-30.45 30.00-30.45 | SPTS D39 | N=24 (3,3/5,5,6,8) | 30.00 | 3.20 | Stiff to very stiff dark grey slightly sandy CLAY with i lenses. (ESTUARINE DEI | brown are fine sand | · · · · · · · · · · · · · · · · · · · | (Thickness) | | Instrument |
| 31.00-31.50 | B 40 | | | | | | utter | | | |
| - 31.50-31.95 - 31.50-31.95 | SPTS D41 | N=27 (3,445,6,8,8) | 31,50 25/05/2003 33,50 | 3.20 3.20 | - | | 111341 412111 | | | |
| 33.00-33.45 33.00-33.50 | \$₽T \$ 8 42 | N=29 (4,4/5,6,8,9) | 33.00 | 3.20 | | | 1 | | | |
| 34.00-34.50 | B 43 | , | | | ,4 , | oy offer use | 1 | | -: | |
| 34,50-34,95 34,50-34,95 - - 35,00-35,50 | SPT S D 44 B 45 | N=27 (3,4/5,6,8,6) | 34.50 | 3.20 | Recovered as brown slights | S. A. | | | - - - | |
| - 35,50-35,95 | SPT S | N=31 (3.5/5,6,9,11) | 35,50 | 3.20 | aspection of the real | | 4 | • • •• •• | | |
| - 35,50-35,95 - - - 36,00-36,39 | D46 SPTC | 47 (4,6/10,12,18,7 for 10mm) | 36.00 | | Recovered as brown slights with occasional subangular cobbles. Gravel is angular fine to coarse. (possible we | o subrounded | | 35.50 <i>-31.86</i> (1. 00) | 0 0 0 20 0 0 | |
| (m) | t strike behav | | Date T Casing W | 3.20 | EXPLORATORY HOLE EN | DS AT 36.50 m | | 26.50 -32.86 Chiselling Depths (m) Tile 36.40 -36.50 45 | o a a a a a a a a a a a a a a a a a a a | : tesed |
| Notes: For explanation abbreviations see key levels in metres. Stratu in depth column. Scale 1:50 | sheet. All depth: im thickness give | s and reduced en in brackets | Project Project No. Carried out | K | ublin Waste to Energy D3116 ublin City Council | | | Borehole E She | 3 H1 et 4 of 4 | |



| miled by MD ogged by PG Necked by MK | Start 27/05/2003 End | Equipment, Metho Dando 175 cable tool Hand dug inspection Cable percussive bor | ol drailing pit to 1,20m drag to 34,00m | wics | | Depth from 0.00m 13,60m | 13.60m | 25000 | Casing Depth 13.60m 34.00m | Ground La Coordinate National G | tes j | +3.99 ; E 31984 N 23349 |
|--|----------------------------|---|---|---------------|--|-------------------------------|-----------|-------------|----------------------------------|---------------------------------------|--|--|
| | 06/06/2003 | Borehole backfilled W | vith grout. | | | - | - | | · | | | 4 |
| Samples a | 7 | | | | Strata | | | | | | | _ |
| Depth | Type & No | Records | Date Casing | Time Water | <u> </u> | Description | | | | Depth, Lev (Thicknes | ve/ Legend | d B |
| 0.00-0.50 | B1 | | | | TARMAC pavement over | ying grey a | ngular | · | - | | | iand AK |
| 0.50 | | | | | to subangular cobbles (M/ | AUE GRO | uND). | | 7 | (0.50) | | YN |
| 0.50-1.00 | ₽2 | | | | Soft grey brown to black s | lightly sand | dy | ···· | | 0.50 +3 | 3.49 | ٦ľ |
| 1 | l | | | i | CLAY and GRAVEL FILL wood, ceramics and brick | with concu | ete, | | Ē | 1 | \bigotimes | 10 |
| 1.00-1.45 1.00-1.50 | SPT C B 3 | N=10 (2,3/3,2,3,2) | 1,00 | dry | Gravel is angular to subro coarse. (MADE GROUND) | ounded fine | to | | -7 | 1 | · XXX | 41 |
| | | | | i | (MADE GROUNE | 7 | | | <u>-</u> | 1 | \bowtie | ЯK |
| 1.50-2.00 | B4 | | 1 | į. | Į. | | | | E | • | \bowtie | 11 |
| } | Ì | | | l. | (| | | | 4 | • | $\hspace{0.2cm} \hspace{0.2cm} \hspace$ | 11 |
| 200-245 | SPTC | N=14 (2,3/3,4,4,3) | 2.00 | dry | { | | | | 4 | | \bigotimes | 11 |
| 2.00-2.50 | 8.5 | • | | , | (| | | | E | · (3.10) | \bowtie | 11 |
| 2.50-3.00 | 86 | | 1 | I | 1 | | | | # | 1 | \bowtie | 11 |
| | | | | į | 1 | | | | + | ļ | \ <u>\</u> \\ | 10 |
| 3.00-3.45 | SPTC | N=16 (2,2/4,3,4,5) | 3.00 | الم | 1 | | | | 3 | Ī | | 11 |
| 3.00-3.50 | 87 | (C.P.C.P.C.P.C.P.C.P.C.P.C.P.C.P.C.P.C.P | ~~~ | dry | • | | | | 4 | 1 | \bowtie | 11 |
| | | | | i | Ţ | | | | <u> </u> | 1 | $\bigotimes\!$ | 11 |
| 3.60-3.70 3.70-4.15 | D 8 SPT S | N=12 (1,1/ 2.2,3,5) | 3.70 | 1 | Medium dense | | | | <u> </u> | 3.60 + <i>0</i> . | 39 | 11 |
| 3.70-4.15 | D 9 | | 3.70 | фŋ | SAND with rare shell fragm | nentsGrav | r∈ rei | | # | | | 10 |
| 4.00-4.50 | 8 10 | | 1 | 1 | is subangular to subrounde | ed fine to | | | 크 | 1 | - | 11 |
| | 1 | | | 1 | .A. A |) [*] | | | 3 | | نسو. اد نست ا | 11 |
| 4.50-4.95 4.50 | SPT C W 11 | N=26 (3,4/4,5,7,9) | 4.50 | 3.20 | ्ठारित वर्षा | | | | 3 | - | | 飮, |
| 4.50-5.00 | B 12 | | 1 | ł | medium. (ESTUARINE DE CONTROL DE | | | | # | (2.00) | } | |
| 5.00-5.50 | B 13 | | | 1 | 2 Bulk Chin | | | | Ē | | | 10 |
| | | ٠ | | ì | ection et l' | | | | ‡ | | ·÷:3 | 11 |
| 5.50-5.95 5.50-6.00 | SPT C | N=24 (4,4/4,8,8,8) | 5.50 | 3.20 | SPIOT | | | | 4 | | 1: | K |
| 5.50-6.00 | B 14 | • | | For | Medium dense dark grey to | multi-colo | ured | | | 5.60 -1.0 | .62 | 1 |
| | | | | 800 | is fine to coarse. Gravel is s | subangular | Sand r | | = = | | ه خو ۱ | 1/ |
| | 1 | | CORSENT | 70, | to rounded fine to coarse. (I DEPOSIT). | ESTUÁRIA | NE | | 耳 | | | 1 |
| 6.50-7.00 | B 15 | | Conser | } | - | | | | 3 | | 2 | 1 |
| | ~ | | | 1 | 1 | | | | = | | اعد و حر | N |
| 7.00-7 45 | Serv | N=23 : | | }} | , | | | | 7 | | | ' [\] |
| 7.00-7.45 7.00-7.50 | SPT C B 16 | N=32 (3,6/8, <i>8</i> ,7,9) | 7.00 | 3.20 | | | | | 3 | | | 1 |
| 1 | } | | 1 | 1 | | | | | # | | ه. وي | 1 |
| 1 | | | 1 | | | | | | 4 | | ه خر | 1 |
| ļ | 1 | | 1 | 1 | • | | | | E | | | 1 |
| | | | - |] | | | | | 土 | | | 1 |
| - | | | 1 | | | | | | 4 | | م ورور ه م | 1 |
| 8.50-8.95 8.50-9.00 | SPT C B 17 | N=28 (4,4/6,7,7,8) | 8.50 | 3.20 | | | | | 3 | | | 1 |
| | ~ " | | | j | | | | | ‡ | | | 1 |
| İ | | | 1 | j | | | | | _== | | اغرون | 1 |
| | 1 | | ł | l | | | | | 3 | | | 1 |
| ļ | - | | 1 | - | | | | | # | | 4 | 1 |
| | 1 | | | 1 | | | | | # | | | 1 |
| | | | 27/05/2003 10.00 | 3.20 | Stratum continued new | d sheet | | | E | | ه ص | 1 |
| Depth T | ype & No | Records | Date T | Time Kater | The second secon | | | | - | | | |
| undwater Entric | | VP | | | Depth Related Remarks | | | | | Chiselling | | |
| Struck Posts (m) | | | | | From to (m) | | • | | 1 0 | Depths (m) | Time Tool 45 mins Chisel | ds used |
| 4.70 Rose | ю 4.50 m aft | er 20 minutes, Slow i | | - | | i | | | , J' | ,.00 | GIES | |
| For explanation of riations see key shi in metres. Stratum | symbols and | and reduced | Project | | Publin Waste to Energy | | | | | Borehole | | |
| viations see key sh in metres, Stratum th column, | | | Project No. | . к | (D3116 | | | | [\ | | | |
| | | ornorgous taxes:16 AGS | Carried out | | Sublin City Council | | | | | | BH2 | |



| • | Drilled by Mi Logged by PC Checked by Mi | 3 27/05/2003 End | | ods and R | omarks | | Depth from to 0.00m 13,60m 13,60m 34,00m | 250mm | asing Depth 13.60m 34.00m | Ground Level Coordinates National Grid | E | 3.99 mOD 319847.27 233497.54 |
|---------|--|--|--|-------------------------------------|-------------------|--|--|------------------------|--|---|------------------------------------|------------------------------------|
| 1 | Samples | and Test | <u> </u> | | | Strata | | | | | | |
| | Depth | Type & No | Records | Date Casir | | | Description | | | Depth,Leve/ | T | Backfill |
| | 10.00-10.45 10.00-10.50 10.50-10.95 | SPT C B 18 SPT C | N=25 (3,444,7,7,7) N=15 (2,3/2,2,3,7) | 10.00 | 3.20 | Medium dense dark grey sandy GRAVEL with she is fine to coarse. Gravel is | to multi-coloured il fragments. Sand | | | (Thickness) | Legend | Instrument |
| | 10.50-11.00 | B 19 | N=28 (3,44,7,7,10) | 12.00 | 3.00 | to rounded fine to coarse. DEPOSIT). | . (ESTUARINE | | | | | |
| | 12.00-12.50 | B 20 | N=28 (4.4/4,5,5,1.2) | 13.50 | | | | | 1,11,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1 | (12.90) | , o o o o o | |
| | 13.50-14.00 - - - 15.00-15.45 15.00-15.50 | SPT C B 22 | N=27 (3,5/5,6,8,8) | 15,00 | 3.00 | For its period purple bedired h | of any other use. | | | ر و د د | 0.00 | |
| | 16.50-16.95 16.50-17.00 | SPT C B 23 | N=32 (4,4/7,7,8,10) | 16.50 | C 3.00 | For itspection and the fortist of the fortion of the fortist of th | | | | L- | | |
| | 18.00-18.45 18.00-18.50 | SPT C B 24 | N=27 (8.644,8.8,7) | 18.00 | J 5 | Stiff to very stiff dark grey br lightly sandy CLAY, Sand I ESTUARINE DEPOSIT). | own s fine. | 18.00-18 becoming o | tayey | 50 -14.51 | | |
| | 19.50-19.95 19.50-19.95 | SPT S D 25 | N=19 (3.3/4.4,4,7) | 19.50 28/05/200 19.50 | 3.00 3 3.00 | Stratum continued nex | t chaat | | 11111 | | | |
| | Depth | Type & No | Records | Date Casing | Time Water | | (4)-4 | | | | | 77 |
| No 1 | 4.70 Ros | st strike behavior | r 20 minutes, Slow i | Depth s | | Opph Related Remarks rom to (m) | | | Dej | isetting pths (m) Time 30 -14,45 30 min 50 -17.80 45 min | Tools us is Chisel is Chisel | bed |
| in de | es: For explanation reviations see key is in metres. Stratu epth column. le 1:50 | n of symbols and sheet. All depths a am thickness given to MESO Ham (201), 30 | an diacres | Project Project No Carried or | ъ. КО | blin Waste to Energy 3116 blin City Council | | | В | orehole BH Sheet | | |



| Dritted by MD Logged by PG Checked by MK | Start 27/05/2003 End 05/05/2003 | Equipment, Method | ts and Rema | rics | | Depth from 0.00m 13.60m | n to 13.60 <i>m</i> 34.00m | Diameter 250mm 200mm | Casing Depth 13.60m 34.00m | Ground Level Coordinates National Grid | ` E | 13.99 m/X 319847.27 233497.54 |
|---|--|--|-------------------------------------|--------------|--|-------------------------------|----------------------------------|----------------------------|------------------------------------|--|-------------------|-------------------------------------|
| | 06/06/2003 | | | | 0. | | | | | 1 | ** | . د |
| Samples a | | | Date | Time | Strata | | | | | | | |
| Depth | Type & No | Records | Casing | Water | | Description | on | | | Depth,Level (Thickness) | Legend | Bacid |
| 21.00-21.45 21.00-21.45 | B 26 SPT S 0 27 | N=31 (3,5/5,8,8,10) | 21.00 | 3.80 | Stiff to very stiff dark grey slightly sandy CLAY. Sar (ESTUARINE DEPOSIT) | nd is fine. | | | | | | |
| - 22.00-22.50 | B 28 | | | | | | ٠ | | | | [| |
| 22.50-22.95 22.50-22.95 | SPT S D 29 | N≃35 (4,4/5,9,10,10) | 22.50 | 3.80 | | | | | بمتينات | | | |
| 23,50-24,00 | B 30 | | | | | ,01* | | | 1 | | | |
| 24.00-24.45 24.00-24.45 | SPTS D31 | N=39 (3,57,10,10,12) | 24.00 | 3.80 | Spection purposes only and | otheruse | | | 1 | | | |
| - 25.00-25.50 | B 32 | | | | ection purporteduited | | | . • | 1 | | | |
| 25.50-25.95 25.50-25.95 | SPT S D33 | N=40 (4,48,11,10,11) | 25.50 | 3.80 For | ight o. | | | | 1 | | | |
| - 26.00-26.50 - 27.00-27.45 | B34 | N=36 (4,5/5,8,10,12) | 25.00 27.00 | 3.60 | | | | · | | (15.50) | | |
| 27.00-27.45 | 035 | (+,,e,t,,o,,tV, i2) | 21.00 | 3,00 | • | | | , | - | · | | |
| - 28.00-28.50 28.50-28.95 28.50-28.95 | SPTS D37 | N=28 (3,4/4,7,7,10) | 28.50 | 3.60 | | | | | 141111 | | | |
| 29.50-30.00 | B 38 | | | | | | | | 41144111 | | | |
| | | | Date | Time | Stratum continued a | next sheet | | | | | | |
| | Type & No | Records | | Water | | | | | [| | | |
| (m) | t strike behavi | iour fter 20 minutes. Slow | Dapth so | ealed (m) | Depth Related Remarks From to (m) | | | | | Chisetling Depths (m) Ti | ime Tool | is used |
| lotes: For explanation bbreviations see key s wels in metres. Stratus depth column. cale 1:50 | | s and reduced en in brackets , seriocoon scase AGS | Project Project No Carried ou | s. F | Oublin Waste to Energy CD3116 Oublin City Council | | | | | Borehole E | BH2 eet 3 of 4 | |



| Orilled by MD Logged by PG Checked by MK | Start 27/05/200 End 06/06/200 | 1 | s ≠nd Rema | rics | - | Depth from to (0.00m 13.60m 13.60m 34.00m | Nameter (250mm 200mm | asing Depth 13.60m 34.00m | Ground Leve Coordinates National Grid | E | 13.99 m() 319847,2 233497.5 |
|---|--|---------------------------------|----------------------|---------------|---|--|-----------------------------|---------------------------------|---|------------|-----------------------------------|
| Samples | and Test | s | - | | Strata | | <u> </u> | | | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Description | | | Depth_Level | 7. | Bacid |
| 30.00-30.45 30.00-30.45 | SPT S D 39 | N=37 (4,4/7,8,11,11) | 30.00 | 3,60 | Stiff to very stiff dark gre | ne horsen | | | (Thickness) | Legend | Instrum |
| | 5 | | | | slightly sandy CLAY, Sa (ESTUARINE DEPOSIT | ind is fine. | | 3 | | | |
| | 1 | | 1 | i | (CO. O. AUNE DELOGI | <i>-</i> | | - | | | 11 |
| | İ | | | | ٠. | | | 7 | | -:- | // |
| 31.00-31.50 | B 40 | | | | | | | E | | [] | |
| | 1 | | | | | | | # | | I.≕ ∄ | |
| 31.50-31.95 31.50-31.95 | SPT S D 41 | N=43 (5,7/8,10,11,14) | 31.50 | 3.60 | | | | 3 | | F | |
| - 1100 01110 | 541 | | | | - | | | 3 | | | |
| | ł | } | | - 1 | | | | # | | | |
| | | | | | | | | E | , | | |
| 32.50-33.00 | 8 42 | | | I | | | | | | :- | |
| | } | | 1 | I | | • | | - 4 | ĺ | | 11 |
| 33.00-33.44 | SPTS | 45 (8,7/10,10,13,12 for 65mm) | 33.00 | | | | | E | | | |
| 33.00-33.45 | D43 | -5 (0,17 (0,10,15,12 for gonga) | 33.00 | 3.60 | | | | | | · — : - | |
| 33.50-33.95 | | | 05/06/2003 33.00 | 3.60 | | | | # | | | |
| 33,50-33,95 | SPTS D44 | N=42 (5,5/8,8,10,16) | | | | | | - 1 | | : - | |
| | | | 06/06/2003 33.50 | 3.40 | | . 115e. | | E | | <u>-</u> - | |
| | | | | | EXPLORATORY HOLE E | NDC 4704 W | ·- | | 4.00 -30.01 | | 77 |
| | | | | | 40.00000 | A STANDIN | | 3 | j | | |
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| | | | _ | [| | | | 3 | | - 11 | |
| Depth 1 | Type & No | Records C | Date Tin asing Wa | ne ter | | | | | | | |
| indwater Entrie Struck Post | es Strike heber | | Do-st | J 5 | epth Related Remarks | | | | iselling | | |
| (III) | | | Depth seale (n | a Fi | om to (m) | | | | agas (w) 13we agas (w) | Tools u | sed . |
| a.ru Kose | : 10 4.5U M 2ft | er 20 minutes. Slow ing | e ss | • | | | | | | | |
| | | | | ŀ | | | | | | | |
| For explanation o | f symbols and | | roject | | Sm Wignes 4 - ** - | | | | | | |
| riations see key shin metres. Stratum th column. | neet. All depths othickness give | and reduced in brackets | - | | (in Waste to Energy | | | B | xehole | | |
| | | | roject No. | | 116 | | | | BH | 12 | |
| | S NESC HER CON 2 | 0,00300 157234 198 | erried out fo | r Dub | lin City Council | | | | Sheet | 14 | i i |



| | Drilled by MD Logged by Jt. Checked by MK | 67/06/2003 End | Equipment, Methods Dando 175 cable tool di Relocated from BH3 du Hand dug inspection pit Cable percussive boring | irill rig ue to obstruction it to 1,20m. a to 35.50m. | | Depth from to Diameter Casing De 0,00m 16.00m 250mm 16.00m 16.00m 35.50m 200mm 35.50m | Coo | und Level rdinates onal Grid | E | 3.59 mOD 319938.91 233526.20 |
|-----|---|---|--|--|---------------|---|---|------------------------------------|---------------------------|------------------------------------|
| 1 | Samples | and Tests | Rombole haddiled with | | | Strata | _ | | | _ |
| | Depth | Type & No | Records | | Time Water | Description | | th,Level | Legend | Backfill |
| l | 0.00 0.00-0.50 | B1 | " " " " " " " " " " " " " " " " " " " | 1 | | TARMAC pavement over roadstone (MADE | 1 | | XX | Instrume |
| | 0.50-1.00 | 82 | 1 | | | GROUND) Soft dark brown sandy gravelly CLAY and | | +3.29 | XX | 111 |
| | - | | ! | | | ASH FILL with occasional subrounded cobbles and fragments of brick, concrete and plastic. (MADE GROUND) | ======================================= | | \bigotimes | |
| | - 1.20-1.65 | SPTC | N=40 (3,4/4,8,10,18) | 1.20 | | 1.20-1.70 a | | | | 11) |
| i | - 1.20-1.70 | B3 | 1 | | į | ار احتراد ا Concret cobbles an boulder | : - | | ₩ | 111 |
| ł | <u>-</u> | -{ | | | | ooude: | | | \bigotimes | |
| | 2.00-2.45 2.00-2.50 | SPTC B4 | N=37 (6,6/7,8,12,10) | 2.00 | | | 7 | (3.30) | \bigotimes | |
| ļ | | | ı | | | | 1 | | | 111 |
| ļ | <u>-</u> | | † | | | | 1 | | \bigotimes | |
| (23 | 3.00-3.45 3.00-3.50 | SPTC 85 | N=36 (5,7/7,8,9,12) | 3.00 | | | 4 | | \bigotimes | |
| | | " | 1 | | | | ‡ | | | #// |
| ŀ | - 3.60-4.05 - 3.60-4.00 | SPTS B6 | N=8 (2,1/1,2,3,2) | 3.60 | | Soft black sandy slightly gravelly CLAY | 3.60 | 0.01 | \bowtie | |
| | 4.00-4.50 | 87 | 1 | 07/06/2003 4.00 08/06/2003 | 3,30 | | 4 | | XX | |
| ı | - | | 1 | 08/06/2003 35.00 | 3.20 | (MADE GROUND). |] | ol teur | ₩ | M |
| ļ | 4.50-4.95 4.50-5.00 | SPTS D8 | N=7 (2,2/2,2,1,2) | 4,50 | | es of for all, |] | (1.60) | \bigotimes | 11 |
| 1 | <u> </u> | 1 | | | | nuthatited | = | | ₩ | 111 |
| | - 5.20-5.65 - 5.20-5.70 | SPTC B9 | N=12 (2.3/3.2.3.4) | 5.20 | | FILL with fragments of concrete and ceramics and rare pockets of sity sand. (MADE GROUND). Medium dense to dense dark grey sandy | 5.20 | -1.61 | | |
| ļ | | | 1 | | 13 | Stables and shell fragments. Sand is | ‡ | | 0 | 11) |
| ļ | <u> </u> | | | | FOI! | ne to medium. Gravel is subangular to subrounded fine to coarse. (ESTUARINE DEPOSIT). | 1 | | 0 | 111 |
| l | - 6.00-6.45 - 6.00-6.50 | SPT C B 10 | N=26 (4,4/7,7,6,5) | 6.00 | oti | |] | | 000 | |
| 1 | <u>-</u> | | | Courser | | |] | | PO 0 | |
| | <u>_</u> | | 1 | | | | ‡ | | 200 | 111 |
| | 7.00-7.45 | SPT C B 11 | N=30 (3,345,5,8,10) | 7.00 | | | 1 | | 1 9 | |
| ļ | <u> </u> | | 1 | | | | ‡ | | 2 | 111 |
| | <u>-</u> | | 1 | | | · | ‡ | | 200 | 111 |
| | 8.00-8.45 8.00-8.50 | SPT C B 12 | N=30 (4,4/7,7,7,9) | 8.00 | | | 4 | | المامة ط | |
| ļ | <u> </u> | | • | | | | 3 | | 0.0 | 111 |
| 1 | - - - - | | | | | |] | | | |
| | - - 9.00-9.45 - 9.00-9.60 | SPT C 8 13 | N=34 (6,6/7,8,8,11) | 9.00 | | | = | | | 111 |
| ļ | 9.00-9.50 - | B 13 | 1 | | | | 4 | | | 111 |
| } | - - | | t | | | | # | | 0 | |
| | | | | <u> </u> | TIP | Stratum continued next sheet | 1_ | ***** | 00.0 | 77 |
| | Depth Groundwater | Type & No | Records | Date Casing 1 | Time Water | Denth Related Parenter | +- | | | |
| ^ . | (m) | Post strike beha | sviour after 20 minutes. Slow | Depth se vingress | saled (m) | Depth Related Remarks From to (m) | Dept | | Time Too 90 mins Chise | ois used ei |
| | Notes: For evelop | nation of symbols an | d . 1 | Project | | Dublin Waste to Energy | +- | phot- | | |
| ļ | abbreviations see levels in metres. S in depth column | nagon of sympols an blory sheet. All depti Stratum thickness gi | ths and reduced even in brackets | Project No. | s . | KD3116 | Bo | rehole E | знза | |
| | Scale 1:50 | | 17, 2010/2000 12:45:44 AGS | Carried ou | | Oublin City Council | 1 | Sh | eet 1 of 4 | · : |



| : | Drilled by MD Logged by JL | Start 07/06/2003 End | Equipment, Method | s and Rema | rks | Depth from to Diameter Casing Depth 0.00m 18.00m 250mm 16.00m 16.00m 35.50m 200mm 35.50m | Coordinates | E 319935,91 |
|----------|---|--------------------------------------|--|--|------------------------|--|--|---|
| | Checked by MK | 13/06/2003 | <u> </u> | | | | National Grid | N 233526.20 |
| | Samples a | ınd Test | \$ | | | Strata | | |
| ı | Depth | Туре & No | Records | Date Casing | Time Water | Description | Depth,Level (Thickness) | Legend Backfill |
| | 10.00-10.45 10.00-10.50 | SPT C 8 14 | N=26 (4,4/8,5,5,8) | 10.00 | | Medium dense to dense dark grey sandy GRAVEL with occasional subrounded cobbles and shell fragments. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse. (ESTUARINE | | |
| | 11.00-11.45 - 11.00-11.50 | SPT C 8 15 | N=22 (3,44,7,2.9) | 11,00 | | DEPOSIT). | (12.40) | |
| | | SPT C B 16 | N=34 (4,444,8,8,14) | 12.00 | | | | |
| | 13.00-13.45 - 13.00-13.59 | SPT C B 17 | N≃39 (6,6:8,8,10,13) | 08/06/200: 13.00 09/06/200: 13,00 | 3.30 3 0800 3.20 | | | |
| | - 14.00-14.45 - 14.00-14.50 | SPT C B 18 | N=30 (5,4/5,6,8,11) | 14.00 09/06/2003 14.00 | 3 1800 3 20 | For inspection purposes only any other use. | | 0 0 |
| | - 15.00-15.33 15.00-15.50 | SPT C B 19 B 20 | 55 (4,8/10,20,25 for 25 _{cmm}) | 15,00 | 3.20 | inspection purposes like the | | |
| | - 16.00-16.40 | \$PTS | 46 (5,6/9,12,17,8 for 25mm) | 16.00 | onsen | For Field | | |
| | - 17.00-17.45 17.00-17.50 | SPTS B21 | N=50 (6,8/8,10,14,18) | 10/06/2003 17.00 11/06/2003 17.00 | 1860 3.20 | | | |
| | 17.60-18.00 - 18.00-18.45 18.00-18.50 | D 22 SPT S B 23 | N=26 (4,444,6,8,8,8) | 18.00 | | Stiff to very stiff grey brown stightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT). | 17.60 -14.01 | |
| Trititi | - 19.00-19.45 19.00-19.45 | SPT S D24 | N=24 (3,314,8,7,7) | 19.00 | | · · · · · · · · · · · · · · · · · · · | | 1.1.1.1. |
| F | | | | | | Stratum continued next sheet | [- | |
| | Depth | Type & No | Records | Date Casing V | Time Vater | | | |
| | Groundwater Entri No. Struck Post (m) 1 4.10 Rose | t strike behav | riour fler 20 minutes. Slow in | Depth se | tled (m) | Depth Related Remarks From to (m) | Chiselling Depths (m) Tin 11.80 - 11.95 30 12.60 - 12.85 45 | ne Tools used mins Chisel mins Chisel |
| in in | iotes: For explanation abbreviations see key s rivels in metres. Stratus depth column. | sheet. All depth; m thickness giv | s and reduced | Project Project No. Carried out | . * | ublin Waste to Energy D3116 ublin City Council | | H3A et 2 of 4 |



| Drilled by MD Logged by JL Checked by MK | Start 07/06/2003 End 13/06/2003 | Equipment, Methods | s and Rema | 11 (3 | Depth from to Diameter Casing Dep 0.00m 16.00m 250mm 16.00m 16.00m 35.50m 200mm 35.50m | th Ground Level Coordinates National Grid | E | 3.59 31990 2335 |
|--|--|--|--------------------|----------------|--|---|-----------------------------|-----------------------|
| Samples a | |) | | | Strata | ٦ | | |
| Depth Depth | Type & No | Records | Date | Time Water | Description | Depth, Level | Legend | В |
| 20.00-20.45 | SPTS | N=29 (2,3/8,6,7,8) | Casing 20.00 | Water | Stiff to very stiff grey brown slightly | (Thickness) | | lns: |
| 20.00-20.45 | D 25 | - | | Ì | sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT). | 4 | 1-3 | K |
| 20.50-21.00 | B 26 | | | ļ | |] | F - | 1 |
| | 1 | | | 1 | | ‡ | 1 -:- | 1 |
| - 21.00-21.45 | SPTS | N=27 (4,4/6,6,7,8) | 21.00 | i | | 4 | - | 1 |
| 21.00-21,45 | 027 | · | 1 | 1 | | 3 | [- <u>-</u> -: | K |
| 21.50-22.00 | B 28 | | | į. | | ‡ | [-:] | 1 |
| | 1 1 | | } | ì | | 3 | F | 1 |
| - 22.00-22.45 | SPTS | N=27 (3,44,7.7,9) | 22.00 | ì | | 1 | -: 1 | 1 |
| 22.00-22.45 22.00-22.45 | D 29 | | | ļ | | 4 | F - | 1 |
| 77 EA 00 00 | 830 | | 1 | l | 1 | 3 | : | 1 |
| 22.50-23.00 | 630 | | | į | | = | 1 | 1 |
| | | ganga | - | ì | | ‡ | 1 | 1 |
| - 23.00-23.45 23.00-23.45 | SPTS D31 | Ne32 (4,4/4,8,9,11) | 23.00 | ļ | | Ē | | 1 |
| | 1 | | | 1 | | ‡ | r -: | 1 |
| | 1 | | | i | 1 | ‡ | <u> </u> | 1 |
| ļ | (1 | | | į | e. | 3 | F | 1 |
| - 24.00-24.50 | B 32 | | | ļ | of the contract | 4 | - - | 1 |
| | ! | | | ļ | other and the | 4 | -: | K |
| 24.50-24.95 24.50-24.95 | SPTS D23 | N=37 (4,3/7,9,9,12) | 24.50 | į | ONLY ANY | 3 | F -1 | 1 |
| 24.50-24.95 | D33 | | 11/06/200 | 1800 | oses of for | 4 | <u> </u> -:: | 1 |
| _ | 1 | | 25.00 | 3.30 | Dury drift | 4 | | 1 |
| . 1 | 1 | | 12/06/200 25.00 | - 0800 3.30 | citon nerv | 3 | ⊬ | K |
| 25.50-26.00 | B 34 | | } | J | Region but oses only any other use. | 4 | J -: + | 1 |
| • | [| | | For in | A. Carrier and Car | 3 | | 1 |
| - 26.00-26.45 | SPTS | N=32 (3,4/4,8,8,12) | 25.00 | ,000 | | 4 | <u>[</u> . → | 1 |
| 26.00-26.45 26.00-26.45 | D 35 | | ۸ | igi | | 3 | | K |
| | 1 | | ~ OTISET | | | 3 | - - | 1 |
| | () | | O | į | | (17.90) | -: | 1 |
| _ 97.05 | | | Ī | ļ | | 4 | ; | 1 |
| - 27,00-27,50 | 8:36 | | } | į | | Ŧ | -:4 | K |
| Ì | 4 | | | ļ | | ‡ | <u></u> | 1 |
| 27.50-27.95 27.50-27.95 | SPTS D37 | N=29 (4,4/6,8,7,10) | 27.50 | ļ | | 3 | <u> </u> | 1 |
| | | | | ļ. | |] | [-:- | 1 |
| - 28,00-28.50 | 9 38 | | } | 1 | | 4 | 片 - | K |
| | 1 | | 1 | ļ | | E | [:-] | 1 |
| | į į | | 1 | Ì | | <u>-</u> | F | 1 |
| | i 1 | | | 1 | | ‡ | i | 1 |
| - 29,00-29,45 - 29,00-29,45 | SPT S | N=38 (3,7/7,8,10,13) | 29.00 | ļ. | | -] | | K |
| 29,00-29,45 | D 39 | | | Ì | | ‡ | | 1 |
| | 1 | | | į | | 1 | 1:-: | 1 |
| | 1 | | 1 | 1 | | 3 | | 1 |
| | | | Dec. | - | Stratum continued next sheet | 4 | <u> 1</u> | 1 |
| Depth | Type & No | Records | Date Casing | Time Water | | | 1 | 1 |
| Groundwater Ent No. Struck Por | | viour | Depth s | | Depth Related Remarks From to (m) | Chiselling Depths (m) 1 | Time Too | ols us |
| (m) | | after 20 minutes. Slow | • | (m) - | | | | |
| lotes: For explanation | n of symbols and | d la la la la la la la la la la la la la | Project | | Dublin Waste to Energy | Borehole | | |
| lotes: For explanation abbreviations see key evels in metres, Strat n deoth column. | y sneet. All depti tum thickness giv | ris and reduced iven in brackets | Project N | | KD3116 | | 3 H3A leet 3 of 4 | |
| n depth column. | | 11), 30/19/2003 12:45:51 AGS | Carried o | | Dublin City Council | , £ | UA | |



| Drilled by MD Logged by JL Checked by MK | Start 07/06/2003 End 13/06/2003 | Equipment, Method | s and Rema | nics | Depth from to Diameter Casing Depth 0.00m 18.00m 250mm 16.00m 16.00m 35.50m 200mm 35.50m | Ground Level Coordinates National Grid | E 319936 |
|--|--|-------------------------|---------------------|---------------|--|--|-----------------------|
| Samples a | nd Tests | | | | Strata | 1 | |
| Depth | Type & No | Records | Date | Time | Description | Depth,Level | Legend Bac |
| 30.00-30.50 | B 40 | | Casing | Water | Stiff to very stiff grey brown slightly | (Thickness) | instru |
| - | | | | | sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT). | 1 | |
| - - 30.50-30.95 - 30.50-30.95 | SPTS D41 | N=35 (4,4/8,8,11,12) | 30.50 | | beroall). | 1 | - |
| - 30,30,30,30 | 24. | | | | | 1 | [-: [] |
| - 1 | İ | | | | <u>-</u> | 1 | |
| } | j | - | | | | ! • | |
| | ŀ | | | | | 1 | -:- N |
| ; | | | | | : | İ | |
| - 32.00-32.45 | SPTS | N=35 (4,5/5,8, t0,14) | 32.00 | | <u>.</u> | } | - |
| 32.00-32.45 | D 42 | | | | : | İ | |
| | ľ | | | | | | |
| } | } | | 1 | | : | } | - |
| . | ŀ | | | i | <u>-</u> | ٠ | |
| | ŀ | | | İ | - | | · -:4// |
| 33.50-33.95 | SPTS | N=40 (3,6/6,10,12,12) | 33.50 | ļ | : | | |
| \$3.50-33.95 | D 43 | * | | | EXPLORATORY HOLE ENDS AT 35,50 m | | F // |
| | | | | | use. | | -:- |
| | | | | 1 | aller | l | |
| 34.50-35.00 | 844 | | | | 97. 814 ₀ | | |
| 4.50 55.50 | | | | | ses of for | | |
| 35.00-35.45 | SPTS | N=48 (4,8/3,12,14,14) | 12/06/2003 35.00 | 1800 3.30 | att of the control of | | |
| 35.00-35.45 | D 45 | (4-40 (4,000,12,14,14) | 13/06/2003 35,00 | 0800 3.30 | in the filed | | |
| | | | 13/06/2003 35.50 | 1200 3.30 | Dect Onlie | | |
| | | | | | CONT. | 35.50 -31.91 | |
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| Depth 1 | Type & No | Records | Date Casing \ | Time Nater | | | |
| roundwater Entrie | es etrika habaw | ione | | | Ceptin Related Remarks | Chiselling | |
| (m) | | ter 20 minutes. Slow i | Depth sea ngress | (m) | from to (m) | Depths (m) Ti | me Tools used |
| | | | - | | | • | |
| tes: For explanation of | of symbols and | and reduced | Project | | blin Waste to Energy | Borehole | |
| breviations see key si rels in metres. Stratun depth column. | n thickness give | · I | Project No. | | 3115 | | НЗА |
| | | 30110/2000 12:45:54 AGS | Carried out | tor P | blin City Council | She | |



| Drilled by MD Logged by PG Checked by MK | Start 13/06/2003 End 17/06/2003 | Equipment, Method: Dando 175 cable tool of Hand dug inspection pl Cable percussive drillin Installed 50mm diamete | rill rig. t to 1,20m. g to 33.50m | iks | | epth from to 0.00m 14.50m 14.50m 33.50m | Diameter 250mm 200mm | Casing Depth 14.50m 33.50m | Ground Le Coordinate National G | s E | +3,49 c 31985 23362 |
|---|--|---|---|---------------|---|---|----------------------------|----------------------------------|---------------------------------------|--------------------|---------------------------|
| Samples a | nd Tests | <u> </u> | | | Strata | | | | | | |
| Depth | Type & No | Records | Date Casino | Time Water | 1 | escription | | | Depth,Lav | M Legend | Ba |
| 0.00-0.50 | Bi | | | | Hard standing GRAVEL (M. | ADE GROUND) | | | (Thicknes 0.10 +3 | 39 | mstr |
| 0.50-1.00 | B2 | | | | Soft brown slightly sandy C GRAVEL FILL with fragmer concrete and wood (MADE | LAY and its of brick, | | 1311 | | | 111 |
| 1.00-1.45 1.00-1.50 | SPT C B3 | N=12 (3,24,3,2,3) | 1.00 | | | | | 17411 | | | |
| 1.50-2.00 | 84 | | | | | | | | (3.50) | \otimes | |
| 2.00-2.45 2.00-2.50 | SPTC B5 | N=25 (4,445,4,9,7) | 2.00 | | | | | , Here | (4.00) | | 7000 |
| 2.50-3.00 | B6 | | | | | | | | | | 000 |
| 3.00-3.45 3.00-3.50 3.30 | SPT C B7 W42 | N=24 (3,4/4,6,5,5) | 3,00 | | | | | 1 | | \bigotimes | 0 0 |
| 4.00-4.45 4.00-4.50 | SPTC BB | N=11 (3,3/2,3,3,3) | 4.00 | | Medium to dense grey brow GRAVEL with abundant she Gravel is angular to subroun coarse. (ESTUARINE DERG | Il fragments. | Di | SSO-3.50 m | 3.60 -0. | 12 | 00000 |
| 5.00-5.45 5.00-8.50 | SPTC B9 | N=22 (4,4/4,5.5,8) | 5.00 | | coarse. (ESTUARINE DER | | | 5.00-5.50 m | (1.90) | | 000 0000 |
| 6.00-6.45 6.00-6.50 | SPT C B 10 | N=21 (4,3/3.4.7,7) | e.oo | For it | Medium dense grey sandy of shell fragments. Sand is fine Gravel is subangular fine to (ESTUARINE DEPOSIT). | to medium. | | ar cobbles. | 5.50 -2. | 02 | 0 0000 0 |
| 7.00-7.45 7.00-7.50 | SPTC B11 | N=26 (3,4/4,5,8,8) | 7.00 | | | | | بيبيليبيي | | | 0000 000 |
| 8.00-8.45 8.00-8.50 | SPT C B 12 | N=26 (3.5/5.5,7.9) | 8.00 | | | | | 1111111 | | 9 9 9 | 0 0000 |
| 9.00-9.45 9.00-9.50 | SPT C B 13 | N=16 (3,3/4,4,4,6) | 9.00 | | · | | | | | | 000 0 000 |
| Depth | Type & No | Records | | Time Vater | Stratum continued next | sheet | | | | ه ضربی | 0 0 |
| oundwater Entri Struck Post (m) 3.60 Ros | t strike behav | lour fter 20 minutes. Slow i | Depth sea | | Depth Related Remarks From to (m) | | | | Chiselling Depths (m) | Time Too | ls us |
| es: For explanation reviations see key s els in metres. Stratur | of symbols and sinest. All depths | and reduced | Project | | Oublin Waste to Energy | | ···· | | Borehole | | |
| as in metres, su aiui lepth column. ile 1:50 | (c) MESC HEST CE D. | | Project No. Carried out | | (D3116 Dublin City Council | n - 1 | | | St | BH4 neet 1 of 4 | - |



| Drilled by MD Logged by PG Checked by MK | 13/06/2003 End | Equipment, Methods | and Remar | lcs | | Depth from to Diameter 0,00m 14,50m 250mm 14,50m 33,50m 200mm | Casing Depth 14.50m 33.50m | Ground Level Coordinates National Grid | +3.49 mOD E 319857.30 N 233620.06 |
|--|--|--|--|--------------|--|---|---|--|---|
| Samples | and Test | <u> </u> | = | | 184-4- | | | | |
| Depth | Type & No | Records | Date | Time | Strata | | | Depth,Leve/ | |
| 10.00-10.38 | SPTC | N=15 (3 for 60mm/3,3,4,5) | Casing 10,00 | Water | | Description | | (Thickness) | Legend Backfill |
| 10.00-10.50 - 11.00-11.45 - 11.00-11.50 | 8 14 SPT C B 15 | N=22 (3,4/4,6,5,7) | 14/06/2003 11.00 15/06/2003 11.00 | 3.30 | 9 | fine to medium, to medium | | | |
| - - - 12.00-12.45 - 12.00-12.50 | SPTC B 16 | N=21 (4.4/4,6,5,6) | 12.00 | | | | | (13.35) | |
| 13.00-13.45 13.00-13.50 | SPT C B 17 | N=28 (3,5/5,7,7,9) | 13.00 | | | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | |
| - 14.00-14.45 - 14.00-14.50 | SPTC B18 | N=36 (4,4/8,8,10,12) | 14,00 | | For its petion purposes on the convince of the | A. any other use. | | ļ. | |
| 15.00-15.45 - 15.00-15.50 | SPT C B 19 | N=33 (4.6/6.6,6,11) | 15.00 | | ospection purposer edited | Ó | | | |
| 16.00-16.45 16.00-16.50 | SPT C B 20 | N=29 (5,5/6,7,7,9) | 16. 0 0 | JIISER | for high | | | | |
| 17.00-17.45 17.00-17.50 | SPT C B 21 | №29 (6,6/5,4,8,12) | 17.00 | | | | بيبلييني | | |
| 18.00-18.45 18.00-18.50 | SPT C B 22 | N=41 (4,418,9,10,14) | 18,00 | | | | عنيلتنين | a . | |
| 18.85-18.90 19.00-19.45 - 19.50-20.00 | D 23 SPT S | N=12 (2.3/3,2,3,4) | 19.00 | | Firm to very stiff dark grey slightly sandy CLAY. Sand (ESTUARINE DEPOSIT). | brown is fine. | | 3.85 -15.36 | |
| - - | | | | 1800 3.30 | Cu_u_ | | ‡ | - | |
| Depth | Type & No | Becomb | Date In | ne iter | Stratum continued n | BX S 100 1 | | | ╼╌┤╠┺┸ |
| (स) | st strike behavi | | Depth scale | T | Depth Related Remarks From to (m) | | | hiselling epths (m) Time | 7 Tools used |
| Notes: For explanation abbreviations see key levels in metres. Stratin depth column. Scale 1:50 | sheet. All depths um thickness give | n in brackets | Project Project No. Carried out fo | K | Oublin Waste to Energy 203116 Publin City Council | | E | Borehole Bl Sheet | 14 2 of 4 |



| Drilled by MID Logged by PG Checked by MK | Start 13/06/2003 End 17/06/2003 | Equipment, Method | s and Remarks | | Depth from to 0.00m 14.50m 14.50m 33.50m | Diameter C 250mm 200mm | asing Depth 14.50m 33.50m | Ground Level Coordinates National Grid | E | 3,49 m 319857, 233620 |
|---|--|---------------------------------------|-------------------------------|---|--|------------------------------|---------------------------------|--|--|-----------------------------|
| Samples a | | ; | | Strata | <u> </u> | | | | | |
| Depth. | Type & No | Records | Date Time Casing Water | | Description | | | Depth,Level | Legend | Bac |
| 20.00-20.20 20.00-20.50 | SPTS | 25 (12,25/25 for 50mm) | 16/06/2003 0800 | Firm to very stiff dark are | v brown | · | | (Thickness) | | Instru |
| 20.00-20.50 | B 25 | | 20.00 3.00 | slightly sandy CLAY, Sar (ESTUARINE DEPOSIT) | d is fine | | - | | | 2.1 |
| | . | | 1 | 1 | • | | = | | | |
| | | | | | | | | | | |
| 21.00-21.45 21.00-21.45 | SPTS D26 | N=20 (3,3/4,4,6,6) | 21.00 | ĺ | | | 4 | | - | |
| 21.00-21.40 | 020 | | 1 | 1 | | | - | | | |
| | | | Ì | | | | • | | [_: <u>]</u> | |
| ļ | į | | l l | | | | 4 | | | |
| 22.00-22.50 | B 27 | | | | • | | Ē | | : | |
| | j | | | | | | = | | F -1 | |
| | j | | Ì | 1 | | | = | | | |
| | | | | | | | = | | | |
| | | | | ļ | · | | 3 | | | |
| | | | | 1 | | | E | | -:- | |
| 23.50-23.95 | SPTS | N=24 (4.4/4.6.8.8) | 23.50 |] | • | | = | | | |
| 23.50-23.95 23.50-24.00 | D28 B29 | · · · · · · · · · · · · · · · · · · · | | | | | 4 | | <u>[</u> | · |
| 24.00-24.45 | SPT S | bings # 7ff a *a *m | 24.00 | Section purps required for any | use. | | E | | [-:4 | |
| 24.00-24.45 | D30 | N=38 (5,7/7,9,10,12) | 24.00 | | theri | | 7 | | <u> - </u> | |
| | | | | W. 29 | Off | | E | | → } | |
| | | | | as off of ar | | | - 1 | | | |
| | ļ | | } | ryosered r | | | 3 | | | |
| 25.00-25.50 | B 31 | | | an Pilitedil | | | | | -: | |
| ľ | | | | ection net | | | - 4 | | 1 | |
| 25.50-25.95 25.50-25.95 | SPT S D 32 | N=39 (6.8/8,8,10,13) | 25.50 | Spt o' | | | 3 | | | |
| - | 1 | | For | Tio I | | | 4 | | | :- |
| • | | | 800 | | | | | | | |
| | | | asent. | | | • | | (14.62) | -:- | |
| 26.50-27.00 | B 33 | | Coll | | | | E | į | | |
| | | | ì | | | | E | | | |
| 27,00-27,45 27,00-27,45 | SPTS D34 | N=42 (5,7/7,10,11,14) | 27.00 | | | | - 4 | | F: | |
| 27,30-27,45 | | | | | | | E | | | |
| | İ | | - | | | | = | ŀ | · - ; | |
| | | | | | | | = = | | <u> </u> | |
| 28.00-28.50 | B 35 | | 1 | | | | E | Ì | : | |
| | | | | | | | # | | | |
| 28.50-28.95 | SPTS | N=47 (8,679,9,14,15) | 28.50 | | | | 3 | ļ | <u>-</u> ¹ | i |
| 28,50-28,95 | D36 | | | | | | E | | _: | • |
| | | • | | | | | # | | | |
| 1 | Ì | | | | • | | 3 | | <u></u> | |
| 1 | | | 1 | | | | | | · —:] | |
| | | | { ! | | | • | 4 | • | | |
| | i | | 16/06/2003 1800 30.00 3.00 | Stratum continued | next sheet | | E | } | _; } | |
| Depth | Type & No | Records | Date Time Casing Water | | | | | | | |
| roundwater Entri o. Struck Post | | iour | Depth sealed | Depth Related Remarks | <u></u> | | | Chiselling | \ <u>-</u> - | |
| (m) | | fter 20 minutes, Slow i | (m) | From to (m) | | | | Depths (m) Tir | me Tools | s used |
| tes: For explanation | of symbols and | | Project | Dublin Waste to E | | | | | | |
| tes: For explanation of breviations see key sels in metres. Stratur depth column. | heet All depth: n thickness giv | s and reduced en in brackets | | Dublin Waste to Energy | | | [| Borehole _ | | |
| enz an menear anami | | | Project No. 1 | KD3116 | | | | | 3H4 | |



| Drilled by MD Logged by PG Checked by MK | Start 13/06/2003 End 17/06/2003 | Equipment, Method | is and Remarks | | Depth from to Diameter 0.00m 14.50m 250mm 14.50m 33.50m 200mm | Casing Depth 14.50m 33.50m | Ground Level Coordinates National Grid | +3.49 mOD E 319857.30 N 233620.06 |
|--|--|---|--|---|---|---|--|---|
| Samples a | <u> </u> | <u> </u> | | 164-4- | | | [| |
| Depth | Type & No | Records | Date Tin | | December | | Depth_Level | |
| _ 30.00-30.45 | SPT S | N=49 (5,8/10,10,13,15) | Casing Wat | | Description | | (Thickness) | Legend Backfill |
| 31.00-31.50 | D 37 | | 17/06/2003 06 30.00 3. | slightly sandy CLAY. Sal (ESTUARINE DEPOSIT) | nd is fine. | 111111111111111111111111111111111111111 | | |
| 31.50-31.95 31.50-31.95 | SPT S D 39 | N=53 (5,&11,13,14,15) | 31.50 | | | 1111111111 | | |
| 32.50-33.00 - - - 33.00-33.45 - 33.00-33.45 | SPTS D41 | N=48 (7.7/10,12,12,14) | 33.00 | | | وأراءهان | | |
| - | | | 17/06/2003 180 33.50 3.0 | o · | | | ŀ | |
| | | | Consec | EXPLORATORY HOLE E SEPLORATORY HOLE E A CONTROL THE REGISTER OF THE CONTROL | Stany office. | | | |
| Groundwater Entrie | strike behavio | Records ar ar 20 minutes. Slow in | Date Time Casing Water Depth scaled (m) | Depth Related Remarks From to (m) | | 1 1111111111111111111111111111111111111 | Chiselling leptis (m) Time | Tools used |
| otes: For explanation of oreviations see key shalls in metres. Stratum depth column. ale 1:50 & | f symbols and eet. All depths a thickness given a MESC Hell (201), 30 | | Project No. | Dublin Waste to Energy KD3116 Dublin City Council | | | Sorehole Bl Sheet | -14 4 of 4 |



| rilled by MD ogged by PG hecked by MK | Start 18/06/2003 End 27/06/2003 | Equipment, Methods Dando 175 cable tool d Hand dug inspection pit Cable percussive boring installed 50mm standpit | riii rig. Ho 1 20m | rics | | Depth from to 0.00m 14.50 14.50m 34.50 | Diameter m 250mm m 200mm | Casing Depth 14.50m 34.50m | Ground Level Coordinates National Grid | E | 4.38 31991 23368 |
|---|--|---|------------------------|----------------|--|--|--------------------------------|----------------------------------|--|--------------|------------------------|
| Samples a | <u> </u> | | | | Strata | | | | 1 | | |
| Depth | Type & No | Records | Date | Time | | Description | · | | Depth,Level | T | Ba |
| 0.00 0.00-0.50 | B1 | | Casing | Water | Soft brown sandy CLAY | | , | | (Thickness) | Legend | instr |
| 0.00-0.50 | 2, | | | | with occasional cobbles a fragments of metal, brick | and abundant | - | - | İ | \bowtie | Z |
| 0.50-1.00 | 82 | | - | | concrete. Slight hydrocar detected. (MADE GROU | bon odour | | | | \bowtie | |
| | | | 1 | | account (white output | NO) | | - | | KXXI | K |
| 1.20-1.65 | SPTC | | | | | | | _ | | | |
| 1.20-1.70 | B3 | N=42 (3,6/6,8,10,18) | 1.20 | | | | | 7 | | KXXI | |
| | | - | | | | | | 3 | Ì | XXX | K |
| | | | İ | | | | | = | | \otimes | |
| 2.00-2.50 | 84 | | | | | | | 7 | | KXX | |
| 0.50.0.70 | | | | | | | |] | | | |
| 2.50-2.78 2.50-3.00 | SPTC 85 | 50 (6,18/25,25 for 55mm) | 2.50 | | | | | # | (5.00) | \otimes | 6 |
| | | | | Ī | | | | E | | KXXI | 0 |
| İ | | | | | | | | 4 | | | ٦ |
| 3.50-3.71 | SPTC | 25 (10,25/25 for ¢0mm) | 3.50 | | | | | 3 | | \bowtie | 00 |
| 3.50-4.00 | 86 | TO (10753153 IDL DOLLIN) | | Ì | | | | 4 | | KXX | |
| 3.90 4.00-4.50 | W39 B7 | | 18/06/2000 4.00 | 3 1800 | Median gense grey sand, | (115°. | | = | | | 40 |
| | ٠, | | 24/06/2003 4.00 | 3 0800 3,90 | 1 | other | | 亅 | | \bigotimes | |
| 4.50-4.75 | SPTC | 50 (3,20/25,25 for 20mm) | 4.50 | | ज्याम् व्याम् | | | 1 | ļ | KX X | 0 |
| 4.50-5.00 | B8 | tolerander or control | | Ì | ses altor | | | | , | | G |
| 5.00-5.50 | в9 | | - | · [| DUTP! CHITE | | | | 500 | \sim | 000 |
| | | | | Ī | ara man siles il sone ents | and occasional | | | 5.00 -0.62 | | 0 |
| 5.50-5.95 | SPTC | N=21 (4,4/4,6,5,5) | 5.50 | | subrounded cobbles. Sand medium. Gravel is angular | d is fine to | | ‡ | | 0 | ြ |
| 5.50-6.00 | B 10 | | ŀ | FOT | AND IN ANSWAR ALCOHOLD IN DIE | NE DEPOSIT). | | - 3 | | | 0 |
| 6.00-6.50 | B 11 | | 6.50 OT 501 | ofcol | - | | | Ē | | | 0 |
| |] | • | seri |) | | • | | 4 | ŀ | 0.0 | ို |
| 6.50-6.95 | SPTC | N=22 (3,4/4,4,7,7) | 6.50 OT | İ | | | | 3 | | 0.0 | 0 |
| 6.50-7.00 | B 12 | | | ĺ | | | | = | f | [ح.ه.م | ٥ |
| } | | | 1 | .] | | | | 4 | į, | 0 | 0 |
| ŀ | | | | 1 | | | | Ē | 1 | ا د د | ွ |
| 7.50-7.96 7.50-8.00 | SPT C B 13 | N=26 (3,4/4,7,7,8) | 7,50 | | | | | ‡ | F | | |
| | | | | 1 | | | | Ē | | ~ ~ 4 4 1 | ° |
| | | | | l | | | | 4 | Į. | 0 | 0 |
| | | ; | | | | | | 3 | | امره | ٥ |
| 8.50-8.95 8.50-9.00 | SPT C B 14 | N=23 (3,4/5,5,5,5) | 8,50 | l | | | | = | ļ. | | 000 |
| | | | | | | | | 3 | j- | 0, | ٥ |
| | | | | | | | | | <u>;</u> | ا ۾ | 0 |
| | 1 | i | | - { | | | | 4 | . la | الخذاه | 00 |
| 9.50-9.95 9.50-10.00 | SPT C 8 15 | N=28 (4,4/8,6,6,10) | 9.50 | I | | | | = | | 0 | ۶ |
| | | ļ | 24/06/2003 10.00 | 1800 5.60 | Stratum continued n | ent sheet | | | je F | a 'o ' a | % |
| Depth 7 | Type & No | Records | Date | Time Nater | | | | | | | , لـم |
| undwater Entrie Struck Post | | our | Depth sea | | Depth Related Remarks | | | | Chiselling | | |
| (m) | | ter 15 minutes, slow int | | (m) | From to (m) | | |] ' | Depths (m) Tin | ne Tools | use |
| | 440 | IT INDITION OF BUILDING | ··· · · · · | - | • | | | | | | |
| 4,10 Aust | | | | | | | | | | | |
| | | <u>-</u> | | | | | | | | | |
| s: For explanation of existions see key st | of symbols and heet, All depths | and reduced | Project Project No. | | ublin Waste to Energy D3116 | · <u>·</u> | | | Borehole | - 10 | |



| Drilled by MD Logged by PG Checked by MK | Start 18/06/2003 End 27/06/2003 | Equipment, Metho | ds and Remarks | | Depth from to Dias 0.00m 14.50m 250 14.50m 34.50m 200 | neter Casing Depth run 14.50m run 34.50m | Ground Level Coordinates National Grid | +4.38 mO E 319914.9 N 233683.6 |
|---|---|---|--|--|---|--|--|--------------------------------------|
| Samples a | nd Tests | ; | | Strata | | | | |
| Depth | Type & No | Records | Date Tim Casing Wat | • | Description | | Depth_Leve/ | Back Back |
| 10.50-10.95 10.50-11.00 | SPT C B 16 | N=22 (2.34,4,7,7) | 25/06/2003 08: 10.00 3.3 | Medium dense grev sand | and occasional addis fine to acto rounded | | (Thickness) | Instrum |
| 11.50-11.95 11.50-12.00 | SPT C B 17 | N=20 (1.2/4.4,6,6) | 11.50 | | | 11.11.11.11 | - | 0 0 0 0 0 |
| 12.50-12.95 12.50-13.00 | SPT C B 18 | N=27 (3,3/4,7,8,8) | 12.50 | | | 7 | (14.10) | SP |
| 13.50-13.95 13.50-14.00 | SPT C B 19 | N=26 (4,4/4,7,7,10) | 13.50 | | Jeg. | | | |
| 14.50-14.95 14.50-15.00 | SPT C B 20 | %~26 (4.5/5,6,6,9) | 14.50 | For its bedion purposes on a for its bedied to the former required t | A. any affect | | o, | |
| 15.50-15.95 15.50-16.00 | SPT C B 21 | N=33 (4,4/8,7,8,10) | 15.50 | For its pedion Perfect | | 711111111111111111111111111111111111111 | e | 0 |
| 16.50-16.95 16.50-17.00 | SPT C B 22 | N=31 (5,4/4,8,8,11) | 25/06/2003 1800 17.00 3.90 26/06/2003 0800 | o' | | | 0 | |
| 17.50-17.95 17.50-18.00 | SPT C B 23 | N=18 (3,44,4,5,5) | 17.50 4.00 | | | | \$ 0. | |
| 18.50-18.95 18.50-19.00 | SPT C B 24 | N=23 (4,4/5,8,6,5) | 18.50 | <i>,</i> | | 1 | 9 | |
| | D 25 SPT S B 26 | N=12 (1,2/2,3,3,4) | 19.50 | Firm to very stiff dark grey b slightly sandy CLAY. Sand i (ESTUARINE DEPOSIT). | rown s fine. | 19.10-20.00 m 19 lightly gravely 1 | .10 -14.72 | |
| Depth Ty | pe & No | | Date Time | Stratum continued ne | d sheet | | | _: // |
| oundwater Entries Struck Post st {m} | trike behavio | Records ur of 15 minutes, slow in | Depth sealed | Depth Related Remarks From to (m) | | CI | hiselling epths (m) Time | Tools used |
| test: For explanation of s revisitions see key shere ets in metres. Stratum to depth column. | symbols and et. All depths a hickness given | | Project No. | Oublin Waste to Energy (D3116 Rublin City Council | | . B | orehole Bl | 15 2 of 4 |



| Drilled by MD Logged by PG Checked by MK | Start 18/06/2003 End 27/06/2003 | Equipment, Method | is and Rema | rks | | Depth from 0.00m 14 14.50m 34 | to Diameter 50m 250mm 50m 290mm | Casing Depth 14.50m 34.50m | Ground Level Coordinates National Grid | E.S | 4.38 mOD 319914.98 233683.89 |
|---|--|--|---|----------------------------------|--|-------------------------------------|---------------------------------------|---|--|--------------------------|------------------------------------|
| Samples a | nd Tests | 3 | | | Strata | | | | 1 | | |
| Depth | Type & No | Records | Data Casing | Time Water | | Description | | | Depth,Level (Thickness) | Legend | Backfil |
| 20.50-20.95 20.50-20.95 20.50-20.95 | D 27 SPT S D 28 | N≃23 (3,444.6.6.7) | 20.50 | - | Firm to very stiff dark gree slightly sandy CLAY, San (ESTUARINE DEPOSIT). | d is fine. | | · · · · · · · · · · · · · · · · · · · | (11/montess) | | Instrume |
| 21.50-21.95 21.50-22.00 | SPT S B 29 | N=36 (4,5/8,8,10,10) | 21.50 | | | | | 111111111111111111111111111111111111111 | | | |
| - 22.50-22.95 - 22.50-23.00 | SPTS 830 | N=29 (4,4/5,7,7,9) | 22.50 | | | | 2 si | 2.10-23.00 m | | | |
| 23.50-23.95 23.50-24.00 | SPT S B 31 | N=22 (3,34,4,6,8) | 23.50 | | | inge. | | + 1.1.1.1.1 | | | |
| 24.50-24.96 24.50-25.00 | SPT S B 32 | N≃30 (4,4/7,7,7,9) | 24,50 26,06/200 25,00 27,06/200 25,00 | 3 1800 8.00 3 0800 3.90 | Tection buttoses only any tight of the state | other | | | | | |
| | SPTS B33 | N=30 (3.4/5.7,7,11) | 26.00 Consen | For it | or the state of th | | | *************************************** | (14.90) | | |
| 27.50-27,95 27.50-28.00 | SPTS B34 | №31 (3,4/4,8,7,12) | 27.50 | | , | - | | Linitation | | | |
| 29.00-29.45 29.00-29.50 | SPTS B35 | N=3S (4,4/7,7,10,11) | 29,50 | | .* | | | | | | |
| - | | | Date | 71000 | Stratum continued r | rext sheet | | | | | |
| (m) | st strike behav | Records viour after 15 minutes, slow i | Casing Depth se | Time Water ealed (m) | Depth Related Remarks From to (m) | | | | Chiselling Depths (m) Tir | ne Took | s used |
| Notes: For explanation abbreviations see key levels in metres. Stratu in depth column. Scale 1:50 | | d instance of the control of the con | Project No Carried oc | o. 1 | Oublin Waste to Energy CD3116 Oublin City Council | | | | Borehole E She | 3 H5 et 3 of 4 | |



| | Drilled by MD | Start 18/06/2003 | Equipment, Method | is and Rema | erics | | Depth from to | Diameter Casino Denth | Ground Level | | 20 |
|--------------|---|---|----------------------------|---------------------|-------|--|-------------------------------|---|------------------------------|-----------------------|---------------------------------|
| <i>:</i> ' , | Logged by PG Checked by MK | 18/06/2003 End 27/06/2003 | | | | | 0.00m 14.50m 14.50m 34.50m | Diameter Casing Depth 250mm 14,50m 200mm 34,50m | Coordinates National Grid | E3 | 138 mOD 19914.98 33683.89 |
| | Samples a | | <u> </u> | | | 184-4 | ! | · · · · · · · · · · · · · · · · · · · | 1 | | |
| ı | Depth | Type & No | Records | Date | Time | Strata | | | Don'th I was | , | |
| | | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | records | Casing | Water | <u> </u> | Description | | Depth, Level (Thickness) | Legend | Backfilly nstrumen |
| ł | <u>.</u> | | | | | Firm to very stiff dark gre slightly sandy CLAY. San | ud ic fina | | 1 | | 11 |
| ŀ | - - 30.50-30,95 - 30.50-31,00 | SPTS B36 | N=34 (4,5/5,8,8,12) | 30.50 | | (ESTUARINE DEPOSIT) | • | - | 1 | | |
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| ŀ | | | | ĺ | | | | = | 1 | - - | |
| Ē | - 32.00-32.45 32.00-32.50 | SPTS B 37 | N=43 (8,6/8,9,12,14) | 32.00 | | | | | | | |
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| F | | | | | | | | | | [::46 | |
| E | 33.50-33.95 | SPTS | N=49 (7,8/8,13,14,14) | 33 50 | | EXPLORATORY HOLE EN TOP LONG TO THE POLICE OF THE POLICE O | | = | | ┝╴╌╢╽ | |
| E | 33.50-34,00 | B 38 | (7,000,75,74,74) | 33.30 | | | | 3 | | | |
| E | _ | | | 27/05/2003 34.00 | 3,90 | | 1150. | | | :—: {\ | |
| E | | | | | | EXPLORATORY HOLE E | NOS AT 34,00 m | _ | 34.00 -29.62 | | |
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| F | Depth T | Demo 8 14- | Su | Date 1 | ime | | | E | | | |
| - | roundwater Entrie | ype & No | Records | Date 1 Casing W | fater | Death Balance | · · | | | | |
| | o. Struck Post: | | HUT . | Depth sea | | Depth Related Remarks From to (m) | | | Chiselling Depths (m) Tim | e Tools u | sed l |
| 1 | | to 3.90 m aft | er 15 minutes, slow in | | - | | | · | | | |
| | | | | | ı | | | | | | • |
| No | tes: For explanation o | symbols and | | Project | | ublin Waste to Energy | | | 5 | | |
| lev in | tes: For explanation o breviations see key sh els in metres, Stratum depth column. | neet. All depths : I thickness giver | and reduced in brackets | Project No. | | D3116 | | | Borehole | Lie | İ |
| 1 | | k) MESC MANI (201), S | D | Carried out | | ublin City Council | | 1 | B Shee | H5 t 4 of 4 | i |
| | | | | | | | | | _ | | ! |



| Drilled by MN Logged by PG Checked by MK | Start 16/05/2003 End 20/05/2003 | Equipment, Methods : Casagrande C8 rotary dril Hand dug inspection pit to Rotary open hole drilling to Rotary coring to 40.20m. Installed 50mm standnice | end Remari Erig o 1,20m. to 33.00m | ks | Depth from to Diameter Casing Depth 0.00m 26.70m 131mm 26.70m 25.70m 33.00m 120mm 33.00m 33.00m 40.20m 76mm 35.90m | Ground Level Coordinates National Grid | +3.91 mOD E 319822.62 N 233458.92 |
|--|--|---|---|--------------------------------|--|--|---|
| Samples a | nd Tests | Instance of the second | | | Strata | | |
| Depth | Type & No | Records | Date Casing | Time Water | Description | Depth, Level (Thickness) | Legend Instrument |
| | | | | - | Driller reports black waste FILL with strong hydrocarbon (oily) odour. | (5.60) | |
| 5,70-6.15 | SPT C | N=19 (2,3/5,4,4,5) | 5.70 Conse | For State of | Rection Hunders only and other use. Poiller reports SAND and GRAVEL. | 5.60 -1.70 | |
| 7.20-7.65 | SPTC | N=21 (4,3/4,5.5.7) N=17 (2,2/3,2.5.7) | 8.70 | | | *************************************** | |
| Depth Groundwater Er No. Struck P (m) 1 5.20 - | Type & No intries Post strike bel | | Date Casing Depth | Time Water sealed (m) | Stratum continued next sheet Depth Related Remarks From to (m) | Chiselling Depths (m) | |
| Notes: For explanal abbreviations see & levels in metres. St in depth column. Scale 1:50 | | and politics and reduced given in brackets | Project Project Carried | No. | Dublin Waste to Energy KD3116 Dublin City Council | Borehole | BR6 heet 1 of 5 |



| Drilled by MN Logged by PG Checked by MK | Start 16/05/2003 End 20/05/2003 | Equipment, Methods | and Rema | rics | | 0.00m 2 26.70m 3 | to Diameter 6.70m 131mm 3.00m 120mm 0.20m 76mm | Casing Depth 26.70m 33.00m 35.90m | Ground Level Coordinates National Grid | +3.91 mOD E 319822.62 N 233458.92 |
|---|--|---|--|---------------|---|---------------------|---|--|--|---|
| Samples a | nd Teete | <u></u> | | | Strata | | ······································ | | l | |
| Depth Depth | Type & No | Records | Date | Time | Juaca | Description | | | Depth,Level | Legand Backfill |
| - Separ | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | Casing | Water | Driller reports SAND and | | | | (Thickness) | Legend Instrument |
| 10.20-10.65 | SPTC | N=23 (3,415,5,7,6) | 10.20 | | uniner reports samu and | GRAVEL | | | (10.70) | |
| 11.70-12.15 | SPT C | N=33 (5,777,3,9,9) | 11.70 | | | | | | | |
| 13.20-13.59 | SPTC | 28 (4,5/6,7,8,7 for 13mm) Flush: 0.00-25.70 Air (oam, 100 % | 13.20 | | | * | .g.; | | · | |
| 14.70-15.15 | SPTC _ | N=27 (2.2/3.7,7,10) | 14.70 | | For its ged owner required | Hy. any other | , The second | بأبيينينيانيي | | |
| 16.20-16.65 | SPTC | N≈33 (8,7/7,8,9,9) | 16.20 | Conse | For install to For Early SILT | | | | 16.30 -12.39 | |
| 17.70-18.15 | SPTC | N=29 (9,948,7,7,7) | 16/05/2003 17.70 17/05/2003 17.70 | | , | | | 1 | , | |
| 19.20-19.65 | SPTC | N=41 (8,7/9,10,11,11) | 19.20 | | Stratum continued | nggt sheet | | | | |
| Depth | Type & No | Records | Date Casing | Time Water | | | | | | |
| Groundwater Entr | | | Depth so | | Depth Related Remarks From to (m) | | | | Chiselling Depths (m) Ti | me Tools used |
| Notes: For explanation abbreviations see key levels in metres. Strati in depth column. Scale 1:50 | | is and reduced sen in brackets | Project Project No Carried or | p. 1 | Dublin Waste to Energy KD3116 Dublin City Council | | | | Borehole E She | 3 R6 et 2 of 5 |



| Drilled by MN ogged by PG Thecked by MK | Start 16/05/2003 End 20/05/2003 | Equipment, Methods | and Remar | les | | Depth from to 0.00m 26.70 26.70m 33.0 33.00m 40.2 |)m 131mm)m 120mm | Casing Depth 26.70m 33.00m 35.90m | Ground Level Coordinates National Grid | E 31 | .91 mOD 19822.62 13458.92 |
|---|--|---|--|--------------------------------------|---|--|----------------------|--|--|--|---------------------------------|
| Samples a | nd Tests | | | | Strata | | | | | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Description | | | Depth,Level (Thickness) | Legend | Backfi Instrume |
| 20.70-21.15 | SPT C | №39 (10,7/9,9,10,11) | 20.76 | | Driller reports sandy SIL | · | | | (10.40) | ************************************** | |
| 22.20-22.65 | SPTS | N=25 (4,4/5,8,7,7) | 22.20 | | | | | | | X X X X X X X X X X X X X X X X X X X | |
| 23.70-24.15 | SPT S | N=23 (4.5/5,8,5,7) | 23.70 | | s of the | ny offer use. | | - | | * * * * * * * * * * * * * * * * * * * | |
| - 25.20-25.65 | SPTS | N=26 (5,5/6,6,7,7) | 25.20 | For stoleof | Specification purposes on the second for a second for the property of the second for the second | | | | | ************************************** | |
| 26,70-27.15 | SPT S | N=27 (4,517,7,8,7) | 17/05/20 26:70 18/05/20 26:70 | 03 1800 22.00 103 0800 4.75 | Driller reports SILT/CL/ | Υ | | | 26.70 -22.79 | ×. ×. | |
| 28.20-28.65 | SPTS | N=29 (4,6/7,7,8,7) | 28.70 | | | | | - | | X X X X X X X X X X X X X X X X X X X | |
| 29.70-30.15 | SPT S | N=30 (4,717,7,8,8) Records | 26.70 Date Casing | Time Water | Stratum continu | red next sheet | . | | (6.00) | * * * * * * * * * * * * * * * * * * * | 77777 |
| Groundwater E No. Struck F (m) 1 5,20 | ntries Post strike bel | haviour | Depth | sealed (m) | Depth Related Remarks From to (m) | | | | Chiselling Depths (m) | Time To | ols used |
| Notes: For explana abbraviations see! levels in metres. S in depth column. Scale 1:50 | tion of symbols key sheet. All de ratum thickness (a) seese nom | and potes and reduced given in brackets | Project Project Carried | | Dublin Waste to Energy KD3116 Dublin City Council | | | | Borehole SI | BR6 heet 3 of | 5 |

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|-------------------|---|-------------|----------------|-----------------|---------------------|-----------------------------|----------------|--------------------|----|---------------------|----------|----------------|-----------------------|------------|----------|----------|
| | | mg/kg | BAKE | PH Units | mg/kg | mg/kg | | | | | | | | | | |
| | Helmon Donas : | מלאלאם | + | WOLMS | VVSCM4 | 200 | | | | | | | | | | |
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| | UKAS Accredited: | Yes | Y68 | 768 | Ves | 2 | | | | | | | | | 1 | |
| TES ID Number CL/ | Client Sample Description | | TPH GCFID (AR) | pH units | Phenol Index | Boron. | | | | | | | | | | |
| 0330243 | BH001 3.6 | | 72 | | | | | | | | | | | | <u> </u> | |
| 0330244 | BH002 4.0 | <0.5 | | 9.6 | 3.0 | 1.3 | | | | | | | | | | |
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| 7 | LES Bretoy | 100 | | Mr M Vollay | | | | | | , | 2 | | alegy 318 | | 3 | <u> </u> |
| 2 | | CORRECT | | INIC INI EVOIDO | | | | | | | | Amended Report | ort | | 7 | ٠ |
| Bretby | | | | | | | | | | Date Printed | ited | | 7 November 2003 | ser 2003 | · | |
| | | | ٠ | | Dilbl | Dublin Waste | Sto | | | Report Number | umber | | 1 1 1 1 | EFS/034319 | | S |
| | FBX +44 (0) 1283 554422 | | | | 2 | |) | | | Table Number | mber | | | - | 1252 | ر د |
| | | | | | | | | | | Page Number | mber | | | 2 of 2 | | ı |
| | | | | | | | | | | | | | | | | 1 |

Report Notes

Soil/Solid analysis specific:

Results expressed as mg/kg unless stated otherwise S04 analysis not conducted in accordance with BS1377 Water Soluble Sulphate on 2:1 water.soil extract AR denotes analysis conducted on the As Received sample # co-eluted with benzo(b)fluoranthene ## co-eluted with Indeno(123-cd)pyrene BTEX analysis expressed as ug/kg As Received Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:

Results expressed as mg/l unless stated otherwise

Oil analysis specific:

Results expressed as mg/kg unless stated otherwise S.G. expressed as g/cm³@ 15°C

Filter analysis specific:

Results expressed as mg on filter unless stated otherwise

VOC analysis specific:

Explanatory notes for data flagging U = undetected above reporting limit

J = concentration at instrument was below lowest calibration standard

E = concentration at instrument was above top calibration standard

B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:

Results expressed as ug/l unless states otherwise

Air (Carbon tube) analysis specific:

Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:

CH denotes Chrysotile

CR denotes Crocidolite

AM denotes Amosite

NADIS denotes No Asbestos Detected in Sample

NBFO denotes No Bulk fibres Observed

T Trace

L Low (2-15%)

M Medium (15-50%)

H High (>50%)

General notes:

* this analysis was subcontracted to another laboratory

\$ Within laboratory tolerances

\$\$ unable to analyse due to nature of sample

¥ Results for guidance only, possible interference

& Blank corrected

I.S insufficient sample for analysis

Intf Unable to analyse due to interferences

N.D Not determined

N.R Not recorded

N.Det Not detected

Req Analysis Requested, see attached sheets for results

* denotes this result not UKAS accredited on this sample

P Raised detection limit due to nature of sample



| Drilled by MN Logged by PG Checked by MK | Start 16/05/2003 End 20/05/2003 | | and Rema | rks | 0 26 | th from to .00m 26,70m .70m 33,00m .00m 40,20m | 131mm 120mm | asing Depth 26.70m 33.00m 35.90m | Ground Leve Coordinates National Grid | · E | +3.91 mC 319822.6 233458.9 |
|--|--|--|---------------------------------------|---------------------|--|---|--------------------|---|---|---------------------------------------|----------------------------------|
| Samples | and Test | s | | | Strata | | | | 1 | | |
| Depth | Type & No | Records | Date Casing | Time Water | | cription | | | Depth,Level | Legend | Back |
| 31,20,31,65 | SPTC | nt=28 (5,6/6,7,7,6) | 26.70 | 1144 | Driller reports SILT/CLAY | | | | (Thickness) | * | |
| 32.70-32.88 | SPTC | 50 (20,5 for Oram) 28,22 for 25mm) | \$2,70 18/05/2003 33.00 | 0.00 | Driller reports clayey GRAVEL weathered rockhead) | _ | | - | 32.70 <i>-</i> 28.79 | × × × × × × × × × × × × × × × × × × × | VIIIIII |
| 33.00-33,75 m | 67 0 0 | Flush: 25,70-40,20 Water, 100 % TCR 60, SCR 0, RQD 0 | 33,00 | 4.90 | Core recovered as dark grey a subrounded GRAVEL and CO limestone with some dark brow sitt/day. | BBLES of | | | | 0000 | |
| 33.75-34.05 m - 34.05-34.60 m | 64 0 | | | i | sitt/clay. For its get in the required for a control of the contr | y other use. | | | (3.34) | 0.0 | |
| 34.60-34.70 m 34.70-34.74 m | NI NI NI | TCR 100, SCR 0, RQD 0 TCR 100, SCR 0, RQD 0 | | | roses only a | y * | | ווייודוון | , | 0000 | |
| 34.74-35.40 m | 0 | - | | | gertion pur fedu. | | 25 40 | | | 0.00 | |
| 35,40-35,90 m | 26 0 0 | | | | For its first | | 20.40 | ~AZGE = | | 0 0 0 | |
| 35.90-36.34 m | 0 0 | | | Onser | Core recovered as very stiff dat to black slightly sandy gravelly Gravel is angular to subangular medium. | CLAY. | | | 36.04 -32.13 (0.30) 36.34 -32.43 | | |
| 35.34-37.40 m | 100 Nt 69 110 63 340 | | | | Strong to very strong grey fine- LIMESTONE with rare calcite to Joints are closely spaced, 20 to dip, and planar rough. Weather | veins. 9 45° | 37.24- | 37.34 m ʃ] | (1.16) | | |
| 37.40-37.88 m | 100 NI 65 95 0 120 | | | | includes slight day infill along fracture planes and zones of no core reduced to angular to subagravel. | ingular | | | 37.50 -33.59 (0.38) 37.88 -33.97 | | |
| 37,98-38,70 m | 100 65 50 N1 65 320 | | | | Moderately strong to strong dar black fine-grained MUDSTONE Joints are closely spaced, 45 to dip, and planar rough. Weather includes zones of weak core. | 60° | | sak core | (1.42) | | |
| 38.70-39.63 m | 100 59 32 | if NB/100/100 | 18/05/2003 35.90 | 1830 8.60 | Strong grey fine-grained LIMES Joints are closely to very closely spaced, 30 to 45° dip, and plans Weathering includes zones of wand slight orange discoloration : | y ar rough. reak core | very we 39,30-3 | n-intact | 39.30 -35.39 | | |
| 39.63-40.20 m | 100 Ni 75 50 40 250 | | 20/05/2003 35,90 | 0730 4.35 | fracture planes. Stratum continued need sh | | 39.63-3 no | 9.73 m [# n-intact | 39.53 <i>-35.62</i> (0.67) | | |
| Depth Groundwater Ent No. Struck Po- (m) 1 5.20 - | ries st strike beha | Records/Samples | Casing V Depth sea | vater led (m) | Depth Related Remarks From to (m) | | | | Chisetting Depths (m) Ti | me Tool | s used |
| totes: For explanation bbreviations see key evels in metres, Strat in depth column, icale 1:50 | sheet. All dept um thickness gi | ns and reduced wen in brackets | Project Project No. Carried out | · | Oublin Waste to Energy CD3116 Oublin City Council | _ | | | | 3 R6 et 4 of 5 | |



| Drilled by Logged by Checked b | PG | End | t 5/2003 5/2003 | Equipment, Methods | and Remarks | | Depth from 0.00m 28.70m 33.00m | 26.70m 33.00m | Nameter 131mm 120mm 76mm | Casing Depth 26.70m 33.00m 35.90m | Ground Lev Coordinates National Gri | • | +3.91 mC E 319822. N 233458.1 |
|---|---|------------------------------------|---------------------------------|--|-------------------------------------|--|--|------------------|-----------------------------------|--|---|------|-------------------------------------|
| Samp | les a | nd 1 | ests | | | Strata | | | | | 1 | | |
| Depti | | Text skirt skirt | H | Records/Samples | Date Time Casing Water | | Description | , | | • | Depth, Leve (Thickness | Lege | nd Back |
| | | | | | 20/05/2003 35 90 | 39.30m - 39.53m : Mode moderatiley strong dark of fine-grained MUDSTON subhorizontal. Weatherin reduced to gravel and co fracture planes coated in slightly gravelly clay. | rey to black E. Joints are ig includes over wall and | : 9 | | - | 40.20 -36. | 29 | SI |
| - | | | | | | 39.53m - 40.20m : Strongrey fine-grained LIMES very closely to closely sport of pandulating resible weathering. EXPLORATORY HOLE | TONE. Joins aced, 20 to ough. No | ts are | | | · | | |
| - - - - | | | | • • • • | | | | • | | - | | | |
| - - - | · | | | | | | | | | - | | | |
| - - - - | | | | | | | ather use. | | | - | | | |
| - - - - - - - - | | | - | | | Section hirtoses only, are specifically are | | | | - | | | |
| | | | - | | For it | section net i | | | ٠ | - | | | |
| | | | | | Consent of cost | | | | | - | | | |
| | | | | | | · | | | | - - - - - | | | |
| | | | | · · | | | | | | | | | ~ |
| | | | | | | · | | | | - - - - - | | | |
| | _ | | | | | | | | | 3 | | | |
| Depti | | 靐 | Ħ | Records/Samples | Date Time Casing Water | | | | | | | | <u> </u> |
| Groundwa No. Stru (m 1 5.2 | ck Po) | ries st strik | ce beha | wiour | Depth sealed (m) | Depth Related Remarks From to (m) | | | | | Chiselling Depths (m) | Time | Tools used |
| Notes: For ex abbreviation levels in met in depth colt | oplanatio s see key res. Strai mn. | on of syr y sheet. turn thic | mbois ar All dept kness g | nd this and reduced even in brackets ini, sorrezona szerzae | Project Project No. Carried out for | Dublin Waste to Energy KD3116 Dublin City Council | | | | | Borehole | BR6 | |



| ٠, | Drilled by M Logged by PC Checked by Mi | 20/05/2003 Fnd | Equipment, Meti- Casagrande C5 rot Relocated 1.00m th Hand dug inspectio Rotary open hole d | ary rig om BH7 due | to mechanica | al faiture. Oring to 40.20m | Depth from 0.00m 22.00m 36,40m | to 22.20m 36.40m 40.20m | Diameter 131mm 120mm 76mm | Casing Depth 22.20m 36.40m | Ground Leve Coordinates National Grid | E: | 3.66 mOD 319919,19 233463.25 |
|---------|---|---|---|--|----------------|---|---|----------------------------------|------------------------------------|----------------------------------|---|---------------------|------------------------------------|
| | Samples | and Test | S | | | Strata | <u> </u> | | | | { | | |
| į | Depth | Type & No | Records | Date | | | Description | | | · | Depth,Level | | |
| | | | | Casi | ng Water | | | | | | (Thickness) | Legend | Backfill/ Instrumen |
| | 1.50-1.95 | SPT S | N=3 (1.1/0,1,1,1) | 1.50 | dry | TARMAC pavement ove (MADE GROUND) Driller reports black CLA waste material with hydrodors. (MADE GROUND) | Y FILL and | | | | (1.20) 1.20 +2.46 | | |
| | 3.60-4.06 | SPTC | N=17 (2,313,4,5,5) | 1.80 | dry | | i ay other i | gse. | | | (4.10) | | |
| | 5.10-5.55 | SPTC | N=24 (3,8/6,£,6,7) | 3.60 | | Driller reports sitty sandy G | RAVEL | | | | •. | ž. | |
| | 6.60-7.05 | SPTC | N=28 (4,4/7,7,6,8) | 5,10 | Consen | \$CC | | | | | ء د د د د | | |
| | 8.10-8.55 | SPTC | N=31 <i>(7,71</i> 6,8.8.9) | 7.00 | | | | | | | , , , , , , , , , , , , , , , , , , , | | |
| - | 9,60-10.05 | SPTC | N=31 (7,7/5,8,8,9) | 7.00 | | Stratum continued nex | t sheet | | | 77.177.11 | | 2 | |
| | Depth | Type & No | Records | Date Casing | Time Water | | | | | | | | |
| No 1 | (m) 4.30 - | t strike behavior | | Depth s | ealed F (m) | Depth Related Remarks from to (m) | | | | | iselling oths (m) Time | Tools us | ed |
| | eviations see key is in metres. Stratu pth column. e 1:50 | of symbols and sheet. All depths ar in thickness given i (c) MESC HBM (081), 301 | | Project No Project No Carried or | . KD : | blin Waste to Energy 3116 blin City Council | | | | В | orehole BR Sheet | 7A 1 of 5 | |



| Drilled by MN Logged by PG Checked by MK | Start 20/05/2003 End 23/05/2003 | | is and Rema | rics | | Depth from 0.00m 22.00m 36.40m | to 22.20m 36.40m 40.20m | Diameter 131mm 120mm 76mm | Casing Depth 22.20m 36.40m | Ground Lew Coordinates National Grid | E | +3,66 3199 23346 |
|--|--|---------------------------------|---------------------|---------------|--|---|----------------------------------|------------------------------------|----------------------------------|--|--|------------------------|
| Samples | and Test | s | | | Strata | | · | | | - | | |
| Depth | Type & No | | Date Casing | Time Water | | Description | <u> </u> | | | Depth,Level | Legend | B |
| | | | June | | Driller reports silty sandy | GRAVEL | | | | (Thickness) | 2.9 | Inst |
| | 1 | | | 1 | | | | | = | | و م | |
| | | | | | | | | | = | l | . A. | |
| - | | | | | | | | | _ | | , | |
| 11.10-11.55 | SPTC | N=50 (12,11/15,10,11,14) | 10,00 | | | | | | - | (11.30) | 2.00 | |
| - | | | 1 | | | | | | = | | | |
| | | | İ | • | | | | | - | | | |
| <u>-</u> | | | | | | | | | = | | | K |
| - | | | | | | | | | 7 | | 7. 3 | |
| <u> </u> | | | | | | | | | 3 | | ج . ت | |
| 12.60-13.05 | SPTC | N=40 (6,9/9,10,10,11) | 12.60 | | | | | | = | | | K |
| - | | | | | | | | | = | | | |
| <u>-</u> | | | | | | | | | = | | x | 1 |
| - | | | | Į | | | | | = | | 2. 20 | K |
| | | | | ı | | | | | Ę | | P. 3 | 1 |
| <u>.</u> | | | | | | use. | | | 3 | | 4 24 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | 1 |
| 14.10-14.55 | SPTC | N=35 (7,8/7,8,10,10) | 14.10 | | | ther | | |] | | 2.00 | N |
| - | | | | | A14. 1014 |) | | | = | | 9. 0. 0. 0 | |
| • • | | | | ı | aes a for w | | | | <u> </u> | | 2 | 1 |
| - | | | | į | author liteu | | | | 3 | | - E - C | N |
| • • | | | | ļ | tion Press | | | | = = | | خ. م | |
| | | | | | Dense grey fine SAND. | | | | ‡ | | 40.40.40.40.40.40.40.40.40.40.40.40.40.4 | 1 |
| • | | | | COLL | tight | | | |] | | | 1 |
| . | | | | , co |) | | | | 直 | | 5° 8 | |
| · · | [i | | on | or | | | | | 3 | | | 1 |
| 1660-1705 | SPTC | N=51 // 2M1 47 44 44 | 20/05/2003 16350 | 1840 3.20 | | | | | Ē | | Tx: 79 | N |
| 16.60-17.05 | SPTC | N=51 (4,8/11,12,14,14) | 21/05/0200 16.60 | 0730 4.00 | Dense grey fine SAND. | | | | | 16.60 -12.94 | ء ه و | |
| · _ | | | | | Driller reports SAND and C | RAVEL | | | 4 | | 000 | 1 |
| | | | | . [| | | | | = = | | | |
| | | | | | | | | | 3 | | اط منصد | |
| | | | | | | | • | | 3 | | وم | / |
| _ | | | | | | | | | 4 | (2.60) | | |
| 18.20-18.65 18,20 | SPTS D1 | N=39 (7,6/8,10,10,11) | 18.20 | | | | | | 1 | | 9 | |
| | [| | | | | | | | = = | | 9 | |
| | | | | | | | | | 3 | | | |
| - | | | | | | | | | 寸 | | | |
| | | | | | Very stiff dark grey brown s | lightly | | |] 1 | 9.20 -15.54 | | / |
| 19.60-19.91 | SPTS | 50 (3,9/14,21,15 for 10mm) | 19.60 | - 1 | sandy CLAY. | | | | 3 | | -: : | // |
| 19.60 | D2 | | | | Clearly and a P | and alt | | | 4 | ļ | ÷ - } | 1 |
| Depth | Type & No | Records | Date 1 Casing V | ime Vater | Stratum continued n | sa sneet | | | | | <u> </u> | ~ |
| Groundwater Enti | ries st strike behav | iour | Depth sea | | Depth Related Remarks From to (m) | | | | | Chiselling | | |
| (m) 1 4.30 - | | - | p | (m) | ······································ | | | |] ¹ | Depths (m) Tis | me Tools | used |
| otes: For explanation | of symbols and | | Project | D | ublin Waste to Energy | ··· | | | | David : | | |
| otes: For explanation obreviations see key vels in metres. Strat. depth column. | aneet. All depth an thickness giv | s and reduced en in brackets | Project No. | | D3116 | | | | 1 | Borehole Di | D 7 4 | |
| | | | Carried out | | ublin City Council | | | | | 8 | R7A | |



| · I | Drilled by MN Logged by PG Checked by MK | End | 1 | is and Rema | arics | | Depth from to 0.00m 22.20m 22.00m 38.40m 36.40m 40.20m | Diameter 131mm 120mm 76mm | Casing Depth 22,20m 36,40m | Ground Level Coordinates National Grid | +3.66 n E 31991: N 23346: | 1.19 |
|-------------------|--|---|--|---|---------------|---|---|------------------------------------|----------------------------------|--|---|----------------|
| t | Samples | and Test | s | | - | Strata | | | | | | |
| T | Depth | Type & No | T | Date | Time | | | | | | | |
| F | ······································ | - | 1000 | Casing | Water | | Description | | | Depth,Level (Thickness) | Legend Bac Instru | idill/ ment |
| | 21.20-21.65 | SPTC | .· N=37 (4,7/8,8,9,12) | 21.20 | | Very stiff dark grey brown sandy CLAY. | i siightliy | | | | | |
| | 22.60-23.05 22.60 | SPTS D3 | N=28 (9.846,7,7,8) | 22.20 | | | | | Linning | | | |
| المييسينينينانيات | 24.20-24.58 24.20 | SPTS D4 | 50 (14,11/14,18,18,- for Omm) | 24.20 | | For inspection during required to | or any other use. | | | - - - - - - | 7.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1 | |
| | 25.60-26.05 25.60 | SPTS D5 | N=49 (7,8/11,12,13,13) | 25.60 | , se | For inspection of the feat | | | بالبعقينيينان | - | | /////// |
| | 27.20-27.80 27.20 | SPTS so | 0 (5,7/11,12,16,11 for 20mm) Fixsh: 22,20-33,20 Water, 100 % | | Cons | | | | | (15.20) | | ///////// |
| | 28.60-29.05 28.60 | SPT S D7 | N=28 (5,5/7,5,7,5) | 28.60 | | | | | | | | 111111 |
| No. | (m) | Type & No | - | Casing W Depth seal | ed F | Stratum continued new Depth Related Remarks From to (m) | d sheet | | G | hiselling poths (m) Time | Tools used | //// |
| ni deş | 4.30 - E. For explanation wildlines see key in metres. Stratuoth column. | of symbols and sheet. All depths on thickness given to MESG HOM GOIL 3 | | Project Project No. Carried out f | Du KD | iblin Waste to Energy 03116 iblin City Council | | | В | orehole BR Sheet | | |



| ogged by PG | En | | | | urks | | 22.00m | 22.20m 36.40m | Diameter 131mm 120mm | Casing Depth 22.20m 38.40m | Ground Le | \$ | 43.66 E 3199 |
|---|----------|-----------|--|-----------------------------|--------------|--|----------------------|------------------|----------------------------|-------------------------------------|-----------------------------------|--|-----------------|
| hecked by MK | | 05/2003 | <u> </u> | | | | 38.40m | 40.20m | 76mm | | National Gr | id | N 2334 |
| Samples | | | T | Date | Time | Strata | | | | | | | |
| Depth | 'yı | e & No | Records | Casing | Water | | Description | n | | | Depth, Leve (Thickness | Legen | d B |
| 30.20-30,65 | s | PTS | N=38 (5,6/8,8,11,11) | 30.20 | | Very stiff dark grey brown sandy CLAY. | n slightly | | | | | <u> </u> | -1 |
| | | | | | | 32.0,021 | | • | | |] | <u> </u> | AF |
| | | | | | | j | | | | = | 1 | <u> </u> | -1[\ |
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| | 1 | Ì | | ļ | | | | | | _ | | - | |
| | l | | | | | | | | | = | | | 11: |
| 31.60-32.05 | _ | тc | | 1 | | | | | | - | | | JK |
| 31.60 | | 8 | N=33 (5,6/7,8,9,9) | 31.60 | | | | | | = | | | Λ |
| | | | | | | | | | | = | | - | 11 |
| | | ļ | | | | | | | | 7 | | <u>-</u> - | 41) |
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| | | ł | | | | | | | | 3 | | → | ИF |
| | | Ī | | 21/05/2000 | 3 1800 | | | | | | | : - | Ήľ |
| 33.20-33,65 | SP | тс | N=43 (7,8/10,10,11,12) | 33.20 83.20 22/05/200 | 6.25 | | | | | = | | -: | 1K |
| | | | | 33.20 | 3.85 | | | | | # | | | 1 |
| | | | | | | | | | | 7 | | <u>. </u> | 11 |
| | | - | | [| | | other use. | | |] | | · _ · | 11) |
| | | | | | ı | | nervi | | | | | | |
| | | | | | Ì | | | | | <u> </u> | | : | 11 |
| 14.60-34.78 | SP | rc | 50 (18,7/50 for 25mm) | 34.60 | Į | Driller reports gravel, bould | ders and | | | | 34.40 -30.7 | 4: . 5 | 11 |
| | 1 | 1 | <u> </u> | |] | clay bands. (possible wear nockhead). | thered | | | = | | 心六 | ſΝ |
| | | | | |] | OUT CHITC | | | | 7 | | | ľ |
| | 1 | | | 1 | 1 | tion of ter | | | | E | | UF | 1 |
| | | | | | J | eDect owith | | | | E | (2.00) | 20 | 11) |
| | | - 1 | | 1 | for tolco | ight | | | | # | ye.ve) | 14.0 | |
| | 1 | [| | 1 | ₹0° | A. S. | | | | # | | 103 | |
| | | | | | of co. | • | | | | 4 | | <u>. '</u> | \mathbb{N} |
| | | | TAD 100 000 00 000 | روج | > | | | | | 3 | | 0 = | $ \rangle$ |
| i.40-36.66 m | | | TCR 100, SCR 35, RQD 0 | Contr | Ī | Recovered core is predom | inantiy | | 36,4 | vn slightly | 6.40 -32.74 | | |
| i.66-36.76 m | | NS . | TCR 100, SCR 0, RQD 0 TCR 100, SCR 68, RQD 39 | i | 1 | non-intact strong to very stand cobbles of LIMESTON | imona arawei | ina | GL: | wit sagrapy rvelly clay bands | | | |
| .76-37,04 m .04-37,08 m | | 112 | TCR 100, SCR 0, RQD 0 | 22/05/2003 36.40 | 1.60 | includes rock mass reduce | d to subana | rdar | | - T | (0.85) | | |
| .08-37.25 m | | | TCR 100, SCR 47, ROD 9 TCR 100, SCR 40, ROD 0 | 23/05/2003 36.40 | U/ 45 | medium gravel with soft broday at NI zones. Clay coa | fino mok | | | 7 | | | |
| .25-37,35 m | \vdash | | , , , , . , . , . , . | | | surfaces 0 to 45° and sub-lidip; undutating and rough. | horizontal 30 |)* | | ∄³ | 7.25 -33.59 | | |
| .35-38.10 m | 100 | | | | | Strong to very strong grey t | No. alone | · | | <u>_</u> | | | |
| .55-56, 10 10 | 71 59 | | | | | LIMICS I UNE WITH occasion | ıal calcile ve | ine | 37.75-37 | 7.90 m NI [_ | | | |
| [| | | • | | | (thickness varying from 1m | • | | | 닠 | | | |
| ļ | 100 | 1 | | | | Joints are closely to mediur to 40° dip, planar and rough | i. Weatherin | 10 | | 7 | | | |
| 10-38.90 m | 81 56 | | | ĺ | | includes zones of rock mas soft to firm brown clay, with | s reduced to | 5 | 38.46 | 38.56 m [] | | | |
| | × | Ni 130 | ĺ | | 4 1 | brown slightly gravelly clay : | infili | | n | on-intact - | m ne | | |
| ŀ | \dashv | 250 | | | | along fracture planes at 37. 37.90m. Rare subvertical fra | 80m to actures at | | | # | (2.95) | | 1 |
| | J | | | | F | calcite veins between 38.39 | to 38.49m. | | 39.04 | 40,04 m | | | N |
| | 100 | | | | | | | | with calc | ite veins | j | | |
| 90-40.20 m | 92 82 | ļ | | | ł | | | | | ! | | | 1 |
| | | | | | | <u>.</u> | | | | - | ļ | | // |
| Depth | 123 | lf | Records/Samples | Date T | me | Stratum continued ne | od sheet | | | <u>_</u> | | | \angle |
| ndwater Entr | | | | Casing W | ater | Denth Belete & D | | | | | | | |
| Struck Pos (m) | | behavio | our . | Depth sea | led i | Depth Related Remarks From to (m) | | | | | hiselling opths (m) | me Tool | s used |
| 4.30 | | | | (| (m) | | | | | ١ | family 16 | | |
| | | | | | | | | | | | | | |
| For emigration | of same | nk and | | Danie : 4 | | | | | | | | | |
| | | deoths: | and reduced | Project | Dı | tblin Waste to Energy | | | | 1 . | 3orehole | | |
| For explanation lations see key : n metres, Stratu h column. | m thickn | ess giver | in brackets | Project No. | | 23116 | | | | ι, | orende | | |



| Drilled by MIN Logged by PG Checked by MK | 23/0 | 5/2003 | Equipment, Method | ds and Remarks | | | Depth from 0.00m 22.00m 36,40m | 22.20m 36.40m 40.20m | Diameter 131mm 120mm 76mm | Casing Depth 22.20m 36.40m | Ground Le Coordinat National G | 85 | E3 | 3.66 mOD 119919.19 33463.25 |
|---|---------------------------------|----------------------------|---------------------|----------------------------|--------------|---|---|----------------------------|------------------------------------|----------------------------------|--------------------------------------|-------------------------|----------------|-----------------------------------|
| Samples a | | est | | | | Strata | | | | | ĺ | | | |
| Depth | TCR SCR NGC | lf | Records/Samples | Date T Casing W | ime later | | Descriptio | n | | | Depth, Lev | | end | Backfill |
| | - | | | 23/05/2003 36.40 | 1800 8.36 | Strong to very strong gre LIMESTONE with occasi (thickness varying from 1 | onal calcite | voine | | - | (Thicknes 40.20 -36 | */ | | Instrumen |
| - - - | | | | | | Joints are closely to med to 40° dip, planar and rou includes zones of rock m soft to firm brown clay, wi | ium spaced gh. Weathe | i, 30 | | | | | | |
| | | | | | | brown slightly gravelly cla along fracture planes at 3 37,90m. Rare subvertical calcite veins between 38. | ry infill 7.80m to fractures a 39 to 38.49 | m. | | | | | | |
| _ | | | | | | EXPLORATORY HOLE E | ENDS AT 40.2 | 10 m | | | | | | |
| | | | | | | | • | | | 1 | | | | |
| | | | | | | | | | | 11000 | | | | |
| - | | | | | | | other | 115°. | | 111111 | | | | |
| | | | . | | İ | outposes only | of any | | | | | | | |
| | | | | | | For inspection purposes only | | | | 7 | | | | |
| | | | | උග් | Sent | \$ \cdot \cdo | | | | | | | | : |
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| | | | | | | · | | | | 77777 | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Depth 3 | | | Records/Samples | Date Time | | | | | | | | | | |
| oundwater Entries Struck Post st | | | | Casing Water Depth sealed | Б | epth Related Remarks | | | | Ch | iselling pths (m) Ti | | | _ |
| 4,30 - | | | | (m) | | | | | | De | pas (m) Ti | me To | ols us | •• |
| es: For explanation of a eviations see key she is in metres. Stratum to epth column. | symbols et. All d hicknes | and epths ar given i | n brackets | roject Project No. | Dub KD3 | lin Waste to Energy 116 | | | | В | orehole | | . . | - |
| e 1:50 😝 | WESG HOU | (281), 391 | 972000 12-48-04 AGS | arried out for | Dub | lin City Council | | | | | B She | R7A et 5 of 5 | ; | |



| Lo | lled by MN gged by PG ecked by MK | Start 24/05/2003 End 28/05/2003 | Hand dug inspection pit | trill rig to 1,20m | | | Casing Depth 20.70m 39.80m 41.20m | Ground Level Coordinates National Grid | E: | 3.95 mQ 319963.1 233492.1 |
|------------------|---|--|------------------------------|--------------------------|-----------------------|---|--|--|---|---------------------------------|
| \$ | amples a | and Test | S | , statistics | ******** | Strata | | 1 | | |
| | Depth | Type & No | Records | Date Casing | Time Water | Description | | Depth,Level | Legend | Back |
| | | | | | | Driller reports FiLL material with concrete, rubble and bricks. (MADE GROUND) | - | (Thickness) | | Instrue |
| - - - - | | | | | | | · - | | \bowtie | |
| | 1.50-1.61 | SPTC | (25,50 for 35mm) | 1.50 | dry | | | (2.30) | \bigotimes | |
| - | | | | | | Driller reports clayey GRAVEL | - | 2.30 +1,65 | \bigotimes | |
| | 260-3.05 | SPTC | N=46 (5,111,4,2,39) | 2.60 | dry | Dillied reports dayey GRAVEL. | 111111 | (1.40) | | |
| • | | | | | | | 11111 | (1.40) | من م و مر | 777 |
| _ | 4.20-4.60 | SPTC | 50 (7,7/14,13,13,10 for 20mm | 4.20 | 3,80 | Driller reports grey blue CLAY/SH T | - | 3.70 +0.25 (0.50) 4.20 -0.25 | | |
| - | | | | | | Driller reports grey blue CLAY/SILT | | | * * * * * * * * * * * * * * * * * * * | ZXXX |
| • | 5.70-5.99 | SPTC | 50 (5,7125,25 for 6Screen) | 5.70 | For it | gen out | - | (2.50) | * * * * * * * * * * * * * * * * * * * | 7777 |
| | | | | Consen | | Driller reports grey SAND. | | 6.70 -2.75 | * | |
| • | 7.20-7.65 | SPTC | N=40 (6,6/9,10,10,11) | 7.20 | | Driller reports coarse GRAVEL | | (0.50) 7.20 -3.25 | | |
| - | | | | 1 | | - | 1 | (1.50) | 0000 | |
| | 8.70-9.15 | SPTC | N=24 (2,3/4,5,5,9) | 8.70 | | Driller reports GRAVEL with clay bands. | | 8.70 <i>-4.7</i> 5 | | |
| • | į | | | | | | 1 1 1 1 1 1 | | 0.00 | |
| | Depth | Type & No | Records | Date | Time | Stratum continued next sheet | | | | 16 |
| Gro No. 1 | undwater Ent | | | Casing Depth se | water paled (m) | Depth Related Remarks From to (m) | | Chiselling Depths (m) Tir | ne Tools | used |
| Vote: | For explanation visitions see key in metres. Strate | n of symbols and sheet. All depth | i is and reduced | Project | [| Dublin Waste to Energy | | Borehole | , | |
| ıu del | in metres. Strati oth column. 1:50 | | n, sorroscos special AGS | Project No Carried ou | | CD3116 Dublin City Council | | | BR8 et 1 of 5 | |



| | Drilled by Mi Logged by PG Checked by Mi | 24/15/2003 End 28/05/2003 | | ods and Remar | ks | | Depth from 0.00m 20.70m 39.80m | to 20.70m 39.80m 46.50m | Diameter 131mm 120mm 76mm | Casing Depth 20.70m 39.80m 41.20m | Ground Leve Coordinates National Grid | E | 3.95 mOD 319983.53 233492.81 |
|-------|--|---|---|--|------------------------------|--|---|----------------------------------|------------------------------------|--|---|---------------------|------------------------------------|
| ı | Samples | and Test | s | | | Strata | | | · | | ! | | |
| | Depth | Type & No | Records | Date Casing | Time Water | | Description | n | ··· | | Depth, Level | 1. | Backfill |
| i | 10.20-10.65 | SPTC | Ne20 (4 5/7 7 7 m) | | | Driller reports GRAVEL w | • | | | | (Thickness) | Legend | instrumen |
| | | | N=29 (4.5/7.7.7.6) Flush: 0.00-20.70 Air, 100 % | 10.20 | | | way ba | AJS. | | | (4.50) | 0 0 0 0 | |
| | 11.70-12.15 | SPTC | N=40 (8,9/8,10,10,11) | 11.70 | | | | | | *************************************** | | 0 0 0 0 | |
| | 13.20-13.65 | SPTC | N=39 (8,7/10,10,9,10) | 13.20 | | Driller reports brown clayer | | | <u>.</u> | | 13.20 -9.25 | 0 0 0 0 | |
| | 14.70-15.15 | SPTC | N=44 (9,7/11,11,10,12) | 24/05/2003 14.70 25/05/2003 14.70 | 1845 4.30 0730 9.83 | For the pection purposes only some reports black sandy S | any offer us | , &. | | ************** | (3.00) | | |
| | 16.20-16,65 | SPTC | N=39 (5,7/6,9,11,11) | 16.20 | speri ! | Driller reports black sandy S gravel bands. | ILT with | , | | 16 | -12.25 3 | | |
| | 17.70-18.15 | SPTC | N=40 (8,8/9,10,10,11) | 17.70 | | | , | | | واستستاست | (2.90) | | |
| - | 19.20-19.65 | SPT C | N=31 (4.8/6,7,9,9) | 19.20 | Fi | irm to very stiff dark grey bro lightly sandy CLAY. Sand is | fine. | | | 19.7 | 10 -15.15 | | |
| _ | Depth | Type & No | Records | Date Time Casing Water | | Stratum continued next | sheet | | | | | | \square |
| No. | 3.80 - | t strike behavior | er . | Depth sealed (m) | 7 | epth Related Remarks com to (m) | | | | Chi Dep | iselling Wis (m) Time | Tooks us | 64 |
| 11 46 | s: For explanation of eviations see key sis in metres. Stratum pth column. | of symbols and theet. All depths ar n thickness given i to Masa Hom (2011), 3011 | m i i | Project Project No. Carried out for | KD3 | olin Waste to Energy 1416 In City Council | | | | Во | Prehole BR Sheet 2 | 18 2 of 5 | |



| Driffed by MIN Logged by PG Checked by MIK | Start 24/05/2003 End 28/05/2003 | Equipment, Methods a | and Remarks | | | Depth from 0.00m 20.70m 39.80m | 10 20.70m 39.80m 46.50m | Diameter 131mm 120mm 76mm | Casing Depth 20.70m 39.80m 41.20m | Ground Level Coordinates National Grid | E | +3.95 mOE 319983.5 233492.8 |
|--|--|--|----------------------------|----------------|---|---|----------------------------------|------------------------------------|--|--|-----------------|-----------------------------------|
| Samples a | nd Tests | <u> </u> | | | Strata | | | | | | | |
| Depth | Type & No | Records | | Time Vater | | Descripti | D.FI | | | Depth, Level (Thickness) | Legend | Bacidi |
| 20.70-21.15 20.70 | SPT S D1 | №22 (2,3/3,5,8,8) | 20.70 | | Firm to very stiff dark gre slightly sandy CLAY. Sar | y brown id is fine. | | | | | | |
| - 22.20-23.15 22.20 | SPT S D2 | N=50 (11,12/10,12,15,13) | 22.20 | | · | | | | - | | | |
| 23.70-24.15 23.70 | SPTS D3 | 89 (9,11/12,13,14,10 for 70mm) | 23.70 | | edily, at | Nother use | r | | - | | | |
| - 25.20-25.65 25.20 | SPTS D4 | N=30 (4,8/6,7,8,8) | 25.20 | F ^O | nspection purposes only and | | | | - | | | |
| 26.70-27.15 26.70 - | SPTS D5 | N=37 (5,10/5,10,10,12) | Consent 26.70 | , | | | | | - | | | |
| - 28.20-28.65 28.20 | SPT S D G | N=28 (6,717,8,6,7) | 28.20 | | | | | | - | (17.10) | | |
| 29.70-30.15 29.70 Depth | SPT S D 7 | N=29 (7,7/7,8,8,8) Records | 29.70 Date T Casing W | ime later | Stratum continued | next sheet | | | - | | | |
| Groundwater Ent No. Struck Po- (m) 1 3,80 - | ries st strike beh | aviour | Depth sea | led (m) | Depth Related Remarks From to (m) | | , | | | Chiselling Depths (m) | Time To | oels used |
| Notes: For explanationable abbreviations see key levels in metres, Stratin depth column. Scale 1:50 | n of symbols a y sheet. All dep turn thickness o | and reduced pives in brackets | Project No. Carried out | | Dublin Waste to Energy KD3116 Dublin City Council | | | | | Borehole Sh | BR8 eet 3 of | 5 |



| Drilled by MN Logged by PG Checked by MK | End | | ds and Remar | ks | | Depth from 0.00m 20.70m 39.60m | 1 to 20.70m 39.80m 46.50m | Diameter 131mm 120mm 76mm | Casing Depth 20,70m 39,80m 41,20m | Ground Level Coordinates National Grid | E | 13.95 mOD 319963,53 233492.81 |
|--|------------|--|--|-------------|--|---|------------------------------------|------------------------------------|--|--|---------------------|-------------------------------------|
| Samples | and Test | s | · | | Strata | | | | | | | |
| Depth | Type & No | T | Date | Time | | Descriptio | | | | Depth, Level | | 1 5 |
| | | | Casing | Wate | | | *1 | | | (Thickness) | Legend | Bacidil Instrume |
| 31.20-31.65 - 31.20 | SPTS D8 | N=29 (5,6/7,7,8,7) | 25/05/2003 20.70 26/05/2003 20.70 | 3.6 | D | is fine. | | | | | | |
| 32.70-33.15 - 32.70 - 32.70 | SPTS D9 | N=23 (5,646,£,6,10) | 32.70 | | | | | | | | | |
| , A | | Flush: 20.70-46.50 Mud drilling, 100 % | | | | <i>ک</i> ر | re. | | | | | |
| 34.20-34.65 | SPT C | N=30 (8,7/7.8,8,7) | 35.70 | i sent | For ingertian and property and the second se | ers and | | | | 3.20 -32.25 | | |
| 37.20 | SPTC | (SO for Oman) | 37.20 | | | | - | | | (2.80) | | |
| 39.00-39.10 m 39.10-39.30 m 39.30-39.70 m | 50 | TCR 0, SCR 0, RCD 0 TCR 50, SCR 0, RCD 0 TCR 0, SCR 0, RCD 0 TCR 25, SCR 0, RCD 0 TCR 25, SCR 0, RCD 0 | 26/05/2003 1 39.80 | 800 5.20 | Recovered as grey sandy GR compact dark brown day ban subangular to subrounded fine sand is fine to coarse. (possib weathered rockhead). | ds. Grave | l ie | | 39.10 m 39 | .00 -35.05 | | |
| 39.80-40.00 m Depth | TCR If | | 27/05/2003 0 Date Tin | 730 | Stratum continued next | sheet | | | <u> </u> | | <u></u> 4 | 111 |
| Groundwater Entri | | Records/Samples | Casing War | d | Depth Related Remarks From to (m) | | | | | riselling pths (m) Time | e Tools u | med |
| lotes: For explanation ubbreviations see key sevels in metres, Stratus n depth column. | | | Project Project No. Carried out for | K | ublin Waste to Energy D3116 ublin City Council | | | | В | orehole Bi Sheet | R8 4 of 5 | |



| Drilled by MN Logged by PG Checked by MK | End | 5/2003 | Equipment, Methods | s and Rema | rks | | Depth from 0.00m 20.70m 39.80m | n to 20.70m 39.80m 46.50m | Diameter 131mm 120mm 76mm | Casing Depth 20.70m 39.80m 41.20m | Ground Leve Coordinates National Gri | | +3.95 mOD 319963.53 233492.81 |
|---|----------------------|----------------------|---------------------------------|----------------------------|---------------|--|---|------------------------------------|------------------------------------|--|--|-------------------|-------------------------------------|
| Samples a | <u> </u> | 5/2003 Test: | <u> </u> s | | - | Strata | | | | 41.20til | • | | . 200 1020 |
| Depth | TOR SCR RGD | H | Records/Samples | Date | Time | | Description | on . | | | Depth,Level | | Backfill |
| 40.00-40.30 m | 29 0 | NI NI 70 | TCR 17, SCR 6, RQD 0 | 39.80 | Water 8.25 | Recovered as grey sandy compact dark brown clay subangular to subrounde sand is fine to coarse. (pr | r GRAVEL bands. Gr | with | | - - - - - | (Thickness (2.30) | 2 2 5 | Instrume |
| 40.65-41.20 m | 18 0 0 | | | | | weathered rockhead). | ossidie | | | | | 000 | |
| 41.20-41.30 m | | | TCR 100, SCR 6, RQD 6 | | | | - | | | | 41,30 -37,3 | × • • • • | |
| 41.30-42.00 m | 100 80 70 | | | | | Moderately weak to stron grained LIMESTONE with content (irregular matrix). Joints are closely spaced | n high calc , 10 to 30° | ite | | | | | |
| 42.00-43.50 m | 100 77 61 | | | | | dip, smooth and stepped, includes slight weakening strength at joints; modera crystalline calcite - platy h 90% calcite content) | Weathering of rock tely weak | ng | 42 | 2.00-42.30 m cone of weak rock | | | |
| 43.50-45,00 m | 100 91 | NI 200 800 | | | | | other use. | | 43 z | .85-44.20 m | (5.20) | | |
| _ | 85 | | | | | hespection but poses out of act | 3 | | | .55-44.70 m subvertical facture, dutating and rough | | | |
| 45.00-46.50 m | 100 99 99 | | | 27/05/2003 41.20 | 1800 6.35 | ne de la companya de la companya de la companya de la companya de la companya de la companya de la companya de | | | un: | .45-45.60 m subvertical fracture, dutating and mough .50-45.55 m Pyrite veins 15-46.50 m subvertical fracture, | | | |
| · · · | | | | | | EXPLORATORY HOLE E | NDS AT 46.5 | iO m | Urk | dulating and rough | 46.50 <i>-42.5</i> 3 | 5 | SP |
| | | | | | | | | | | 111111 | | | |
| - | | | | | | | | | | بمليميهما | | | |
| - | | | | | | | | | | بتبيئية | | | |
| | _ | | | | | | | | | 7 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | | | |
| Depth | 羅 | Ħ | Records/Samples | Date Casing \ | Time Water | ···· | | | | | | | |
| Groundwater Entri No. Struck Post (m) 1 3.80 - | | behan | riour | Depth se | aled (m) | Depth Related Remarks From to (m) | | | • | | Chiselling Depths (m) 1 | Time Tool | is used |
| lotes: For explanation obtraviations see key sevels in metres, Stratus of depth column. | sheet. A m thickr | Al depth hess giv | s and reduced en in brackets | Project No. Carried out | . 1 | Dublin Waste to Energy (D3116 Dublin City Council | | | | | Borehole | BR8 eet 5 of 5 | |



| Drilled by A Logged by F Checked by L | >G End | Hand dug inspection | hods and Remark tary rig on pit to 1,20m rilling to 44,70m .50m | | | Depth from 0.00m 39.00m 44.70m | to 39.00m 44.70m 49.50m | Diameter 131mm 120mm 76mm | Casing Depth 39.00m 44.70m | Ground Level Coordinates National Grid | F 31987/ | 0.84 |
|---|---|---------------------|---|------------------|--|---|----------------------------------|------------------------------------|----------------------------------|--|------------------|---------|
| Sample | s and Test | Installed Some sta | ndoine with stand or | o cover | Canada | <u></u> | | | | | | 1.00 |
| Depth | Type & No | Records | Date | Time | Strata | | | | | | | |
| - | | | Casing | Water | | Descriptio | | | | Depth, Level (Thickness) | Legend Bac | |
| 1.50-1.95 | SPTC | N=12 (3.2/3,3.2.4) | 1.50 | dry | Driller reports soft light gi CLAY. | ey gravelly | | | | (3.00) | | |
| 3.00-3.45 | SPTC | N=10 (1,1/2,2,3,3) | 3.00 | dry | Driller reports soft sandy C | LAY. | | | | 3.00 +1.29 | | |
| 4.50-4.95 | SPT C | N=11 (2.2(2.3,3,3) | 4.50 | 4.10 | Driller reports black shale of | BRAVEL | <u> </u> | - | | (1.20) 4.20 +0.09 | | |
| 6.00-6.45 | SPTC | N=16 (1,1/3,4,4,5) | 6.00 Cons | ~~~ | Driller reports black shale of the control of the c | EL with | | <u>.</u> | | (1.80) | | |
| 7.50-7.95 | SPTC | N=21 (3,4/5,8,5,5) | 7.50 | | | | | | | (2.70) | | 7////// |
| - 9.00-9 <i>.</i> 45 | SPTC | N=24 (4,56,6,5,7) | 9.00 | Dr sa | iller reports GRAVEL with s nd bands. | silt and | | | 8.7 | 70 -4.42 | | |
| Depth Sroundwater Ent lo. Struck Pos (m) 4.10 - | Type & No ries st strike behaviou | Records | Date Time Casing Water Depth sealed (m) | De Fre 0.0 | • • | sheet | | | Chi | selling ths (m) Time | Tools used | |
| otes: For explanation breviations see key rets in metres. Strati depth column. ale 1:50 | or of symbols and sheet. All depths an um thickness given ii (c) MESG KBM (2011), 3014 | 1 | Project Project No. Carried out for | KD31 | in Waste to Energy | | | <u> </u> | 80 | rehole BR Sheet 1 | 9 of 5 | |



| Drilled by MN Logged by PG Checked by MK | Start 09/06/2003 End 12/06/2003 | 1 | and Rema | rica | | Depth from 0.00m 39.00m 44.70m | 1 to 39.00m 44.70m 49.50m | Diameter 131nm 120mm 76mm | Casing Depth 39.00m 44.70m | Ground Level Coordinates National Grid | E | 4.29 m 319870 233701 |
|---|---|---------------------------------|------------------------------|---------------|--|---|------------------------------------|------------------------------------|----------------------------------|--|--------------|----------------------------|
| Samples a | and Test | S | | | Strata | ·! | | | | ł | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Descriptio | vn · | ~~. | | Depth Level | Legend | Bac |
| | | | | - | Driller reports GRAVEL | with silt and | | · · | | (Thickness) | 2.0 | Instru |
| 44.50 | | | | | sand bands. | | | | = | | P 04 | N |
| 10.50-10.95 | SPTC | N=28 (8,6/7,6,7,6) | 10.50 | | | | | | = | | | N |
| | | | | | | | | | - | | 200 | N |
| | | | | | | | | | | | ه ۽ . ۾ | N |
| | İ | | | | | | | | - | | P - A | N |
| | | | | | | | | | = | | | N |
| | | |] | İ | | | | | 4 | | | N |
| 12.00-12.40 | SPTC | 50 (9,10/10,11,12,17 for 20ms | 12.00 | | | | | | 4 | | ٠. ه | N |
| | | | | | | | | | 4 | | 2: - | N |
| | | | | | | | | | 3 | | 2 2 | N |
| | | | | | | | | | = | (8.10) | 2 | N |
| | | | ļ | | | | | | 手 | | م . م | N |
| | | | • | | | | | | | | | N |
| 13.50-13.95 | SPTC | N=38 (8,8/7,9,11,11) | 13,50 | i | | | | | # | | | N |
| | | | | | | _ي و. | | | 3 | | م و | N |
| | | | | | | net 1150 | | | | | 12.0 | N |
| | | | | | ا ا | Office | | | | | | V |
| | | | | | only ail | .) | | | = = | | | N |
| | | | | | poses die | | | | 3 | | | N |
| 15.00-15.38 | SPTC | 50 (10,10/12,14,17,7 for Omm) | 15.00 | | 2 Brits driv | | | | 4 | | F : 34 | N |
| | | | f | | action net l | | | | 3 | | 8 | |
| | | | | | is pt on | | | | 3 | | 2 0 | N |
| | | | | For | yti ²⁶ | | | | 3 | | x - 39 | N |
| | | | | of co. | | | | | | | . 6 | |
| | | | sent | , , | | | | | E | , | | |
| 16.50-16,95 | SPTC | N=35 (8,8/7,8,9,11) | 16(50) | 1 | | | | | # | | 2 24 | N_{\parallel} |
| |] | ĺ | | ı | Specification further required for and | | | | | 16.80 <i>-12.51</i> F | | |
| İ | [| | | | Firm to stiff grey brown si CLAY. Sand is fine. | ightly sandy | | | 4 | .0.00 | | \setminus |
| İ | | | | | | | | | 3 | | | |
| | l | | | | | | | | # | - | _:4} | |
| | | | | | | | | | 3 | ļ | : | \backslash |
| 18.00-18.45 18.00 | SPTS D1 | N=31 (4,6/8,7,9,7) | 18.00 | | | | | | | ŀ | _= | |
| | -, | | | | | | | | = | F |] | |
| | ł | ļ | | - 1 | | | | | 3 | | | J [|
| | | | | | | | | | E | } | <u></u> | 7 |
| } | | - | | | | | | | 4 | ļ. | | 11 |
| I | | | | | | | | | 3 | <u> </u> | | 10 |
| 19.50-19.95 19.50 | SPT S | N=19 (4,5/4,4,5,6) | 19,50 | | | | | | 3 | | - 1 | 11 |
| | DE | | | | | | | | = 1 | į. | | I K |
| Depth | Type & No | Records | Date T | іпе | Stratum continued | next sheet | | | | | <u>-:1</u> } | <u>1</u> L |
| undwater Entri | es | | | later | Depth Related Remarks | - | | | | hiselling | | |
| Struck Post (m) | strike behav | 10UT | Depth seal | led (m) | From to (m) | | | | | Depths (m) Tim | e Tools | used |
| 4.10 - | | | | - [| | | | | | | | |
| er Eng punianatian | of squares | | | | | | | | | <u></u> . | | |
| s: For explanation of relations see key so in metres, Stratum | ur sympois and iheet. All depth: in thickness giv | s and reduced en in brackets | Project | | ubiin Waste to Energy | | | | | Borehole | : | |
| pan column. | | ra i | Project No. Carried out 1 | | D3116 ublin City Council | | | | | В | R9 | |
| لاجرا ت | (c) MESS HOW (281). | TOTAGOOT TEAMES ATES | | | | | | | I | Shee | t 2 of 5 | |



| · · · | Driffed by M Logged by P Checked by M | G (5906/2003) | Equipment, Metho | ds and Remark | ks | | Depth from to 0.00m 39.00m 39.00m 44.70m 44.70m 49.50m | Diameter 131mm 120mm 76mm | Casing Depth 39.00m 44.70m | Ground Level Coordinates National Grid | E3 | 1.29 mOD 19870.84 33701.08 |
|----------------|--|--|--------------------|--|---------------|--|---|------------------------------------|----------------------------------|--|---------------------|----------------------------------|
| ı | Samples | and Tests | 5 | | | Strata | L | | | ł | | |
| | Depth | Type & No | Records | Date Casing | Time | | Description | | | Depth,Level | Legend | Backfill |
| | 21.00-21.45 21.00 | SPT S D3 | N=29 (4,4/6,7,8,8) | 09/05/2003 21.00 10/05/2003 21.00 | 1830 12.47 | Firm to stiff grey brown s CLAY. Sand is fine. | lightly sandy | | | (Thickness) | | |
| | 22.50-22.95 22.50 | SPTS D4 | N=28 (5,4/5,7,7,9) | 22.50 | | | | | | | | |
| | - 24.00-24.45 24.00 | SPT S D 5 | N=26 (5.5/6,5,7,8) | 24.00 | | For its pection purposes only | A. and other use. | | | | | |
| | 25.50-25.95 25.50 | SPTS D6 | N=27 (5,6/6,7,7,7) | 25.50 | Olise | For its petion it re | | | | - | | |
| | 27.00-27.45 27.00 | SPT S D7 | N=25 (4,4/6,5,6,8) | 27.00 | | | . • | | | (22.20) | | |
| بينينين إيستين | 28.50-28.95 28.50 | SPT S | N=22 (5,4/6,5,5,5) | 29.50 | | | | | ************ | | | |
| <u> </u> | <u> </u> | | | Dan - | _]. | Stratum confinued ne | at sheet | | # | }. | <u> </u> | 11 |
| | Depth roundwater En Struck Po (m) 4.10 | Type & No tries sat strike behavio | Records | Date Tin Casing Wa Depth seale (n | d d | Depth Related Remarks From to (m) | | | | hiselling epths (m) Time | Tools us | sed |
| 100 | es: For explanations see kersis in metres. Stratepth column. | on of symbols and y sheet. All depths a fluari trackness given (c) MESC HEM (281), 20 | | Project Project No. Carried out fo | K | ublin Waste to Energy D3116 ublin City Council | | | E | Porehole Bl Sheet | ₹9 3 of 5 | |



| Logged by PG Checked by MK | End 12/06/2003 | | | | 39,00m 44,70m 1 44,70m 49,50m | 20mm 44.70m 78mm | National Grid | E 319 N 233 |
|--|-------------------|-----------------------------------|--|--|----------------------------------|---|------------------------------|----------------|
| Samples | and Tests | | | Strata | | | <u> </u> | |
| Depth | Type & No | Records | Date Time Casing Water | | Description | | Depth, Level (Thickness) | Legend ins |
| 30.00-30.45 - 30.00 | SPTS DB | N=26 (4,46,7,7,6) | 30.00 | Firm to stiff grey brown slig CLAY. Sand is fine. | ghtly sandy | | | |
| 31.50-31.95 31.50 | SPTS D 10 | N=23 (4,5/4,6,8,7) | 31.50 | · <u>-</u> | | | | |
| - 33,00-33,45 - 33,00 | SPT S D 11 | N=29 (4,6/7,7,7,5) | 33.50 | | | | | |
| - - - - - - | | Flush: 21.00-46.30 Water, 95 % | | ,4. A | ther hee. | | | |
| 34.50-34.95 - 34.50 | SPTS D12 | N=22 (5,78,5,5,5) | 34.50 | Spection buildese only any spectron buildese only any spectron buildese only any spectron on the spectron of t | | · · · · · · · · · · · · · · · · · · · | | |
| 36.00-36.45 36.00 | SPT'S D13 | N=26 (4,5/5,6,7,8) | Se.00 Good | | | | | |
| 37.50-37.95 37.50 | SPTS D14 | N=29 (5,5/6,7,8,8) | 37.50 | | | *************************************** | - | |
| - 39.00-39.45 39.00 | SPT S D 15 | N=28 (6,7/6,7.7,8) | 10/06/2003 1745 39.00 8.65 39.90 0730 11/06/2003 0730 39.00 5.86 | Driller reports gravelly SILT. | | | I. | |
| Depth | Type & No | Records | Date Time Casing Water | Stratum continued ne | d sheet | | | ¥ : |
| Groundwater Ent | | | Casing Water Depth sealed (m) | Depth Related Remarks From to (m) | | | Chiselling Depths (m) Tim | e Tools us |
| lotes: For explanation abbreviations see key evels in metres. Strat n depth column. | of symbols and | and ordered. | Project (| Dublin Waste to Energy | ··· | | Borehole | |



| Drilled by M Logged by Pt Checked by Mi | G E | Start 19/06/200 End 2/06/200 | | ds and Rema | rks | Depth from to 0,00m 39,00m 39,00m 44,70m 44,70m 49,50m | 120mm 44 70m | epth Ground Leve Coordinates National Grid | E 319870 8 |
|---|----------------------|---------------------------------------|----------------------------------|--|---------------|---|--|--|---|
| Samples | and | Tes | ts | · | | Strata | | | |
| Depth | T | pe & N | o Records | Date Casing | Time Water | | · · · · · · · · · · · · · · · · · · · | Depth, Level | Second Back |
| 40.50-40.95 | | SPTC | N=26 (6,7/7,7,6,5) | 40.50 | | Driller reports gravelly SILT. | <u> </u> | (Thickness) | metrum |
| 42.00-42,45 | S | SPT C | N=28 (5,5/6,7,7,8) | 42.00 | | | | (4.50) | 10. 10. 10. 10. 10. 10. 10. 10. 10. 10. |
| 43.50-43.67 | S | PTC | 22 (25,28/22 for 15mm) | 43.50 | | Driller reports gravel, boulders and clay bands. | · <u> </u> | 43.50 -39.21 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| - - - - - - | | | TCR 100, SCR 50, RQD 0 | | - [| Strong to very strong dark grey fine to coarse-grained LIMESTONE with occasional calcite veins. | 44.70-44.80 m Ni [| -1 | |
| 44.80-46.30 m | 100 91 85 | Ni 70 290 | | | 1630 | Joints are closely to medium spaced, 30 to 40° dip, undulating and smooth. Weathering includes uncompact grey brown six infall along fracture planes. | 45.60 m 60° 1 fracture along 10mm thick calcite vein | | |
| 46.30-47.00 m | 100 86 86 | | | 44.70 | 18.60 | | 46.30-46.45 m Ni 48.70 m 20* fracture along = 5mm thick calcite | | |
| 47.00-48.15 m | 100 89 59 | NI 150 350 | Flush; 46.30-49.50 Water, 0 % | | | | 46.85-48.90 m occasional vugs in calcite veins 47.00-47.05 m M 47.40-49.05 m six coating at joint surfaces | (4.80) | |
| 48.15-49.50 m | 100 96 79 | | | | | | 48.20-48.50 m subvertical fracture along pro-existing calcite vein, smooth and planar | | |
| : | | _ | | 12/06/2003 (44.70 1 | 0730 6.30 | EXPLORATORY HOLE ENDS AT 49.50 m | - | 49.50 -45.21 | |
| Depth | 題 | H | Records/Samples | Date Tin | | • | - | | SP |
| Groundwater Ent No. Struck Por (m) 1 4.10 - | ries | | <u>-</u> <u>-</u> - | Casing Wa Depth seale (n | d F | Depth Related Remarks from to (m) | | Chiselling Depths (m) Tune | Tools used |
| totes: For explanation boreviations see key wels in metres. Strain depth column. | sheet A um thickr | li depths Yess give | n in brackets | Project Project No. Carried out fo | KD | blin Waste to Energy 3116 blin City Council | | Borehole Bl Sheet | R9 5 of 5 |



| Drilled by MN Logged by JL Checked by MK | Start 03/06/2003 End 06/06/2003 | Equipment, Methods Casagrande C8 rotary di Hand dug inspection pit Rotary open hole drilling Rotary coring to 43,17m. Borehole backfilled with | and Remain ill rig to 1.20m. to 38,55m. | ies | | Depth from 0.00m 20.70m 38.55m | 20.70m 38.55m 43.17m | Diameter 131mm 120mm 76mm | Casing Depth 20,70m 38,55m | Ground Level Coordinates National Grid | E | 4.30 mO 320004,8 233686,9 |
|--|--|---|--|---------------|--------------------------------------|---|----------------------------|------------------------------------|----------------------------------|--|--|---------------------------------|
| Samples a | nd Test | 5 | | | Strata | | | | | 1 | | |
| Depth | Type & No | Records | Date Casing | Time Water | | Description | 3 0 | | | Depth,Level | Logend | Back |
| _ | | | Сазину | 112(6) | Driller reports ASH and | GRAVEL F | II with | | | (Thickness) | | histrano |
| - | | | | | metal fragments (MADE | GROUND) |) | | = | | \mathbb{K} | |
| - | | | | | | | | | _ | | KXXI | |
| | | | 1 | | | | | | - | | KXXI | |
| <u>:</u> | | | ļ | | | | | | | | $K\!$ | |
| · | | | Ì | | | | | | = | | KXX | |
| : | | | l | | | | | | _ | | XXXI | |
| 1.50-1,95 | SPTC | N=5 (2.1/1.2,1,1) | 1.50 | dry | | | | | - | | | |
| | | | | | • | | | | - | | KXXI | |
| - | | | | i | | | | | - | | KXX | |
| , | | | 1 | | | _ | | | | | KXX | |
| | | | ļ | | | | | | | | KXX | |
| | | | | | | | | | = | (5.40) | KXX | |
| - 3.00-3.45 | SPTC | N=6 (1,2/1,1,2,2) | 3.00 | | | | | | 7 | , , | \bowtie | |
| 2.2676.76 ³ | GFIQ : | الكيكية والطباح وسود | | dry | | | | | - | | KXXI | 1/ |
| | | | l | | | | | | 3 | | KXXI | |
| | | | | | | | | | = | | \bowtie | |
| Ì | | | | | | se. | | | - | | KXX | |
| | | | | | | nerth | | | | • | KXXI | |
| | | | | | م ده. | ott | | | 3 | | $\mathbb{K}\!\!\times\!$ | |
| 4.50-4.95 | SPTC | N=6 (2,1/1,2,2,1) | 4.50 | dry | ्राप्ति या | , | | |] | | \bigotimes | |
| | | | | - | oses diff | | | | - | | KXXI | |
| | | | | | our Quite | | • | | = | | KXXI | |
| | | | | | tion of the | | | | _ | | KXXI | |
| | | | ŀ | | Decrowiti | | | | = | £40 440 | KXX | |
| | | | ĺ | , at i | Bedjul Hilder Sand and | GRAVEL | with | | - | 5.40 -1.10 | م. قص | |
| } | | | | × A | A' | | | | = | | | |
| 6.00-6.45 | SPTC | N=5 (2,1/1,1,1,2) | 6.00 | 85.80 | | | | | _ | | | |
| İ | | | aseti | ř | | | | | 4 | | | |
| | | | Con | | | | | | E | | 0 | |
| İ | ŀ | | | ı | | | | | 3 | | • | |
| | | • | <u> </u> | - 1 | | | | | = = | | a | |
| · | | | | | | | | • | _ | | ام ونور | |
| | | | | | | | | | 3 | | 0 | |
| 7.50-7.91 | SPTC | 50 (2,4/7,14,17,12 for 35mm) | 7.50 | l | | | | | 3 | | | |
| İ | | | | ı | | | | | | | A | |
| . | | | | ł | | | | | | | خ م ه م | |
| | . 1 | | | - 1 | | | | | 1 | | · • • · | |
| | | | | l | | | | | | | | |
| • | - | | | | | | | | <u> </u> | | - | 11 |
| | | Flush: 0.00-17,70 Air, 100 % | | | | | | | _ | | | |
| 9.00-9.45 | SPTC | N=36 (2,3/5,9,10,12) | 9.00 | | | | | | = | | * | |
| į | 1 | | | | | | | | = | | f | |
| 1 | • | | | 1 | | | | | 7 | | فر وي ه حر | |
| | | | - | | | | | | 3 | | | |
| | | | Docto | | Stratum continued | next sheet | | | | | | |
| | Type & No | Records | Date Casing 1 | Time Nater | | | | | | | | |
| Froundwater Entri lo. Struck Pos | | viour | Depth se | ajed | Depth Related Remarks From to (m) | | | | | Chiselling Depths (m) 17 | me Tool | s used |
| (m) 5,80 - | | | | (m) | | | | | | | | |
| | | | | | | | | | | | | |
| des: For explanation | of symbols an | d I | Project. | | hubin Marie to E- | | | | | | | · |
| otes: For explanation breviations see key s rels in metres. Stratu | sheet. All depti m thickness or | ns and reduced wen in brackets | Project | | Oublin Waste to Energy | | | | [| Borehole | | |
| sepin column. | | | Project No. Carried out | | CD3116 Dublin City Council | | | | | | R10 | |
| ale 1:50 | | | | • | | | | | | Cha | et 1 of 5. | |



| s i | Drilled by MN Logged by JL Checked by MK | U3/05/2003 End | 1 | and Rema | rics | | Depth from to 0.00m 20.70m 20.70m 38.55m 38.55m 43.17m | Diameter 131mm 120mm 76mm | Casing Depth 20.70m 38.55m | Ground Level Coordinates National Grid | E | 4.30 mOD 320004.82 233685.92 |
|-----------|--|---------------------------------------|-------------------------------|---|-------------------------------|---|---|------------------------------------|----------------------------------|--|-----------|------------------------------------|
| I | Samples | and Test | s | | | Strata | | | | | | - |
| Ī | Depth | Type & No | | Date | Time | | Description | | - · · | Depth_Level | | Backfill |
| | 10.50-10.95 | SPTC | N=35 (3,6/7,6,9,11) | Casing | Water | Driller reports SAND and shells. | | | | (Thickness) | Legend | enstrument |
| | - 12.00-12.33 | SPTC | 50 (8,10/12,24,14 for 25mm) | 12.00 | | | | · | | (12.80) | | |
| | 13.50-13.95 | SPTC | N=49 (9.10/9.9,11,20) | 13.50 | | | other use. | · | | | | |
| | 15,00-15.45 | SPTC | N=35 (6,5/6,7,10,12) | 15.00 | | For its perion owner required h | A ANY | | | | 0 0 0 0 0 | |
| المستستين | 16.50-16.90 | SPTC | 50 (7,6/8,9,9,24 for 20mm) | 16.50 | Onsen | of cold | | | | | | |
| | 18.00-18.40 | SPTC | 19 (8,8711,10,11,17 for 2Smm) | 03/06/2003 17.70 04/06/2003 17.70 18.00 | 1630 14.10 0730 6.20 | Firm to stiff grey brown slig CLAY, Sand is fine to medi | htty sandy um. | | | 8.20 <i>-13.90</i> | | |
| | 19.50-19.95 19.50 | SPTS D1 | N=20 (3.2/4,5,5,6) | 19.50 | | Stratum continued n | ext sheet | | | | | |
| | (मा) | Type & No tries st strike behan | | Casing V Depth sea | ime Vater ded (m) | Depth Related Remarks From to (m) | | | | Chiselling Depths (m) Tim | ne Tools | used |
| l n | tes: For exptanation previations see kerels in metres. Strai depth column. ale 1:50 | | , , | Project Project No. Carried out | K | Oublin Waste to Energy CD3116 Oublin City Council | | | | | R10 | |



| Logg | Critical by MAN Start 03/06/2003 End 06/06/2003 End 06/06/2003 | | | | rks | Depth from to Diameter Casing Depth 0.00m 20.70m 131mm 20.70m 20.70m 38.55m 120mm 38.55m 38.55m 76mm 38.55m | Ground Level Coordinates National Grid | +4,30 mOD E 320004,82 N 233688,92 |
|-------------------|--|---|--|------------------|--|---|--|---|
| Sz | imples a | nd Tests | ; | | | Strata | | |
| | Depth | Type & No | Records | Date Casing | Time Water | Description | Depth, Level (Thickness) | Legand Backfill |
| 2 | 21.00-21.45 21.00 | SPTS D2 | N=23 (2,3/4,4,7,8) | 21.00 | | Firm to stiff grey brown slightly sandy CLAY. Sand is fine to medium. | | |
| يتسرير المستميرين | 22.50-22.95 22.50 | SPTS D3 | N=18 (2.3/5,4,4,5) | 22.50 | | | | |
| | 24.00-24.45 24.00 | SPTS D4 | H≈21 (3.2/4.8.5.6) | 24.00 | | ngerion burloses only any other use. | | |
| <u> </u> | 25.50-25.95 25.50 | SPTS D5 | N=21 (3,3/5,4/5,5) | 25.50 | for in for its original to the contract of the | Retion pure reduce | 7 | |
| سسب أست | 27.00-27.45 27.00 | SPT S D6 | N=35 (3,6/7,8,10,10) | 27.00 | | | (18.30) | |
| | 28.50-28.95 28.50 | SPT S D7 | Flash: 20.70-36.00 Water, 100 % N=24 (4.446,6,7,5) | 28.50 | | | مايينينينيانين | |
| 9 | Depth Sroundwater E | Type & N | | Date Casing | Time Wate | Stratum continued next sheet Depth Related Remarks From to (m) | Chisetting Depths (m) | Time Tools used |
| Ni at | | ation of symbols key sheet. All d tratum thicknes | and epitis and reduced signer in brackets | Projec Projec | (m) | Dublin Waste to Energy KD3116 Dublin City Council | Borehol | BR10 Sheet 3 of 5 |



| Drilled by MN Logged by JL Checked by MK | Start 03/05/2003 End 05/06/2003 | [| s and Rema | rics | 0.00m 20.70m 13 20.70m 38.55m 12 | ameter Casing Depth 21mm 20.70m 20mm 38.55m | Ground Level Coordinates National Grid | +4.30 mOC E 320004.82 N 233686.82 |
|---|--|----------------------------------|---|------------------------------|--|--|--|---|
| Samples a | nd Test | s | | | Strata | | | |
| Depth | Type & No | | Date | Time | Process | | Depth_Level | Sacking |
| 30.00-30.45 | SPTS | N=25 (5,5/5,7,7,6) | Casing 30.00 | Water | <u> </u> | · · · · · · · · · · · · · · · · · · · | (Thickness) | Legend instrume |
| 30.00 | D8 | | | | Firm to stiff grey brown slightly sandy CLAY. Sand is fine to medium. | , i | | |
| 31.50-31.95 31.50 | SPTS D9 | N=17 (3,3/4,3,5,5) | 31.50 | i | | , | ì | |
| - 33.00-33.45 - 33.00 | SPTS D10 | N=29 (7,5/6,8,7,5) | 33.00 | | | *************************************** | | |
| - - - 34.50-34.95 - 34.50 | SPTS D11 | N=27 (8,5-8,7,5,6) | 34.50 | | Ecolytish owner leadined for any other use. | | | |
| 36.00-36.45 - 36.00 | SPT S D 12 | N=43 (9,11/5,11,9,15) | 04/06/2003 36.00 36.90 05/06/2003 36,00 | 1630 1.20 0730 4.35 | Driller reports clayey SAND and GRAVEL and boulders with clay. | 111111111111111111111111111111111111111 | 36.50 -32.20 | |
| 37.50-37.56 | SPTC | io (25 for 35mm/50 for 20mm) | 37.50 | | | | (2.05) | |
| 38.55-39.15 m | -SPT C 100 42 N1 42 N1 150 | (25 for Omm/50 for Omm) | 38.50 | ı | Moderately strong to strong dark and light grey slightly fossiliferous medium to coarse-grained LIMESTONE with rare calcite veins. | 38.55-38,70 m 3 non-intact, recoved as - gravel | 8.55 -34.25 | |
| 39.15-39.66 m | 100 71 53 100 88 78 | Flush: 36.00-43.17 Med, 100 % | | | Joints are closely to medium spaced, 45 to 60° dip, and rough undulating. Weathering includes soft grey sandy clay infill along fracture planes. Stratum continued next sheet | 39.40-39.60 m | (2.45) | 计则 |
| Depth Groundwater Entrie No. Struck Post. (m) 1 5.80 - | | | Depth seal | inter later led (m) | Depth Related Remarks From to (m) | | Phiselling Depths (m) Time | Tools used |
| Notes: For explanation o abbreviations see key sh levels in metres. Strabum in depth column. Scale 1:50 | | _ | Project Project No. Carried out : | К | ublin Waste to Energy 03116 ublin City Council | | | R10 4 of 5 |



| rilled by MN ogged by JL hecked by MK | \$tart 03/06 End 06/06 | | Equipment, Methods a | uja Kemari | us , | Depth from to Diameter Casing Depth 0.00m 20.70m 131mm 20.70m 20.70m 38.55m 120mm 38.55m 38.55m 43.17m 76mm | Ground Level Coordinates National Grid | E | 4.30 mOD 120064.82 233696.92 |
|--|---------------------------------|----------------------|---|-------------------------------|--------------------------------|--|--|--------|------------------------------------|
| Samples a | nd T | ests | | | 1 | Strata | | | |
| Depth | TER SER ROD | H. | Records/Samples | Date Casing | Time Water | Description | Depth,Level (Thickness) | Legend | Backf Instrum |
| | 105 | ฟเ 70 270 | | | | Moderately strong to strong dark and light grey slightly fosslifterous medium to coarse-grained LIMESTONE with rare calcite veins. Joints are closely to medium spaced, 45 to 60° dip, and rough undulating. | | | |
| 40.17-41.67 m | 93 71 | | | 05/06/2000 38.55 | 11.30 | Weathering includes soft grey sandy clay Infill along fracture planes. Strong dark to light grey medium to coarse-grained thickly laminated to thinly bedded LIMESTONE. Joints are medium spaced, 35 to 45° dip, | 41.00 -36.70 | | |
| 41.67-43.17 m | 93 93 90 | 40 150 300 | | 38.55 | 643 | smooth and planar, predominantly along bedding planes. No visible weathering, slight discolouration along fracture planes. 42.50-42.58 m C subvertical rough fracture | (2.17) | | |
| _ | | | | 08/08/200 38.55 | G 1500 | <u>-</u> | • | | |
| - - | | | | | | EXPLORATORY HOLE ENDS AT 43,17 m Sepection purposes only one tree on the second of th | 43.17 -38.87 | | |
| | | | | Colle | For Sent of Co | | | | |
| | | | | | | | | | |
| - - - | | | | | | |] | | |
| <u> </u> | | | | A | | 4 | 4 | | |
| Depth Groundwater E No. Struck (m) 1 5.80 | Post st | | | Casing Depth | Time Water sealed (m) | | Chiselling Depths (m) | Time 7 | Tools us |
| Notes: For explana abbreviations see levels in metres. S in depth column. Scale 1:50 | key she tratum l | et. All d hicknes | and aptitis and reduced s given in brackets | Project Project Carried | | Dublin Waste to Energy KD3116 Dublin City Council | | BR10 | |

Trial Pit Log



| Logged by PG Checked by MK | Start 14/05/2003 End 14/05/2003 | Equipment, Method Excavated by JCB 3CX Trial pit terminated at n Pit backfilled with arisin | (equired depth. | Dimensions and Orientation Width 0.75 m Length 3.20 m D G 110 (Deg) | Ground Level Coordinates National Grid | E: | 3.81 mOD 319901.10 233417.70 |
|---|--|--|--|--|--|--------------------|------------------------------------|
| Samples a | nd Tests | | Strata | | | - | |
| Depth | Type & No. | Date Records | | Description | Depth, Level (Thickness) | Legend | Backfilli Instrument |
| | | | Soft, brown slightly sandy slightly gravelly FILL with rare brick fragments metal and Gravel is subangular to subrounded fine (MADE GROUND) | plastic | (0.50) | | |
| - 0.50-0.60 0.50-0.60 - | B1 D2 | | Grey slightly clayey gravelly SAND with A Gravel is subangular to subrounded fine (MADE GROUND) Soft dark brown sandy slightly gravelly CI FILL with occasional brick fragments. Grasubangular to subrounded fine to medium GROUND). | to medium LAY and ASH avel is | 0.50 +3.31 0.70 +3.11 | | |
| - 1.20-1.60 1.20-1.60 | B3 D4 | | · | - - - - - | | | |
| - - - - 2.40-2.60 2.40-2.60 | 85 D6 | • | Consent of copyright owner require | 2.00 m Rare shells and some caramic fragments | (3.30) | | |
| - 3.40 - 3.40 · 3.50-3.70 - 3.50-3.70 | W7 W8 D10 B9 | | | · | 4.00 <i>-0.19</i> | | |
| | | | EXPLORATORY HOLE ENDS AT 4 | | | | |
| Depth | Type & No. | Records Date | | | | | |
| Groundwater Entr No. Struck Post Str (th) 140 3.40 Vary Fac | ke Behaviour | | Depth Related Remarks From to (m) | | Stability Mod Shoring Non Weather | | |
| Notes: For explanatio abbreviations see key levels in meters. Strat in depth column. Scale 1:25 | _ | nd his and reduced wen in brackets | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | Trial Pit 7 She | FP01 eet 1 of 1 | |

Trial Pit Log



| Logged by PG Checked by MK | Start 14/05/2003 End 14/05/2003 | Equipment, Metho Excavated by JCB3C Trial pit terminated at Pit backfilled with aris | X required depth. | Dimensions and O Width 0.75 to Length 3.42 m | r 4 | 285 (Deg) | Coon | nd Level dinates nat Grid | E | 3.72 mO(319667.74 233463.93 |
|---|--|---|--|--|-------------------|-------------|--------------------|---------------------------------|----------------------|------------------------------------|
| Samples a | ind Tests | 3 | Strata | ' | | | _ | | | |
| Depth | Type & No. | Date Records | | Description | | | Depti | h, Level ckness) | Legend | Backfill |
| | | Records | 1 TARMAC pavement (MADE GROUND) | , | | | | · | XXX | V Service |
| - - | | | Grey slightly clayey sandy GRAVEL (suit frequent angular to subangular cobbles. to coarse gravel is angular fine to coarse GROUND) | Sand is fine | | - | 0.08 (f 0.38 | +3. <i>64</i> 0.30) +3.34 | | |
| , - | | | Soft dark brown slightly sandy gravelly C FILL with many pockets of gravel and oc cobble and boulder-sized fragments of n glass concrete, wood, state and plastic (| casional ed brick, | | - | | | | |
| - 1.00-1.10 1.00-1.10 | 81 D2 | | • | | | - | | | | |
| · · · | | | | | | - | | | \bigotimes | |
| | | | | ٠6. | | - | | | \bigotimes | |
| - 2.00-2.20 2.00-2.20 | B3 D4 | | esoliti. at | y other us | | - | (3 | 3.22) | \bigotimes | |
| · · · | | | Consent of copyright owner required for all | | | - | | | | |
| 3.20-3.40 3.20-3.40 | B 5 D 6 | | Consent of | | 3.1 becoming d | Om = = | | | | 1 |
| | | · | Dark grey fine to medium SAND with sor dark grey laminae of SILT. (ESTUARINE | me medium spaced DEPOSIT) | i | - | 3.60 | +0.12 | | |
| - - - | | | | | | - | (0 |).80) | x x x | |
| - | | | EXPLORATORY HOLE ENDS AT | 4.40 m | | - - - | 4.40 | -0.68 | *.* | |
| Depth | Type & No. | Records Date | · | | | - - | | | | _ |
| Groundwater Entr No. Struck Post Str (m) 1 3.45 Strong I | ike Behaviour | <u>armun</u> | Depth Related Remarks From to (m) | | | | | lity Mode ing None | | <u>.l—</u> |
| Notes: For explanation abbreviations see key levels in metres. Strain depth column. Scale 1:25 | y sheet. All dept tum thickness g | hs and reduced | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | | | Trial | Т | P02 et 1 of 1 | , |

Trial Pit Log



| | Logged by Po Checked by Mi | 13/05/2003 | Excavated by 300 | d due to poor stability | Oimensions and O Width 0.60 m Length 3,00 m | | Coord | id Level linates hal Grid | E | +3.67 mOE 319961.50 233435.75 |
|-------------|--|--|------------------|--|---|-------------------------------|----------------------|---------------------------------|--------------|-------------------------------------|
| | Samples | and Test | <u> </u> | Strata | | - | | | | |
| ı | Depth | Type & No. | Date | Oliata | Description | | Denth | , Level | | |
| | - | | Records | TARMAC pavement overlying crushed GROUND). | • | DE | (Thic | kness) | Legend | Backfill |
| | - - - 0.60-0.80 - - - | B 1 D 2 | | Soft brown sandy CLAY and GRAVEL pockets of coarse gravel and occasion (50 x 25 x 20cms) fragments of red/yel plastic metal, concrete. Sand is fine to gravel is subangular to subrounded fine (MADE GROUND) | 2! boulder-sized low brick, | | 0.30 | +3.37 | | |
| | 1.80-2.00 1.80-2.00 | B3 D4 | | | ily, ital after tise. | | (3.1 | 6 | | |
| | 2.80-3.20 2.80-3.20 | B 5 D 6 | | Consent of convirient owner require | | 3.20-3.40 m sidewall collarsa | | | | |
| No. | oundwater Entrie Struck Post Strik (m) | e Behaviour | Records Date | EXPLORATORY HOLE ENDS AT: | 3.40 m | collapse | 3.40 + | | w 3.20 m. | |
| Soh | 3.20 Moderate | of cumbale and | | | | | Shoring Weather | | | |
| eve n de | ts in metres. Strains | heet, All depths a n thickness given MESG HBH (2011, 30% | - m | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | | Trial Pit | TP(Sheet 1 |)3 of 1 | |



| | Logged by PG Checked by MK | Start 14/05/2003 End 14/05/2003 | Trial Pit terminated a | X t required depth. | Dimensions and O Vidth 0.75 m Langth 3.10 m | rientation | Ground Leve Coordinates National Gric | E | +3.70 mOD 319855.15 233525.52 |
|---|--|--|---------------------------------|--|---|------------|---|------------------|-------------------------------------|
| | Complex | | L | | | -6 | * | | |
| i | Samples | | | Strata | | | | | |
| ļ | Depth | Type & No. | Records | | Description | | Depth, Love/ (Thickness) | Legend | Backetti Instrume |
| | - - - 0.50-0.60 | B1 | | TARMAC pavement over dark grey gra GROUND). | | | (0.47) | | |
| | 0.50-0.50 | D2 | | 3 Dark brown sandy CLAY and GRAVEL ash and coarse gravel to cobble-sized i red/yellow bricks, concrete, state, wood bars and plastics (MADE GROUND) | tagments of | d. | | | |
| | - 1.20-1.40 - 1.20-1.40 | B3 D4 | | | a other use. | | (2.33) | | |
| | - 2.40-2.50 2.40-2.50 | 85 D6 | | 4 Grey clayer gravely SAND. Gravel is su subrounded fine to medium (ESTUARIN | 8 | | | | |
| | - 2.80-3.00 2.80-3.00 | 87 D8 | | 4 Grey clayer gravelly SAND. Gravel is su subrounded fine to medium (ESTUARIN | ibangular to E DEPOSIT) | | - 2.80 +0.90 - - - - | | |
| | 3,90-4,10 3,90-4,10 | D 10 B 9 | | | | | - (1.40) | | |
| | Depth | Type & No. | Records | EXPLORATORY HOLE ENDS AT | 4.20 m | | 4.20 -0.50 | | |
| H | Groundwater Entri | | Date | Parth Palyard Parada | | | | | <u> </u> |
| | No. Struck Post Strii {m} None observed (see lotes: For explanation | ke Behaviour Key Sheet) | | Depth Related Remarks From to (m) | | | Stability poor Shoring none Weather | | |
| å | bbreviations see key evels in metres. Strati | sheet. All depth m Thickness and | s and reduced en in brackets | Project Dublin Waste to Energy | | | Trial Pit | • | |
| ľ | o debar commu. | (c) MESG HBM (201). | Ca Ca | Project No. KD3116 Carried out for Dublin City Council | | | T | P04 et 1 of 1 | |



| Logged by PG Checked by MK | Start 15/05/2003 End 15/05/2003 | Equipment, Methor Excavated by JCB 3 Trial pit terminated a Pit backfilled with arising the property of the pr | ids and Remarks CX 3.10 m due to obstruction. sings. | Dimensions and Orientation Width 0.90 m Length 2.90 m | 270 (Deg) | Ground Level Coordinates National Grid | +3.35 m E 319849 N 233570 |
|---|---|--|---|---|-----------------------|--|---------------------------------|
| Samples ar | nd Tests | | Strata | | | | |
| Depth | Type & No. | Date Records | | Description | | Depth, Level (Thickness) | Legend Baci |
| - | ٠. | | TOPSOIL: soft sandy gravelly CL fine to medium. Gravel is subanged in the to medium. | AY with roots. Sand is ular to subrounded | | 0.15 +3.20 | XXX |
| • - - | | | Soft dark brown sandy CLAY and abundant pockets of coarse grave boulder-sized (up to 160cm) fragri concrete, some wood, glass, wire GROUND) | el and occasional nents of brick and | | | |
| - 0.70-0.80 0.70-0.80 | B1 D2 | | | | - - - | | |
| | | | | · | | (2.95) | |
| 1.80-2.00 1.80-2.00 | B3 D4 | | | diffet use. | | | |
| | | | ection drive | poses of the any other use. 2.8 DS AT 3.10 m | 1 | | |
| 2.80-3.00 2.80-3.00 | B 5 D 6 | | For its of | 2.6 | 0 m concrete - blocks | 3.10 + <i>0</i> .25 | |
| | | | EXPLORATORY HOLE EN | IDS AT 3.10 m | | 3.10 +0.25 | |
| | | | | | <u> </u> | | |
| | | | | | | | |
| - | | | | | 1 | | |
| | | | | | | | |
| | | | · | | 1 | | |
| Depth T | una P Ma | Records | | | | | |
| Sroundwater Entries | ype & No. | Date | Depth Related Remarks | | | | |
| io. Struck Post Strike (m) | | | From to (m) | | 1 | Stability poor | |
| None observed (see Kr | ey Sheet) | | | | | Shoring none Weather | |
| otes: For explanation o phreviations see key sh vels in metres, Stratum depth column. cale 1:25 | f symbols and leet. All depths thickness give | and reduced in in brackets | Project Dublin Waste to Ener Project No. KD3116 Carried out for Dublin City Council | 997 | 1 | | P05 |



| Logged by PG Checked by MK | Start 15/05/2003 End 15/05/2003 | Equipment, Method Excavated by JCB3CX Trial pit terminated due Pit backfilled with arisin | to poor stability. | Dimensions and Orie Width 0.90 m Length 3.10 m | entation Description 15 (Deg) | Ground Level Coordinates National Grid | E: | 3.45 mQD 319916.98 233552,27 |
|--|--|--|--|---|---------------------------------|--|--------------------|--|
| Samples a | nd Tests | | Strata | <u>-</u> | | | | |
| Depth | Type & No. | Date Records | | Description | | Depth, Level (Thickness) | Legend | Backfill Instrume |
| - | | Necords | 1 Gravel - Hard Standing (MADE C | GROUND). | - | (0.40) | | |
| - 0.80-1.00 0.80-1.00 | B1 D2 | | 2 Soft brown slightly sandy CLAY a many pockets of coarse gravel to fragments of yellow/red brick, coblocks, limestone and granite, alter and wood fragments. Sand is fin is subangular to subrounded fine GROUND) | o boulder-sized ncrete, concrete xundant glass, cloth ne to coarse, gravel | | 0.40 +3. <i>0</i> 5 | | |
| - - 1.80-2.00 - 1.80-2.00 | B3 D4 | | . "Rossi | offy, and offet use. | - - - - - - | (3.00) | | |
| - 2.80-3.00 2.80-3.00 - 3.20 3.20 | B5 D6 W7 W8 | | · For its petion purposes for its petion of the consent of copyright owner required to the consent of copyright owner required to the copyright of the copyrigh | | 2.50 m imestone boulder | | | 1 |
| - 3,50-3,70 3,50-3,70 | D 10 B 9 | | 3 Dark grey to black fine to medium DEPOSIT) EXPLORATORY HOLE | m SAND (ESTUARINE | | 3.40 +0.05 (0.30) -3.70 -0.25 | XXX | |
| - - - - - - - | | | | | - - - - - - - | | | |
| <u> </u> | <u> </u> | Records | | | | | <u> </u> | |
| Depth | Type & No. | Records Date | D-4-D-4-12 | | | | 1 | <u> </u> |
| Groundwater Ent No. Struck Post St (m) 1 3.20 Very fa | rike Behaviou | | Depth Related Remarks From to (m) | | | Stability poor | | |
| Notes: For explanati | ion of symbols a | nd | Project Dublin Waste to E | inergy | | Trial Pit | | |
| abbreviations see to levels in metres. Str- in depth column. Scale 1.25 | | oths and reduced given in brackets on corresces 121600 AGS | Project No. KD3116 Carried out for Dublin City Course | all . | | | TP06 eet 1 of 1 | l |



| Logged by PG Checked by MK | Start 15/05/2003 End 15/05/2003 | Equipment, Methor Excavated by JCB30 Trial pit terminated d Pit backfilled with ari | X Les la poor stability | Dimensions and Orien Width 0,80 m Length 3,20 m | tation 197 (Deg) | Ground Level Coordinates National Grid | E 319965.50 |
|---|--|--|---|---|---|--|---|
| Samples a | لسيا | <u> </u> | | C. 1901 3.20 (II | c (209) | <u> </u> | |
| Depth | Type & No. | Date | Strata | Description | | Depth, Lave/ | Legand Backfill |
| | 1,770 = 1,00. | Records | 1 GRAVEL - Hard Standing (MADE GROU | | | (Thickness) | Legend Instrumer |
| - - - - 0.70-0.90 0.70-0.80 | B1 D2 | | Soft brown slightly sandy CLAY and GRA many cobbles and boulders, abundant frorick, wood, plastic, metal, glass, concret and rubble. (MADE GROUND). | VEL FILL with | - | 0.10 +3.67 | |
| - 1.80-2.00 1.80-2.00 | B3 D4 | | | چې | | (3.40) | |
| - 2.80-3.00 2.80-3.00 | B 5 D 6 | | Consett of copyright owner required to | or any other use | 2.00 m boulder sized fragments of concrete (40cm wide) slow progress, | | |
| - - 3.40 | W7 | ! | C | | - | | XX ; |
| 3.40 | B8 | | · · · · · · · · · · · · · · · · · · · | | | 3.50 +0.27 | $\otimes\!$ |
| Depth T Groundwater Entries No. Struck Post Strike (m) 1 3.40 Slow inflow | Behaviour | Records Date | EXPLORATORY HOLE ENDS AT 3.9 Depth Related Remarks From to (m) | O M | | Stability poor b Shoring none Weather | elow 2.00 m. |
| Notes: For explanation of abbreviations see key silevels in metres. Stratum in depth column. Scale 1:25 49 | of symbols and heet. All depths in thickness give passe had (201), 20 | | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | <u>-</u> | Trial Pit TF Shee | 207 t 1 of 1 |



| Logged by PG Checked by MK | Start 27/06/2003 End 27/06/2003 | Equipment, Metho Excavated by JCB 30 Trial pit terminated di Pit backfilled with aris | X se to poor stability. | Dimensions and O Width 0.60 m Length 3.20 m | orientation | 230 (Deg) | Ground Level Coordinates National Grid | E | +4.26 mOD 319982.73 233677.34 |
|---|---|--|---|---|------------------------|---------------------------------------|--|------------------|-------------------------------------|
| Samples a | | <u></u> | Strata | | <u> </u> | | | | |
| Depth | Type & No. | 6 | Strata | Description | | | Depth, Level | 1. | Backta |
| Deput | type a No. | Records | | | | | (Thickness) | Legend | Instrume |
| - | | | Soft brown sandy gravelly CLAY FILL and fragments of brick, metal and plas | with rare cobbles tic. | | <u>-</u> | (0.70) | | |
| - | | | · . | | · . | | (0.70) 0.70 +3.56 | | |
| - 0.80-1.00 0.80-1.00 | B1 D2 | | Loose orange grey clayey sandy GRA with fragments of charcoal and burnt w subangular to subrounded fine to medi | mod Gravelie | | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | | |
| - 1.80-2.00 1.80-2.00 | B3 ⁻ D4 | | | | | 1 1 1 1 1 | | \bigotimes | |
| - | | | | Otheruse | | | | \bowtie | |
| _ | | | oses all ta | day. | | - | (3.30) | | |
| 2.80-3.10 2.80-3.10 | 85 D6 | | Consent of copyright owner required for | | | | | | |
| | | | Conser | - | 3.80 m suban bou | Grigat. | | | |
| 4.00 4.00 | B7 D8 | | EXPLORATORY HOLE ENDS A | T 4 00 - | | | 4.00 +0.26 | | |
| Depth | Type & No. | Records Date | | | | - | | | |
| Groundwater Entri | | Date | Depth Related Remarks | | | | | | |
| No, Struck Post Stri (m) None observed (see | ke Behaviour Key Sheet) | | From to (m) | | | | Stability poor Shoring none Weather | <u></u> | |
| Notes: For explanation abbreviations see key levels in metres, Strati in depth column, Scale 1:25 | n of symbols an sheet. All depti um thickness gi «) меза нап (201) | | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | | | | P08 et 1 of 1 | |



| 1 | Logged by PG | Start 27/06/2003 | Equipment, Method: Excavated by JCB 3CX That pit terminated due | s and Remarks | Dimensions and Orientation Width 0.70 m | | Ground Level Coordinates | E: | 4.36 mOD 119876,08 |
|-----|---|---------------------|---|--|---|--|-----------------------------|-------------------------|-------------------------|
| | Checked by MK | End 27/06/2003 | Pit backfilled with aristo | gs | Length 3.20 m | 195 (Deg) | National Grid | N a | 233676.72 |
| | Samples a | | | Strata | | | Desti : | | |
| | Depth | Type & No. | Date Records | | Description | | Depth, Leve/ (Thickness) | Legend | Backfill/ Instrument |
| | - - - - - 0.70-0.90 0.70-0.90 | B1 D2 | | Soft brown sandy CLAY and GRAVEL FI subangular cobbles and fragments of bric wood, plastic, metal etc. (MADE GROUN | LL with occasional k, concrete, D). | - - - - | | | |
| | - | | | | | - - - - | | | |
| | - 1.70-1.80 - 1.70-1.80 - - - - - | B3 D4 | | Consent of copyright owner require | 1.80 st. 2.0 concre | m many bangular boulders -0-3.40 m te blocks | (3.50) | | |
| | - 2.80-3.10 2.80-3.10 | 85 D6 | | Consent of copyrights | | - | | | |
| . 1 | 3,50 | - D7 | | EXPLORATORY HOLE ENDS AT 3 | i.50 m | | 3.50 + <i>0.86</i> | XXX | |
| | Depth Groundwater Entr | | Records Date | Depth Related Remarks From to (m) | | | Stability poor | | |
| | (m) None observed (see | Key Sheet) | | | | | Shoring none Weather | • | |
| | Notes: For explanatio abbreviations see key levels in metres. Strat in depth column. Scale 1:25 | | nd his and reduced iven in brackets | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | | Trial Pit T She | P09 et 1 of 1 | |



ENCLOSURE B INSTRUMENTATION MONITORING

Installation Details

Groundwater and Gas Monitoring city the required for any other to the foot of the property of the proper

B1

B2

Installation Details



| | , | | | | | | | | |
|---------|-------------------|----------------------|----------------|-----------------------------|------------------------------|-------------------------------|------------------------------|-----------------------|---------|
| Hole No | Installation Type | Date of installation | Tip depth, (m) | Piezometer Diameter (mm) | Top of response zone, (m) | Base of response zone, (m) | Tubing Completion Details | Headworks | Remarks |
| BH1 | SP | 26/05/2003 | 12.00 | 50 | 2.00 | | Open | Gas barrel | |
| BH4 | SP | 17/06/2003 | 20.00 | 50 | 2.00 | 20.00 | Open | Gas barrel | |
| BH5 | \$P | 28/06/2003 | 12.00 | 50 | 2.50 | 12.00 | Open | Gas barrel | |
| BR6 | SP | 20/05/2003 | 40.20 | | 34.20 | 40.20 | Open | Gas barrel | |
| BR8 | SP | 25/05/2003 | 46.50 | • | 40.50 | 46.50 | Open | Lockable top cover | |
| BR9 | SP | 12/06/2003 | 49.50 | 50 | 44.70 | 49.50 | Open | Lockable top cover | |

Consent of copyright owner required for any other use.

Notes: Type: SP - Standpipe, SPIE - Standpipe Piezometer, HPIE - Hydrautic Piezometer, PPIE -Pneumatic Piezometer, EPIE - Vibrating Wire Piezometer, PWEL - Pumping Well

Project No. Carried out for

Project

Dublin Waste to Energy

KD3116 Dublin City Council Table

B1 Sheet 1 of 1

Mowlem Environmental Sciences Group

| | | | , | | - | | | | | | | | | | | | | | | Remarks | | | | | | | Sheet No |
|--|---|--|---|---|---|---|---|-----|-----|-------|-----|---------------|------|-----|--------------|------|------|------|---------|---|------------------|------------|-----------------------------------|--------------------|-------|-----------------|------------------------|
| | | | | _ | | - | | | | | | | | | | | | | | Ammonia (ppm) | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | H ₂ S (ppm) | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | (% vol) | | | 1 | | | | |
| | | | | | | | | | | | | | 4.0 | | 2.2 | 0.0 | 0.4 | 1.3 | 5.1 | CO ₂ (% vo!) | | | | | | | |
| | | | | | | | | | | | | | 19.9 | | 19.4 | 20.8 | 20.1 | 19.9 | 4.1 | O ₂ (% vol) | | | | | | | rergy |
| | | | | | | | | | | | | | | | | | | | | CH4 (% LEL) | | | | | | | Dublin Waste to Energy |
| | ! | | | | | | | OD. | 'جي | | | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | CH4 (% vol) | | | Silgnt None | Easterly | Light | dry | Dublin W |
| | : | | | | | | | | die | any c | KO, | ر د د د | ٥ | | | | | | | FlowRate (I/hr) | Detection Limits | _ | | o | | pun | |
| | | | | | | | | | | | | dire | E TO | ONT | ecti Peti | ·10° | | | | Differential Pressure (Pa) | Detec | ionardon i | Cloud Cover Precinitation | Wind Direction | Wind | State of Ground | Project |
| | | | | | | | | | | | | | | | | | GG (| ુઈ | | Reading Depth (mBGL) | | | | | | | |
| | | | | | | | | | | | | | 2.97 | | 3.75 | 3.61 | 3.57 | 3.87 | 3.17 | Depth to Groundwater (m BGL) | | | | | | • | |
| | | | | | | | - | | | | | | | | | | | | | Time of Reading hh:mm:ss | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | Depth of Installation (m BGL) | | | ble | |] | Γ | |
| | | | | | | | | | | | | | 18 | | 18 | 18 | 18 | 18 | 18 | Air temp (°C) | | 100 | O2 Porta | ves | | 72003 | 16 |
| | | | | | | | | | | | | | 1021 | | 1021 | 1021 | 1021 | 1021 | 1021 | Barometric Pressure (mbars) | | | Used GMI C | P. Gr | | 05/07 | KD31 |
| | | | | | | | | | | | | | 9H4 | | BR9 | BR8 | BR6 | 왕 | BH1 | Borehole/ Instrument | | | Equipment (| Operator | | Date | Project No |
| | | | | | | | | | | | | | 1021 | | 1021 | 1021 | 1021 | 1021 | 1021 18 | Barometric Air temp Depth of Time of Pressure (°C) (m BGL) hh;mm:ss | | | Fourinment Used IGMI CO2 Portable | Operator P. Groves | _ | Date 05/07/2003 | Project No KD3116 |



ENCLOSURE C
SLIT TRENCH RECORDS

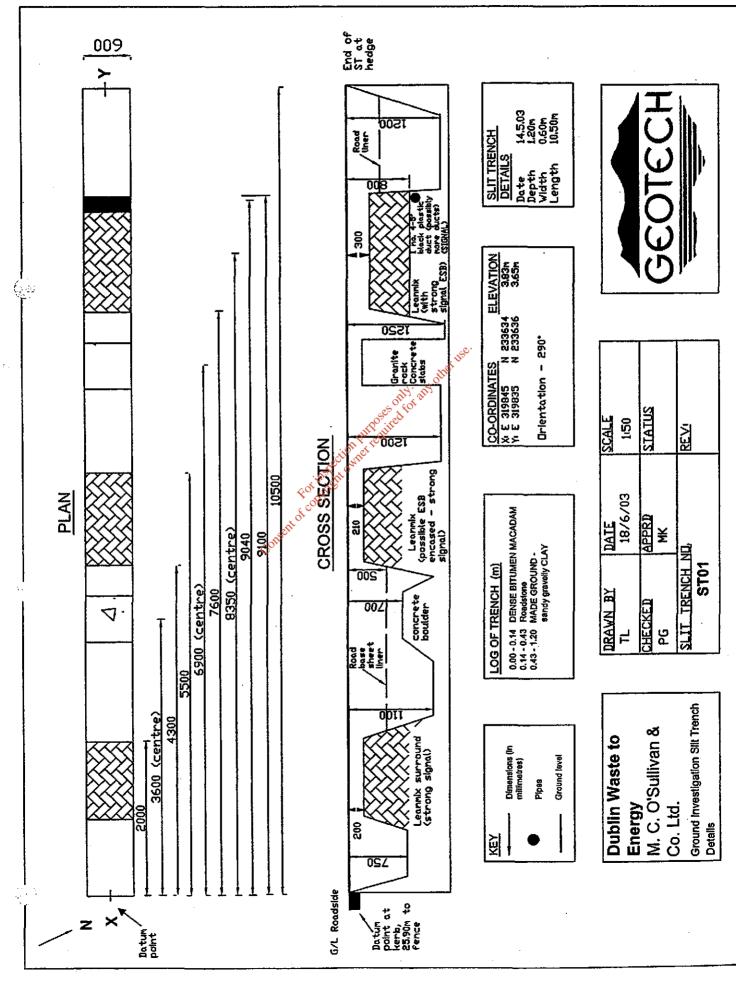
Logs

Logs

Consent of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congrigation burger treatment of congregati

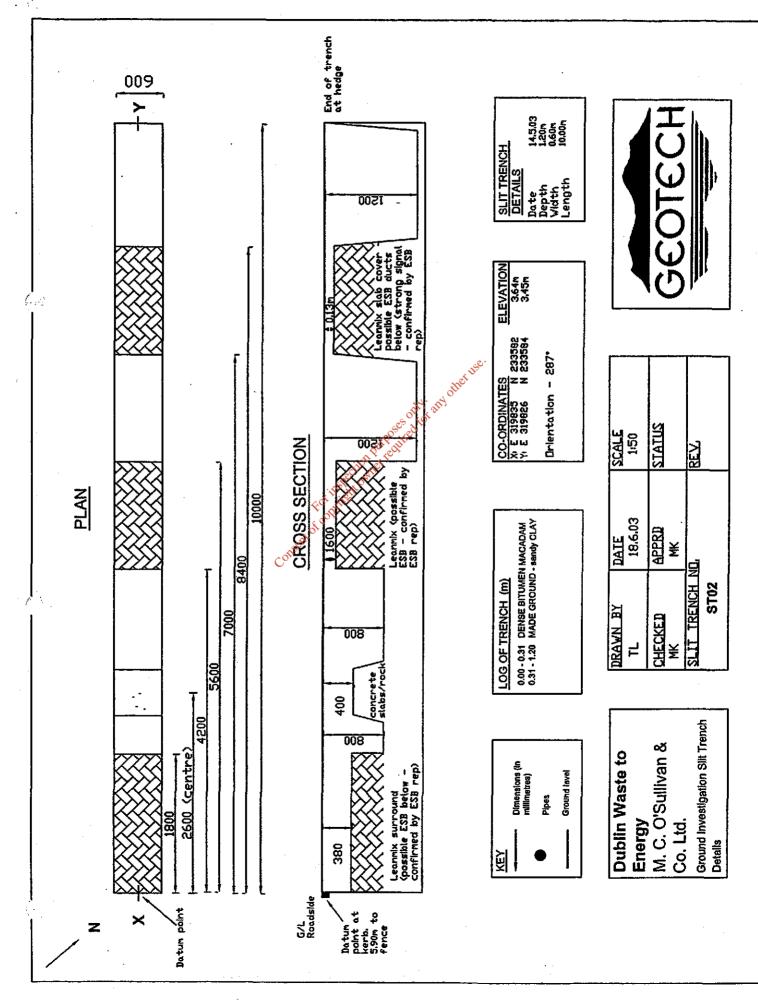
Slit Trench Sketches and Logs

ST1 to ST5



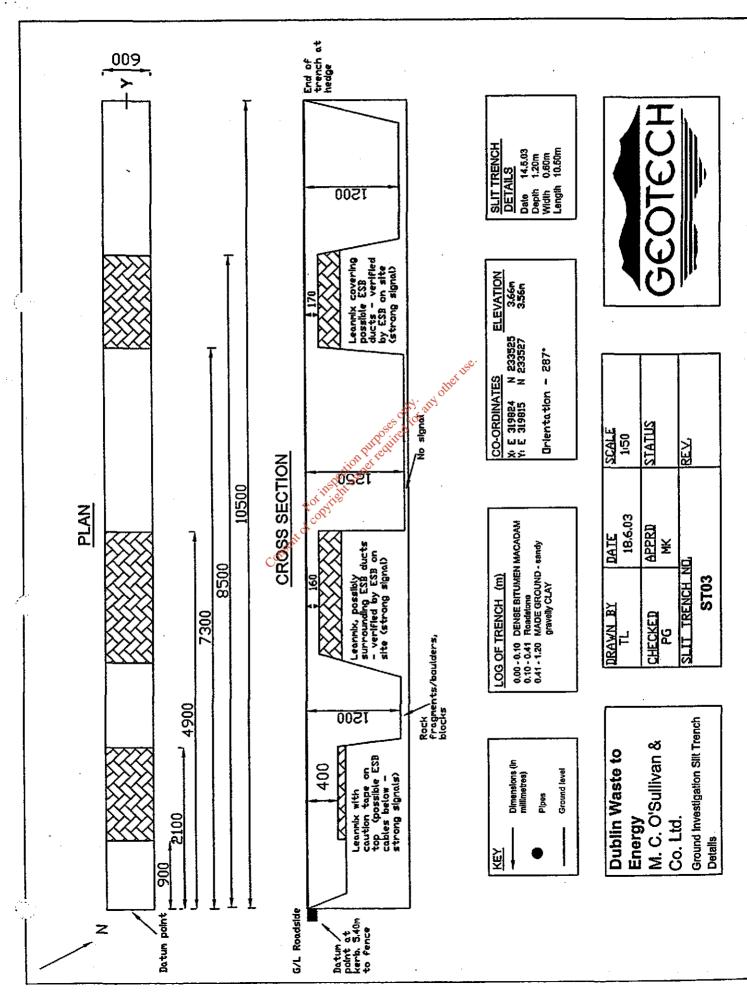


| Logged by PG | Start 14/05/2003 | Equipment, Method: Excavated by JCB and ESB representative on | s and Remarics Komatsu Mini-digger site for dig. Backfilled with | Width | o.60 m | | Ground Level Coordinates | | - |
|---|--------------------------------------|---|--|--|-------------|---|-----------------------------|--|------------------------|
| Checked by MK | End 14/05/2003 | gravel, reinstaked surfa | 00. | | 10.50 m ° c | j= 290 (Deg) | National Grid | | |
| Samples a | nd Tests | | Strata | | | | | | |
| Depth | Type & No. | Date Records | | Descri | ption | | Depth, Level (Thickness) | Legend | BackfilV Instrument |
| _ | | | 1 Dense Bitumen Macad | iam . | | _ | | | |
| - | | | 2 Compacted black ROA ducts) | ADSTONE subbase (Leans | mix over | - | 0.14 | | 600 |
| - | | | and) | | | • | (0.29) | ا ٠ ٠ م | |
| | | | 3 Firm brown fine to coa | rse sandy gravelly CLAY F agments. Gravel is subang | TLL: | - | 0.43 | ŔXX | lo 0 |
| - | | | to subrounded fine to a | agments. Gravei is subang coarse. (MADE GROUND) | andi L | <u>-</u> | | $K\!$ | 600 |
| | | | | | | 0.80.420-7 ~ | מל חו | $\aleph\!$ | |
| _ | | | | | • | 0.80-1.20 m (* * * * * * * * * * * * * * * * * * | (0.77) | $K\!$ | 000 |
| - | | | | | d | brown slightly gravelly clay lods. Imagutar | | $\aleph\!$ | |
| | | | | | | | 1,20 | $\langle X X \rangle$ | 000 |
| - | | | EXPLORAT | TORY HOLE ENDS AT 1.20 m | | - | | | |
| | | | | | | | | | |
| F | | | | | | - | | | |
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| Depth | Type & No. | Records Date | | <u> </u> | | | | ├ | + |
| Groundwater Entr | ies | | Depth Related Remarks | <u> </u> | | | Stability Poo | from 0.43m | bgl |
| No. Struck Post Str (m) | | ' | From to (m) | | | | | | |
| None observed (see | rey Sheet) | | · , | | | | Shoring N/A Weather - | | |
| Notes For an inches | o of cumbols o | od . | Sprained Publication | Whele to Engage | | | | <u></u> | |
| Notes: For explanational abbreviations see key levels in metres, Stra | y sheet. All dep turn thickness (| ihs and reduced given in brackets | Project No. KD311 | Waste to Energy 6 | | | Trial Pit | TO4 | |
| in depith column. Scale 1:25 | | п, жолоком 12:5021 AGS | | City Council | | | She | ST01 set 1 of 1 | |
| L | | | t | | | | <u> </u> | | |



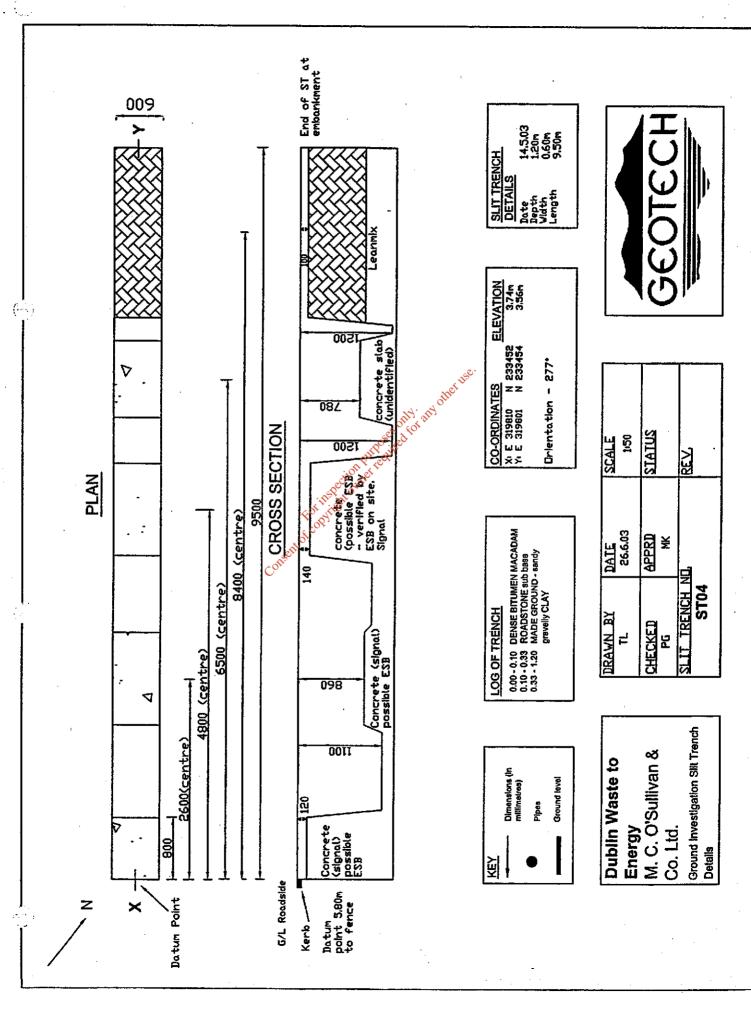


| Logged by PG Checked by MK | Start 14/05/2003 End 14/05/2003 | ESB representative | d Komatsu Mini-digger | | Dimensions and Orientation Width 0.80 m | a 287 (Deg) | Ground Level Coordinates National Grid | | |
|---|---|--------------------|--|---|--|-------------|--|-----------------------|--------------------|
| Samples a | and Test | <u></u> | Strata | | | | | | |
| Depth | | Date | Suata | | Description | | Denth Louis | , | D. et en |
| Depth | Type & No. | Date Records | with many granite fragments, rare costrips. Gravel is su coarse. (MADE G | medium sandy gravelly of boulders, brick and metropper pipe, plastic, rubber unled | al of and iron i, fine to | | (0.31) (0.31) (0.89) | Legend | Bacidilli Instrume |
| | | | Cansental | of its gestion purposes out of its gestion owner required to owner required to owner required to only the contribution of the | A and after use. | | | | |
| iroundwater Entries lo. Struck Post Strike | | Records Date | Depth Related Remarks | | | S | tability Poora | hedge side | |
| (m) None observed (see K | lay Sheet) | | From to (m) Project Dublin | What to Ferri | | s | horing N/A leather - | .cuga 308 | |
| otes: For explanation of obreviations see key si rels in metres. Stratum depth column. Tale 1:25 #3 | heet. All depths n thickness give MESG MBH (201), 30 | | Project No. KD31 | n Waste to Energy 16 n City Council | , | T | rial Pit S7 Sheel | 702 11 of 1 | |





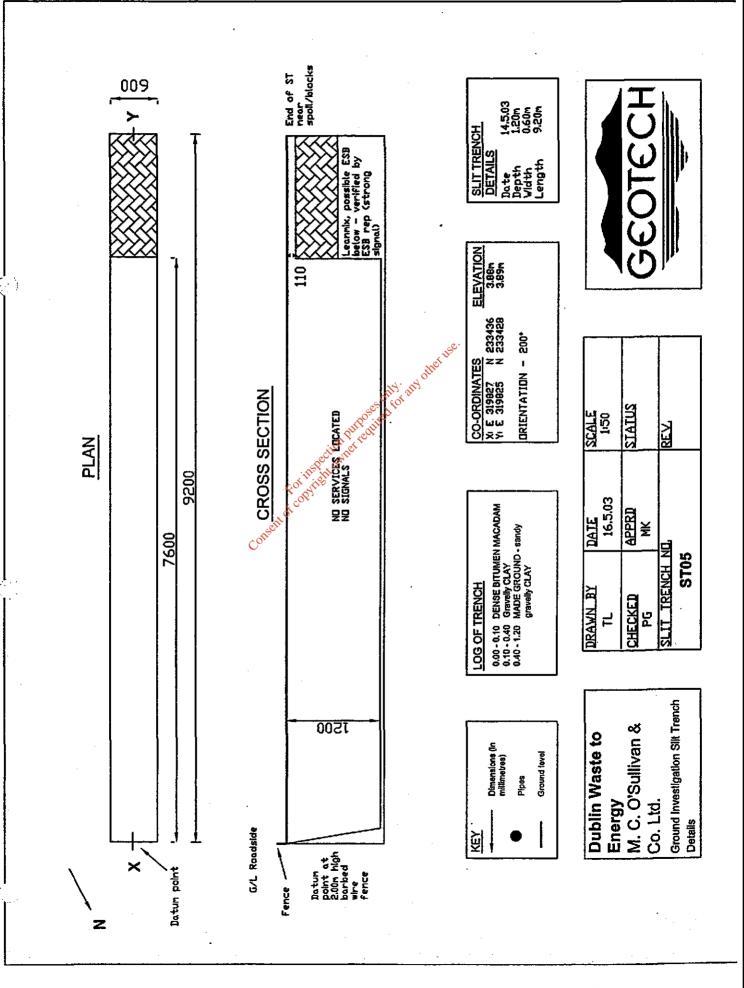
| Legged by PG Checked by MK PG Checked by MK PG Checked by MK PG Checked by MK PG PG PG PG PG PG PG PG PG PG PG PG PG | Backfill/ Instrument |
|--|--|
| Depth Type & No. Pate Records 1 Dense bitumen macadam 2 Grey slightly clayey ROADSTONE subbase. 3 Soft mottled grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, wiring, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare vellow sandstone blocks. Gravel is | |
| Depth Type & No. Date Records Description Depth, Lavel (Thickness) Legend | |
| 1 Dense bitumen macadam 2 Grey slightly clayey ROADSTONE subbase. 3 Soft mottled grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, writing, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare veitow sandstone blocks. Gravel is | , 000000000000000000000000000000000000 |
| 3 Soft motitied grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, writing, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare yellow sandstone blocks. Gravel is | |
| 3 Soft mottied grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, wiring, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare yellow sandstone blocks. Gravel is | |
| 3 Soft mottled grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, wiring, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare veitow sandstone blocks. Gravel is | |
| CLAY FILL with many concrete, granite and brick fragments, writing, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare veltow sandstone blocks. Gravel is | |
| rare re-inforcing bars (not local to trench) and plastic. Rare vellow sandstone blocks. Gravel is | |
| angular to subrounded fine to coarse. (MADE GROUND) (0.79) | 0000 |
| ֈ 1 1 1 1 1 1 1 1 1 1 | 600 |
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| ├ | 000 |
| 120 | |
| EXPLORATORY HOLE ENDS AT 1.20 m | |
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| | |
| Depth Type & No. Records Date | |
| Groundwater Entries Depth Related Remarks Stability poor from 0.41m No. Struck Post Strike Behaviour From 10.41m | bgl. |
| (m) None observed (see Key Sheet) Shoring N/A Weather - | |
| | |
| Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets Project Dublin Waste to Energy Trial Pit ST03 | |
| kerels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESC HOME (281), 301/M2005 125/200 | |



PRELIMINARY



| Logged by PG Checked by | Start 14/05/2003 End 14/05/2003 | ESB representative of | d Komatsu mini-digger n site for dio. Backtilled with | Dimensions and Orientation Moth 0.60 m P 277 (Dec | Ground Leve Coordinates National Grid | | - |
|--|--|-----------------------|---|--|---|---------------|----------|
| Samples a | ınd Test | 5 | Strata | | | ····· | |
| Depth | Type & No. | Date Records | | Description | Depth, Level | Legend | Backfill |
| | | - 200 0000 000 | 1 Dense bitumen macadam | | (Thickness) | 1.4.0. 4 | Instrume |
| _ | | | 2 Grey ROADSTONE subbase. | | 0.10 | | 0 0 0 |
| _ | | | | | 1 | - | |
| - | | | 3 Soft to firm dark brown fine to coarse sandy | gravelly | 0.33 | | 000 |
| _ | | | CLAY FILL with many red brick and concret wood chips, metal bars and plastic. Gravel i | ie - | | KXXI | 000 |
| - | | | subangular to subrounded fine to coarse. (N GROUND). | MADE | 4 | KXX | 600 |
| <u>L</u> | | | GROONDJ. | | - | KXX | |
| • | · | | | | (0.87) | \bowtie | 00 |
| - | | | | | 1 | \bowtie | а° |
| _ | | | | - | 1 | XXX | 000 |
| | | | | | 1,,,, | KXXI | |
| _ | | | EXPLORATORY HOLE ENDS AT 1.20 |) m | 1.20 | | |
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| . | 1 | | | - | | | |
| Depth | Type & No. | Records | | | | | |
| Groundwater Entri | :s | Date | Depth Related Remarks | | | | |
| No. Struck Post Strik (m) | e Behaviour | | From to (m) | | Stability Poor | from 0.33m bg | y. |
| None observed (see I | Key Sheet) | | | | Shoring N/A | | |
| Inject For annianation | of combols as | | Bulliota Bankara | | Weather - | | |
| lotes: For explanation obbreviations see key : evels in metres. Stratu | sheet All depth | s and reduced | Project Dublin Waste to Energy | | Trial Pit | | |
| n depth column. | - | _ 1 | Project No. KD3116 Carried out for Dublin City Council | | | T04 | |
| Scale 1:25 (| (c) NESC (488) (381), 1 | 20100000 12:50:25 ABS | and manner | | Shee | st 1 of 1 | |





| Logged by PG Checked by MK | Start 14/05/2003 End 14/05/2003 | Equipment, Methods Excavated by JCB and ESB representative on gravel, reinstated surface | Komatsu mini-digger site for dig. Backfilled with | Dimensions and Orientation Width 0.60 m Length 9.20 m C 200 (Deg) | Ground Level Coordinates National Grid | | - |
|---|--|---|---|--|--|---|-------------------------|
| Samples a | nd Tests | , | Strata | | <u> </u> | | |
| Depth | Type & No. | Date Records | | Description | Depth, Level (Thickness) | Legend | Backfill/ Instrument |
| | | - Very 19 | 1 Dense bitumen macadam | | | . 0 4 | |
| | | | 2 Stiff brown gravelly CLAY (possible subb is subangular to subrounded fine to coars a subangular to subrounded fine to coars and yellow bit blocks, wood chips, plastic, cloth, glass, strips and re-inforcing bars (not local to the Gravel is subangular to subrounded fine (MADE GROUND). | ravelly x fragments, metal ench). to coarse. | (0.30) (0.30) (0.40 (0.80) | | |
| Depth Groundwater Entr No. Struck Post Str (m) None observed (see | ike Behaviour | Records Date | Depth Related Remarks From to (m) | - - - | Stability Poor leng | along entire th of trench to m bgl. | |
| Notes: For explanational abbreviations see ker levels in metres. Strain depth column. Scale 1:25 | y sheet. All dep turn thickness (| nd tits and reduced given in brackets n, sorozeos 1250-00 | Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council | | Trial Pit S She | T.05 eet 1 of 1 | |



ENCLOSURE D GEOTECHNICAL LABORATORY TEST RESULTS

Key to Geotechnical Laboratory Results

Table of Index Properties

Particle Size Distribution Analyses

CBR & MCV Plots
Unconfined Compressive Strength Test Results

Point Load Index Values

Key

KEY TO SYMBOLS ON LABORATORY TEST RESULTS SHEETS

U Undisturbed Sample Р Piston Sample TWS Thin Wall Sample В Bulk Sample - Disturbed D Jar Sample - Disturbed W Water Sample pΗ Acidity/Alkalinity Index SO₂ % - Total Sulphate Content (acid soluble) SO₂ g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract) + Calcareous Reaction CI Chloride Content Plasticity Index ₹425 % of material in sample passing 425 micron sieve $\mathbf{W}_{\mathbf{L}}$ Liquid Limit W_o Plastic Limit W Water Content NP Non Plastic **Bulk Density** γь Dry Density Ya Ps **Particle Density** U/D Undrained/Drained Triaxial U/C Unconsolidated/Consolidated Triaxial T/M Single Stage/Multistage Triaxial 100/38 Sample Diameter (mm) REM Remoulded Triaxial Test Specimen TST Triaxial Suction Test V Vane Test **DSB** Drained Shear Box **RSB** Residual Shear Box RS Ring Shear σ_3 Cell Pressure $\sigma_1 - \sigma_3$ Deviator Stress C Cohesion C_ Effective Cohesion Intercept Angle of Shearing Resistance - Degrees Effective Angle of Shearing Resistance Strain at Failure Failed under 1st Load Failed under 2nd Load # Untestable ## **Excessive Strain p_o** Effective Overburden Pressure m_{ν} Coefficient of Volume Decrease Coefficient of Consolidation Opt Optimum Nat Natural Std Standard Compaction - 2.5kg Rammer (¶ CBR) Hvy Heavy Compaction - 4.5kg Rammer (§ CBR) Vib Vibratory Compaction **CBR** California Bearing Ratio Sat m.c. Saturation Moisture Content MCV Moisture Condition Value **Project** Contract **Laboratory Symbols** KD3116 **Dublin Waste to Energy Project Dublin City Council**

SEOTECH

KEY

Figure

| Samp | ples | | | Clas | sifica | ation | | | • | ngth | | Other Tests |
|------|-----------------|------|--|------------------------|------------------------|----------------|-------------|--------------------------|------|-----------------------|----------|--|
| Hole | Depth | Туре | Description | <425 l _P | Prep W _L | w _P | Water % | γ _b 3 Mg/m | Test | σ ₃ kPa | C kPa | |
| 381 | 0.50 - 1.00 | 8 | Slightly silty very sandy GRAVEL | 42 | 425μ 25 | Sieve NP | | | | , | | MCV pH = 8.4 Particle Size analysis S03 (2:1) = 0.17g/l Passing 2mm = 46% |
| BH1 | 3.00 | ų | | | | | | <u> </u> | | | | pH = 8.1 SO3 Water = 0.57g/l |
| вн1 | 3.00 - 3.50 | В | Sandy GRAVEL | | | | | | | | | pH = 8.5 SO3 (2:1) = 0.71g/l Passing 2mm = 99% |
| BH1 | 3.60 - 4.00 | В | Sandy GRAVEL | | | | | | | | | Particle Size analysis Sample unsuitable for |
| B#1 | 3.60 - 4.00 | D | Sandy GRAVEL | | | | 2.7 | | | | | |
| ви1 | 6.00 - 6.50 | В | Slightly clayey sandy GRAVEL | | | | 1 48 | | | | | pH = 8.6 Particle Size analysis S03 (2:1) = 1.15g/l Passing 2mm = 22% |
| BH1 | 18.00- 18.44 | В | Slightly sandy CLAY | 95 11 silon pi | 425µ 26 of | Sieve 150 | atter use | | | | | pH = 8.4 Particle Size analysi SO3 (2:1) = 1.02g/l Passing 2mm = 65% |
| вн2 | 0.50 - | В | GRAVEL FOR THE COPY OF | o tion or net | Took Took | | | | | | | MCV pH = 7.8 Particle Size analysi S03 (2:1) = 0.11g/l Passing 2mm = 21% sample insufficient t carry out plastic lim |
| вн2 | 0.50 - 1.00 | D | GRAVEL | | | | 0.9 | | | | | |
| вн2 | 1.50 - | В | Slightly sandy gravelly CLAY | 53 11 | 425µ 35 | Sieve 24 | , | | | | | Particle Size analysi |
| вн2 | 4.00 - 4.50 | 8 | Slightly clayey gravelly SAND | | | | | | | | | pH = 8.3 Particle Size analys: SO3 (2:1) = 0.59g/l Passing 2mm = 96% |
| внза | 0.50 · 1.00 | - B | Clayey very sandy GRAVEL | 43 10 | 425μ 34 | Sieve 24 | | | | , | | MCV pH = 8.4 Particle Size analys SO3 (2:1) = 0.17g/l Passing 2mm = 42% |

(- 3)

Laboratory - Results Summary

Project dubl in waste to energy

Contract K03116x

Sheet

| Sam | ples | - - | T | | <u></u> . | ation | 14 | | | ngth | | Other Tests |
|-------------|----------------|----------------|--|------------|------------------------|----------------------------|-------|--------------------------|----------|-----------------------|----------|--|
| Hole | Depth | Туре | Description | <425 lp | Prep w _L | w _P | Water | γ _b 3 Mg/m | Test | σ ₃ kPa | C kPa | |
| внза | 0.50 - 1.00 | D | Clayey very sandy GRAVEL | | | | 17 | | | | | |
| внза | 3.60 - 4.00 | В | Slightly sandy slightly gravelly SILT | | | | | | | | | Particle Size analysis |
| ВНЗА | 4.00 - 4.50 | В | Slightly sandy slightly gravelly SILT | | | | | | | - | | Org = 8.0% Passing 2mm = 86% pH = 8.1 SO3 (2:1) = 0.95g/t Passing 2mm = 86% |
| внза | 6.00 - 6.45 | В | Very sandy GRAVEL | | | | | · | | | | Particle Size analysis |
| BH4 | 0.50 - 1.00 | 8 | Clayey sandy GRAVEL | 68 12 | 30 | Sieve 18 | | | | | | CBR MCV pH = 7.6 Particle Size analysis SO3 (2:1) = 2.19g/l Passing 2mm = 43% |
| B#4 | 0.50 - 1.00 | D | Slightly sandy gravelly CLAY | | | | 16 | geruse. | | | | |
| BH4 | 4.00 - 4.50 | В | Clayey very sandy GRAVEL | | ion pur | oses on positived peditied | 16 | | | | | pH = 8.6 Particle Size analysis S03 (2:1) = 0.11g/l Passing 2mm = 32% |
| 3H 5 | 0.00 - 0.50 | В | Clayey sandy GRAVEL Cunsent of | PIZICE | 425µ 39 | Sieve 27 | 15 | | | | | MCV pH = 9.0 Particle Size analysis SO3 (2:1) = 0.90g/l Passing 2mm = 36% |
| BK5 | 0.50 - 1.00 | В | Clayey sandy GRAVEL | | | | | | | ļ | | Particle Size analysis |
| BH5 | 1.20 - 1.65 | В | Clayey sandy GRAVEL | | | 1 | | | | - | | pH = 8.5 SO3 (2:1) = 1.38g/l Passing 2mm = 20% |
| 3H5 | 3.90 | w | | | | | | | | | | pH = 8.4 S03 Water = 0.72g/l |
| 3H5 | 5.50 - 5.95 | 8 | Sandy GRAVEL | 26 | 425μ 3 0 | Si eve NP | 11 | | | | Ī | pH = 8.3 Particle Size analysis SO3 (2:1) = 0.32g/l Passing 2mm = 38% |
| Rema | rks | | · · · · · · · · · · · · · · · · · · · | | <u>-</u> | | | | <u> </u> | | | Form 10/2 |
| | | - Res | ults Summary Project | dublin | wast | to er | nergy | | | | | ntract KD3116x |
| <u>GEO.</u> | IECH | | | | | | | | | | She | et |

| Sam | ples | | _ | Cla | ssific | ation | | | Stre | ngth | | Other Tests |
|------|----------------|------|--|----------|------------------------|----------------|------------|------------------------|------|-----------------------|----------|---|
| Hole | Depth | Туре | Description | <425 | Prep w _L | w _P | Water % | γ _b Mg/m | Test | σ ₃ kPa | C kPa | |
| TP01 | 0.50 - 0.60 | В | Silty gravelly SAND | 80 | 425µ 33 | Sieve NP | | | | N. 4 | | pH = 8.0 Particle Size analysis SO3 (2:1) = 0.15g/L Passing 2mm = 88% |
| TP01 | 0.50 - 0.60 | D | Silty gravelly SAND | | | | 15 | | | | | |
| TP01 | 1.20 - 1.60 | D | Sandy slightly gravelly CLAY | | | | 18 | | | | | |
| TP01 | 3.40 | w | | | - | | | | | | | pH = 8.5 SO3 Water = 0.25g/l |
| TP02 | 1.00 - 1.10 | В | SAND and GRAVEL | 58 10 | 425 <u>д</u> 33 | Sieve 23 | | | | | | MCV Particle Size analysis |
| TP02 | 1.00 | | SAND and GRAVEL | ļ | | | 29 | | | | | |
| TP2 | 2.00 - 2.20 | В | SAND and GRAVEL | | | | | | | | | MCV |
| TP02 | 3.20 - 3.40 | В | Sandy GRAVEL | 43 | 39 | Sieve NP | illet Use | | | | | pH = 8.2 Particle Size analysis SO3 (2:1) = 0.85g/l Passing 2mm = 44% |
| TP03 | 0.60 - 0.80 | | Very gravelly SAND | 64 pur | %29μ | Sieve | | | | | | MCV Particle Size analysis |
| TP03 | 0.60 - 0.80 | D | Very gravelly SAND | t Own | | | 12 | | | | | |
| TP03 | 1.80 - 2.00 | В | Very gravelly SAND to the polytic state of the poly | 56 | 425 д 31 | Sieve NP | | | | | | MCV pH = 7.7 Particle Size analysis SO3 (2:1) = 0.29g/l Passing 2mm = 33% |
| TP04 | 0.50 - 0.60 | В | Silty sandy GRAVEL | 45 | 425д 26 | Sieve NP | | | | | | MCV Particle Size analysis |
| TPO4 | 0.50 - 0.60 | D | Silty sandy GRAVEL | | | | 9.8 | | | | | |
| TPO4 | 3.90 - 4.10 | В | Clayey very gravelly SAND | 86 10 | 425µ 22 | Sieve 12 | | | | | | pH = 8.3 Particle Size analysis S03 (2:1) = 0.34g/l Passing 2mm = 83% |
| TP04 | 3.90 - 4.10 | D | Clayey very gravelly SAND | | | | 29 | | | | | |

Laboratory - Results Summary

Project dublin waste to energy

Contract KD3116x

Sheet

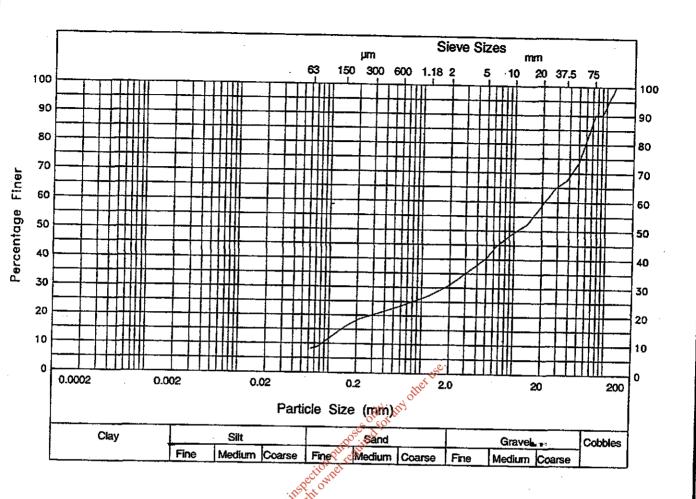
Remarks

| Sam | ples | | | Cla | ssific | ation | | | l . | ngth | | Other Tests |
|--------------|----------------|-------|---|------------------------|------------------------|-------------|-------|------------------------|--|-----------------------|----------|---|
| Hole | Depth | Туре | Description | <425 l _P | Prep W _L | wp | Water | γ _b Mg/m | Test | σ ₃ kPa | C kPa | |
| TP05 | 0.70 - 0.80 | 8 | Black mottled grey sandy gravelly CLAY | 60 13 | 425µ 34 | Sieve 21 | ſ | | | | | pH = 8.2 Particle Size analysis SO3 (2:1) = 0.42g/l Passing 2mm = 50% |
| TP05 | 0.70 - 0.80 | D | Black mottled grey sandy gravelly CLAY | | | | 21 | | | | | |
| TP05 | 2.80 - 3.00 | В | Clayey sandy GRAVEL | | | | | | | | | Particle Size analysis |
| TP06 | 0.80 - 1.00 | В | Clayey sandy GRAVEL | 41 7 | 425µ 33 | Sieve 26 | | | | | | MCV pH = 7.7 Particle Size analysis SO3 (2:1) = 7414.88g/l Passing 2mm = 31% |
| тр06 | 0.80 - 1.00 | D | Clayey sandy GRAVEL | | | | 17 | | · | | | |
| TP06 | 3.50 - 3.70 | | Sandy slightly gravelly CLAY | | lan gur Lamer | | , 8 | et use. | | | | pH = 8.4 Particle Size analysis SO3 (2:1) = 0.28g/l Passing 2mm = 96% |
| TP07 | 0.70 - 0.80 | | Slightly sandy gravelly CLAY | | A.C | seson's | 322 | | | | | |
| TP 07 | 2.80 - 3.00 | D | Clayey sandy GRAVEL | :11:5Pec | don br | ,coc | 24 | | | | | : |
| ТР07 | 2.80 - 3.00 | В | Clayey sandy GRAVEL & | inspi orniel | | | | | | | , | pH = 7.8 Particle Size analysis SO3 (2:1) = 1.74g/l Passing 2mm = 37% |
| TP07 | 3.40 - 4.00 | | Slightly clayey sandy GRAVEL | 27 7 | 425μ 37 | Sieve 30 | | | | | | Particle Size analysis |
| TP8 | 0.80 - 1.00 | | Slightly clayey sandy GRAVEL | | | | | | | | | CBR |
| ТР8 | 1.80 - 2.00 | | Slightly clayey sandy GRAVEL | | | | | | | | | pH = 8.0 Particle Size analysis SO3 (2:1) = 0.35g/l Passing 2mm = 463% Sample unsuitable for PI |
| тр8 | 1.80 - 2.00 | - | Slightly clayey sandy GRAVEL | | | | 20 | | | | | |
| Rema | rks | ! | | | | <u></u> | | | | | | P A |
| Labo | ratory | - Res | ults Summary Project | dublin | n waste | to er | nergy | | <u>. </u> | | Con | Form 10/2 ntract KD3116x |
| <u>GEO</u> | TECH | | | | | | | | | | She | |

| Sam | ples | | ; • | Clas | ssific | ation | | | Stre | ngth | | Other Tests |
|-------------|----------------|------|---------------------------------|--------------|------------------------|-------------|---------|------------------------|------|---|----------|---|
| Hole | Depth | Туре | Description | <425 | Prep W _L | wp | Water | γ _b Mg/m | Test | σ ₃ kPa | C kPa | |
| TP8 | 4.00 | В | Slightly clayey sandy GRAVEL | | | | | | | | | pH = 7.8 Particle Size analysis SO3 (2:1) = 0.39g/l Passing 2mm = 53% |
| TP8 | 4.00 | D · | Slightly clayey sandy GRAVEL | | | | 22 | | | | | |
| TP9 | 0.70 - 0.90 | D | Slightly clayey sandy | | | | 10 | | | | | |
| TP 9 | 1.70 - 1.80 | В | Slightly clayey sandy GRAVEL | 44 | 425µ 33 | Sieve 22 | | | | | | MCV pH = 8.0 Particle Size analysis SO3 (2:1) = 0.46g/l Passing 2mm = 52% |
| тр9 | 2.80 - 3.10 | В | Slightly sandy gravelly CLAY | | | | | | | | | pH = 8.2 Particle Size analysis SO3 (2:1) = 0.30g/l Passing 2mm = 60% |
| • | | | Consent of co | | જુ : જુ | dy and | diferus | | | - Children in the Children in | | |
| | | | Ço ^t | use ction of | i in the second | | | | | | | |
| | | | Consentor | | | | | ٠ | | | | |
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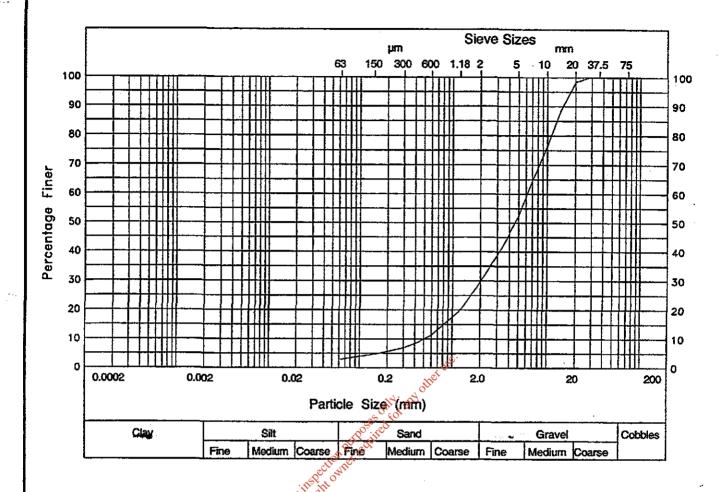
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| Remarks | | Form 10 |
|------------------------------|--------------------------------|---------------------|
| Laboratory - Results Summary | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



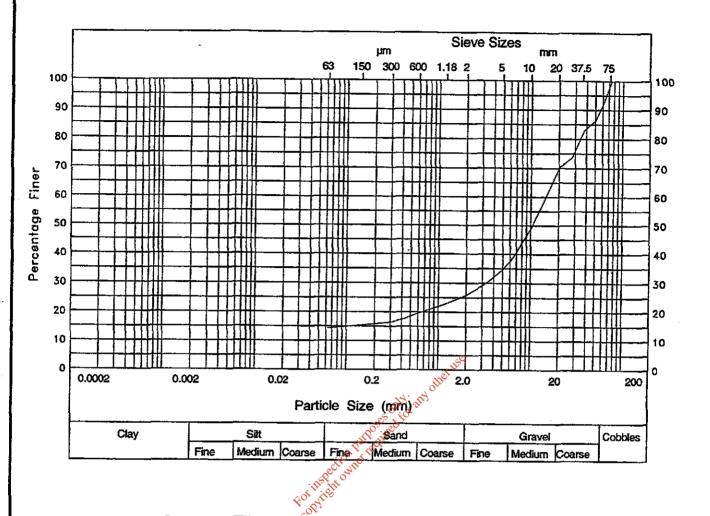
| | FOLDALIS | | |
|----------------|--------------------|---------------------|----------------|
| Particle Size | % Rassing | Particle Size | % Passing |
| 90 mm | Onserit 90 | 2 mm | 31 |
| 75 mm | C _{D2} 20 | 1.18 mm | 27 |
| 63 mm | 83 | 600 μm | 23 |
| 50 mm | 74 | 425 µm | 22 |
| 37.5 mm | 68 | 300 дл | 20 |
| 28 mm | 65 | 212 µm | 19 |
| 20 mm | 59 | 150 µm | 16 |
| 14 mm | 52 | 75 µm | 9 |
| 10 mm | 49 | 63 <u>µm</u> | 8 |
| 6.3 mm | 44 | | |
| 5 mm | 40 | | |
| 3.35 mm | 36 | | |
| Hole | Description | | <u>.t</u> |
| BH1 | Slightly silts | y very sandy GRAVE | :1 |
| Depth | | , , , wanta, assett | • • |
| 0.50 -1.00 | | | |
| Туре |] | | |
| В | | | |
| Test Performed | Uniformity | Coefficient = 256 | |
| Wet | | 230 | |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |



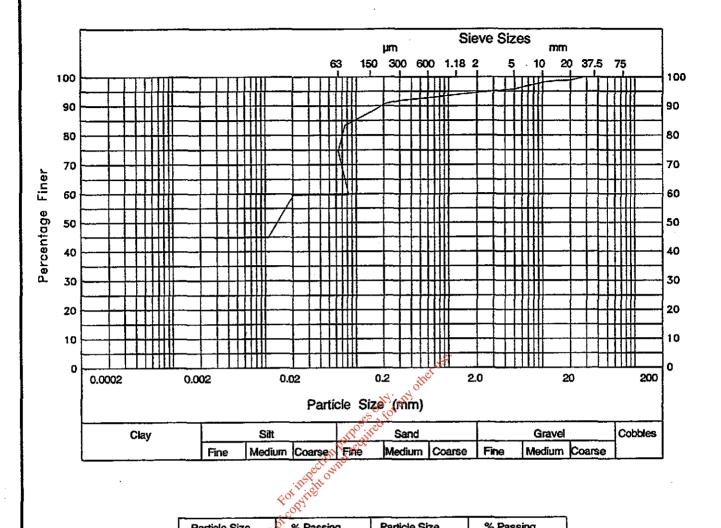
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|--------------|-----------------|----------------|
| 28 mm Cons | 100 | 212 mm | 6 |
| 20 mm | 98 | 150 µm | 5 |
| 14 mm | 89 | 75 µm | 3 |
| 10 mm | 76 | 63 µm | 3 |
| 6.3 mm | 61 | | _ |
| 5 mm | 52 | | |
| 3.35 mm | 41 | | |
| 2 mm | 30 | | |
| 1.18 mm | 20 | | |
| 600 Am | 11 | | |
| 425 µm | 9 | | |
| 300 µm | 7 | | |
| Hole | Description | <u> </u> | - ' |
| 8H1 | Sandy GRAVEL | | |
| Depth | 1 ' | | |
| 3.60 -4.00 | 1 | | |
| Туре | 7 | | |
| В | 1 | | |
| Test Performed | Uniformity C | oefficient = 13 | |
| Wet | | | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



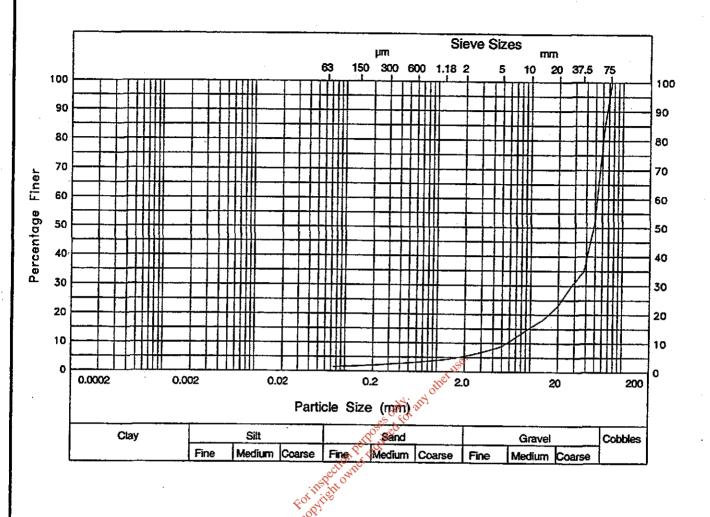
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|--------------------|------------|
| 75 mm | 100 OZ | 1.18 mm | 23 |
| 63 mm | 93 | 600 µm | 20 |
| 50 mm | 86 | 425 மா | 18 |
| 37.5 mm | 83 | 300 µm | 16 |
| 28 mm | 74 | 212 µm | 16 |
| 20 mm | 70 | 150 µm | 15 |
| 14 mm | 59 | 75 µm | 15 |
| 10 mm | 49 | 63 µm | 14 |
| 6.3 mm | 38 | | |
| 5 mmi | 35 | | |
| 3.35 mm | 30 | | |
| 2 mm | 26 | | |
| lole | Description | | |
| BH1 | Slightly clay | ey sandy GRAVEL | |
| Depth |] | | |
| 6.00 -6.50 | | | |
| Гуре | 7 | | • |
| В | | | |
| Test Performed | Uniformity (| Coefficient not ap | oplicable. |
| Dry | | • | • |

| <u> </u> | | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | - | Sheet |



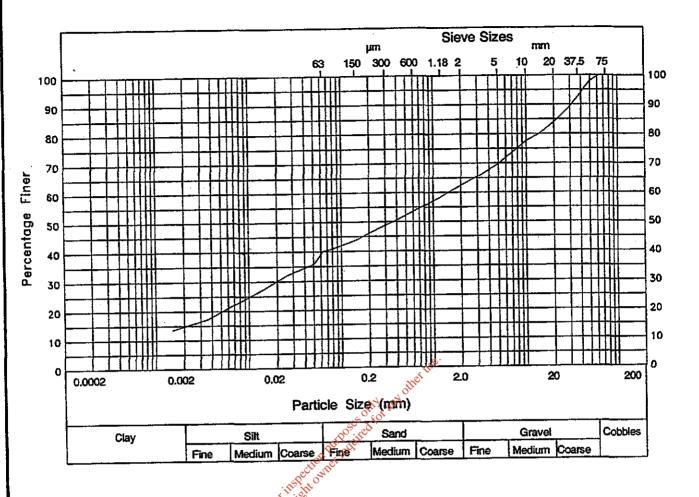
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|-------------------|------------|
| 28 mm Cons | 100 | 212 µm | 91 |
| 20 sum | 99 | 150 µm | 88 |
| 14 am | 99 | 75 µm | 83 |
| 10 mm | 98 | 63 µm | 75 |
| 6.3 mm | 97 | | |
| 5 mm | 96 | | |
| 3.35 m | 95 | | |
| 2 mm | 94 | | İ |
| 1.18 mm | 94 | | |
| 600 µm | 93 | į | |
| 425 gm | 92 | | |
| 300 µm | 92 | | 1 |
| lole | Description | | |
| BH1 _ | Slightly same | ty CLAY | |
| Depth | | | |
| 18.00-18.44 | j | | |
| Гуре | 7 | | |
| B | 1 | | |
| Test Performed | Uniformity | Coefficient not a | pplicable. |
| Wet | | | •• |

| <u> </u> | · | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



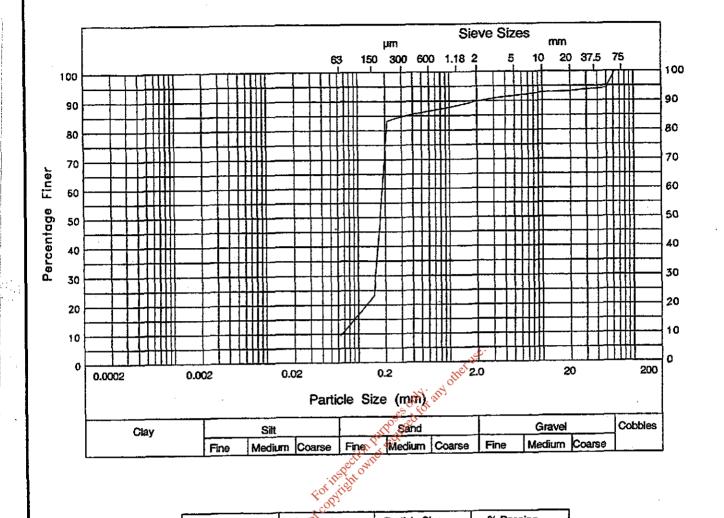
| | FODY! | | |
|----------------|--------------|-------------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 75 mm | OTISE 100 | 1.18 mm | 4 |
| 63 mm | Ψ 8 5 | 600 для | 3 |
| 50 mm | 53 | 425 µm | 3 |
| 37.5 mm | 35 | 300 дm | 2 |
| 28 mm | 30 | 212 µm | 2 |
| 20 mm | 23 | 150 μm | 2 |
| 14 mm | 18 | 75 µm | 1 |
| 10 mm | 15 | | · |
| 6.3 mm | 11 | | |
| 5 mm. | 9 | | 1 |
| 3.35 mm | 7 | | |
| 2 mm | 5 | | 1 |
| Hole | Description | | |
| BH2 | GRAVEL | | |
| Depth | | | |
| 0.50 -1.00 | | | |
| Туре | | | |
| В | | | |
| Test Performed | Uniformity | Coefficient = 9.4 | |
| Dry | | | |

| | · | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



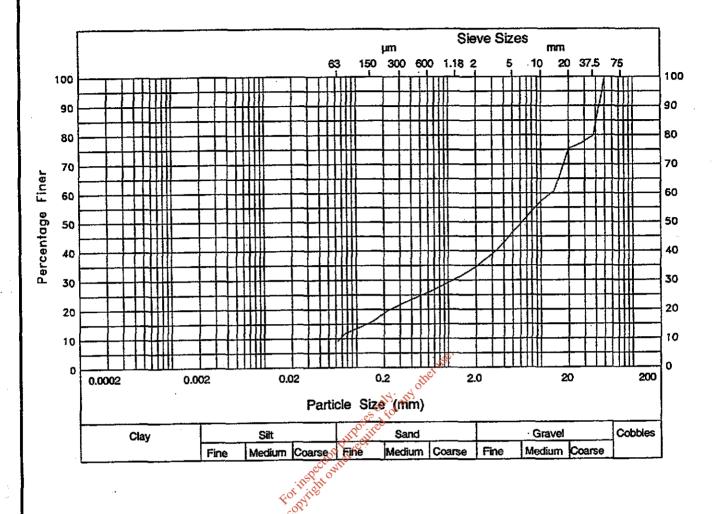
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|-------------------|-------------|
| 63 mm Conser | 100 | 600 для | 54 |
| 50 mm | 98 | 425 µm | 51 |
| 37.5 mm | 93 | 300 для | 49. |
| 28 mm | 88 | 212 µm | 46 |
| 20 mm | 84 | 150 µm | 44 |
| 14 mm | 80 | 75 µm | 41 |
| 10 mm | 78 | 63 µm | 40 |
| 6.3 mm | 72 | 51 µm | 36 |
| 5 mm | 70 | 26 µm | 32 |
| 3.35 mm | 66 | 14 µm | 27 |
| 2 mm | 62 | | ŀ |
| 1.18 mm | 58 | | |
| Hole | Description | | |
| BH2 | Slightly same | y gravelly CLAY | |
| Depth | | | |
| 1.50 -2.00 | _] | | |
| Туре | | | |
| В | | | |
| Test Performed | Uniformity | Coefficient not a | opplicable. |
| Wet | <u> </u> | | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | 1 | Sheet |
| | | |



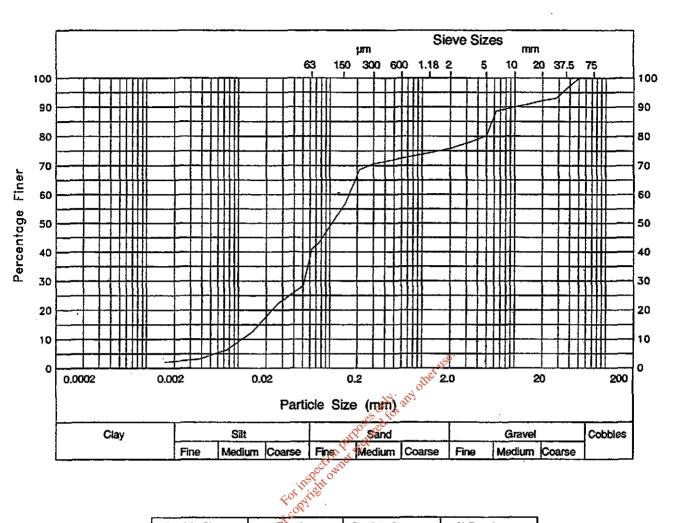
| Particle Size | % Passing | Particle Size | % Passing |
|---------------------|---------------|--------------------|-----------|
| 63 mm | 100 94 | 300 µm | 85 |
| 50 mm | 94 | 212 µm | 83 |
| 28 mm | 94 | 150 µm | 23 |
| 20 mm | 93 | 75 µm | 12 |
| 10 mm | 93 | 63 µm | 9 |
| 6.3 mm | 92 | 1 | |
| 5 mm | 92 | | |
| 3.35 mm | 91 | j | ļ |
| 2 ma | 90 | | ŀ |
| 1.18 mm | 88 | | } |
| 600 µm | 87 | | |
| 425 µm | 86 | | |
| Hole | Description | | |
| BHZ | Slightly clay | yey gravelly SAND | |
| Depth | | | |
| 4.00 -4.50 | | | |
| Туре | 1 | | |
| • - | | | |
| B Test Performed | Uniformity | Coefficient = 2.8 | 3 |
| Wet | CHITCHIBITY | Cocilibricit - 540 | • |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



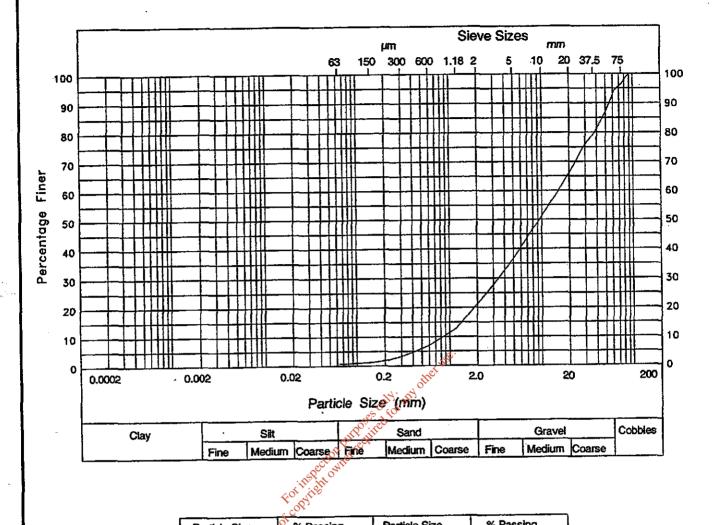
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|-----------------|-------------------|-----------|
| 50 mm CORS | 100 | 425 µm | 24 |
| 37,5 mm | 80 | 300 µm | 22 |
| 28 mm | 77 | 212 µm | 19 |
| 20 mm | 75 | 150 µm | 16 |
| 14 mm | 61 | 75 µm | 12 |
| 10 mm | 57 | 63 µm | 9 |
| 6.3 mm | 50 | | <u> </u> |
| 5 mm | 47 | | 1 |
| 3.35 mm | 40 | | |
| 2 mm | 34 | | |
| 1.18 mm | 30 | · | |
| 600 tru | 26 | | |
| Hole | Description | | |
| BH3A | _ Clayey very s | andy GRAVEL | |
| Depth | | | |
| 0.50 -1.00 | _ | | |
| Туре | 1 | | |
| 8 | | | |
| Test Performed | Uniformity | Coefficient = 195 | |
| Dry | | - | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



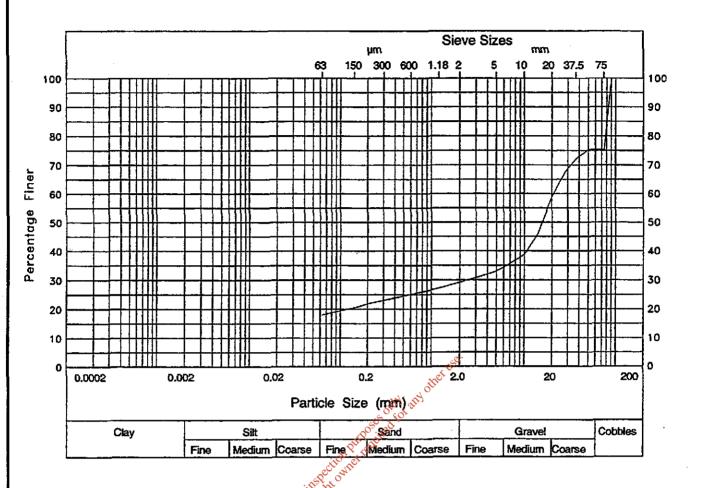
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|-------------------|------------|
| 50 mm | 015 100 | 425 µm | 72 |
| 37.5 mm | 97 | 300 µm | 71 |
| 28 mm | 93 | 212 µm | 69 |
| 20 mm | 92 | 150 µm | 57 |
| 14 mm | 91 | 75 µm | 43 |
| 10 mm | 90 | 63 µm | 41 |
| 6.3 mm | 89 | 51 µm | 28 |
| 5 mm | 80 | 27 µm | 22 |
| 3.35 mm | 78 | 14 µm | 13 |
| 2 mm | 76 | <u> </u> | |
| 1.18 mm | 74 | | |
| 600 µm | 73 | | |
| Hole | Description | • | |
| внза | Slightly sand | y slightly gravel | ly SILT |
| Depth | | | • |
| 3.60 -4.00 | | | |
| Туре |] | | |
| В | | | |
| Test Performed | Uniformity | Coefficient not a | pplicable. |
| Wet | , | | •• |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



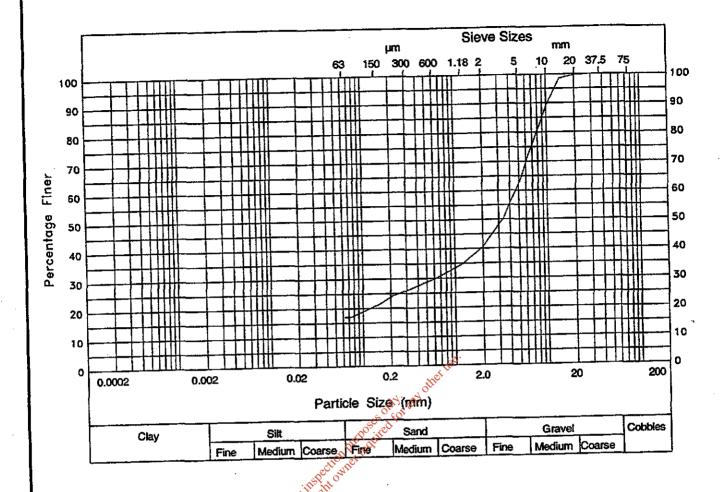
| | troopy. | | |
|----------------|---------------|------------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 90 mm Consen | 100 | 2 mm | 21 |
| 75 mm | 96 | 1.18 mm | 13 |
| 63 mm | 94 | 600 µm | 7 |
| 50 mma . | 67 | 425 μm | 5 |
| 37.5 mm | 80 | 300 µm | 3 |
| 28 mm | 75 | 212 µm | 2 |
| 20 mm | 66 | 150 µm | 1 |
| 14 mm | 58 | 75 µm | 1 |
| 10 mm | 51 | 63 µm | 1 |
| 6.3 mm | 42 | Į. | ĺ |
| 5 mm | 37 | | |
| 3.35 mm | 30 | | |
| Hole | Description | <u> </u> | |
| ВНЗА | Very sandy GR | AVEL | • |
| Depth | | | |
| 6.00 -6.45 | j | | |
| Туре | | | |
| | | | |
| Test Performed | Uniformity | Coefficient = 18 | |
| Wet | <u> </u> | | · |

| | | · | Form 25/4 |
|---------------------------------|--------------------------------|-------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | | Contract KD3116x |
| GEOTECH | <u>.</u> | S. S. S. S. S. S. | Sheet |



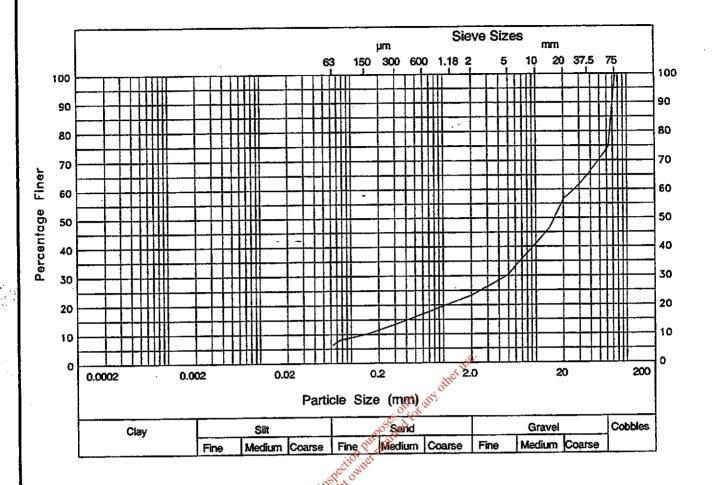
| | FORVITE | | |
|----------------|----------------|-------------------|------------|
| Particle Size | % Passing | Particle Size | % Passing |
| 90 mm | 75 TS | 2 mm | 29 |
| 75 mm (| 7 5 | 1.18 mm | 27 |
| 63 mm | 75 | 600 μm | 25 |
| 50 mm | 75 | 425 µm | 24 |
| 37.5 mm | 72 | 300 µm | 23 |
| 28 mm | 68 | 212 µm | 22 |
| 20 mm | 59 | 150 µm | 21 |
| 14 mm | 46 | 75 µm | 19 |
| 10 mm | 39 | 63 µm | 18 |
| 6.3 mm | 35 | ļ | |
| 5 mm | 33 | | |
| 3.35 mm | 31 | | |
| Hole | Description | | |
| BH4 | _ Clayey sandy | GRAVEL | |
| Depth | | | • |
| 0.50 -1.00 | | | |
| Туре | 7 | | |
| В | | | |
| Test Performed | Uniformity | Coefficient not a | pplicable. |
| Dry | <u> </u> | | <u></u> |

| | | | Form 25/4 |
|---------------------------------|--------------------------------|----------|-----------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract | KD3116x |
| GEOTECH | | Sheet | |



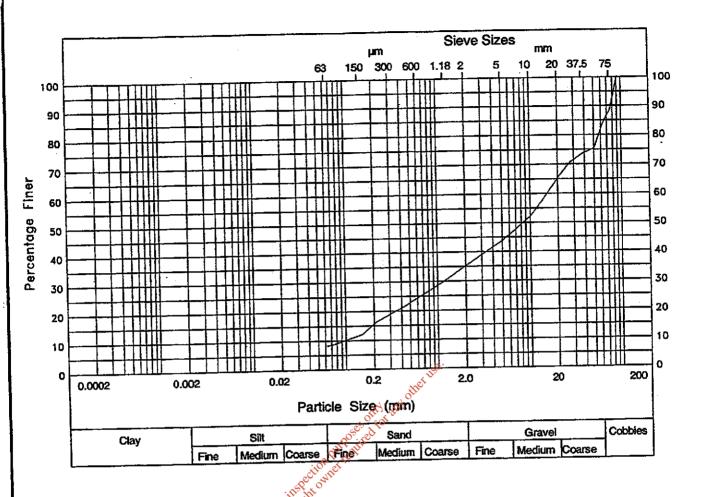
| Particle Size | % Passing | Particle Size | % Passing |
|---------------|-------------|-----------------|-------------|
| 28 mm Conserv | 100 | 212 µm | 24 |
| 20 mm | 100 | 150 µm | 21 |
| 14 mm | 99 | 75 µm | 17 |
| 10 mm | 89 | 63 µm | 17 |
| 6.3 mm | 72 | | |
| 5 mm | 62 | | } |
| 3.35 mm | 50 | | |
| 2 mm | 40 | | İ |
| 1.18 mm | 35 | | |
| 600 дт | 30 | | |
| 425 µm | 28 | | |
| 300 µm | 26 | | |
| ole | Description | | |
| вн4 | Clayey very | sandy GRAVEL | |
| epth | | | |
| 4.00 -4.50 | | | |
| уре | | | |
| 71. |] | | |
| est Performed | Uniformity | Coefficient not | applicable. |
| Dry | | | |

| | FORTIZOVA | |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |
| OCO CO | | |



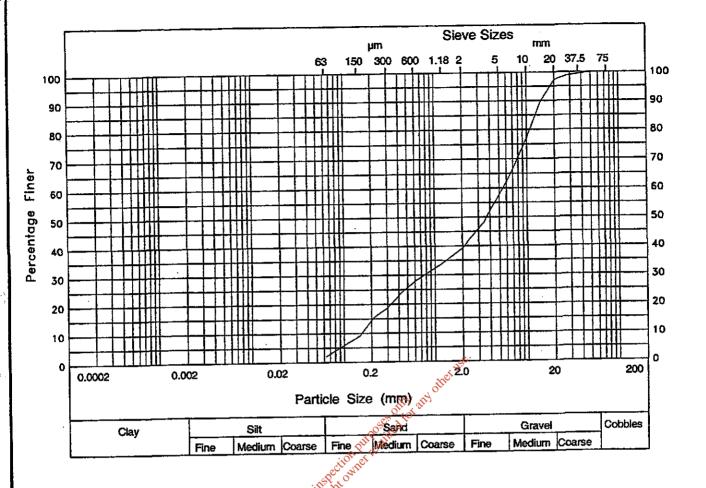
| | FORVITE | | |
|----------------|--------------|-------------------|-----------|
| Particle Size | % Rassing | Particle Size | % Passing |
| 75 mm | 015e11 100 | 600 µm | 17 |
| 63 mm (| 75 | 425 µm | 15 |
| 37.5 mm | 65 | 300 µm | 13 |
| 28 mm | 61 | 515 #w | 12 |
| 20 mm | 56 | 150 µm | 10 |
| 14 mm | 46 | 75 µm | 8 |
| 10 mm | 41 | 63 µm | 6 |
| 6.3 mm | 34 | | |
| 5 mm | 30 | | |
| 3.35 mm | 27 | • | |
| 2 mm | 23 | | |
| 1.18 mm | 21 | | |
| Hole | Description | | |
| вн5 | Clayey sandy | GRAVEL | |
| Depth | | | |
| 0.00 -0.50 | | | |
| Туре | 1 | | |
| <u>B</u> | | | |
| Test Performed | Uniformity | Coefficient = 187 | 7 |
| Dry | | | |

| | | Form 25/4_ |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



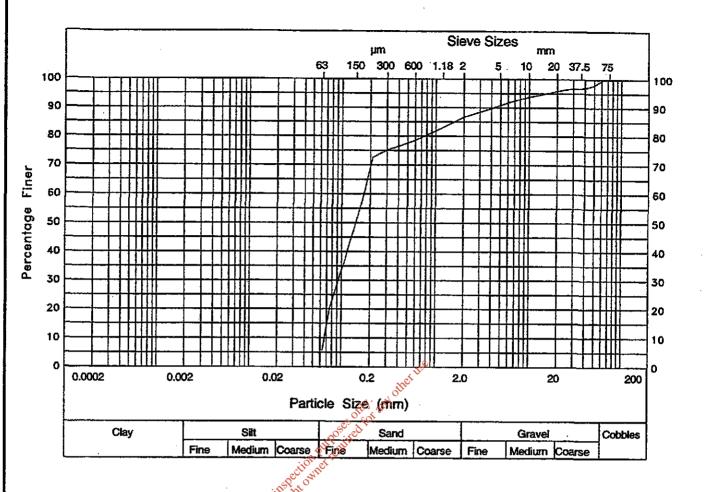
| Particle Size | % Passing | Particle Size | % Passing |
|---------------|--------------|------------------|-----------|
| 90 mm Consen | 100 | 2 11110 | 35 |
| 75 mm Con | 88 | 1.18 mm | 30 |
| 63 mm | 84 | 600 µm | 24 |
| 50 mm | 75 | 425 µm | 21 |
| 37.5 mm | 74 | 300 µm | 19 |
| 28 mm | 71 | 212 µm | 16 |
| 20 mm | 65 | 150 µm | 12 |
| 14 mm | 58 | 75 <u>µ</u> m | 9 |
| 10 mm | 52 | 63 µm | 8 |
| 6.3 mm | 46 | | - |
| 5 mm | 44 | | |
| 3.35 mm | 40 | | |
| lole | Description | | |
| BH5 | Clayey sandy | GRAVEL | • |
| Depth | | | |
| 0.50 -1.00 | | | |
| Гуре | 1 | | |
| В | | | |
| est Performed | Uniformity | Coefficient = 16 | 4 |
| Wet | | | |

| ł | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



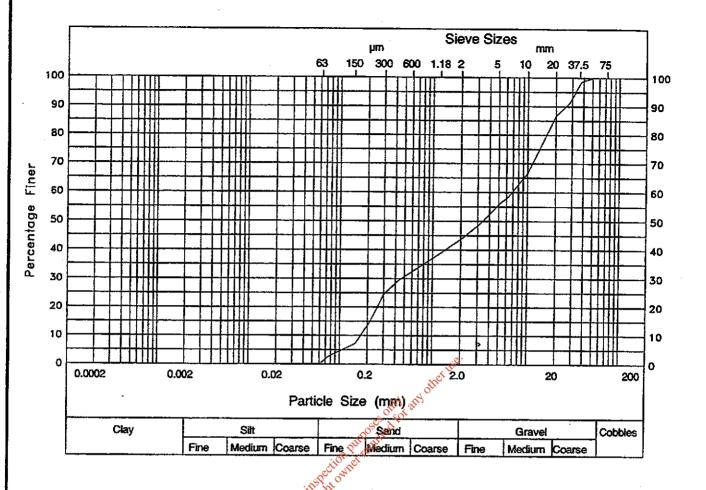
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|--------------|------------------|-----------|
| 50 mm | 015e01 100 | 425 µm | 24 |
| 37.5 mm (| Offis 99 | 300 µm | 19 |
| 28 mm | 99 | 212 µm | 15 |
| 20 mm | 97 | 150 µm | 9 |
| 14 mm | 89 | 75 µm | 4 |
| 10 mm | 77 | 63 µm | 2 |
| 6.3 mm | 63 | | |
| 5 mm | . 58 | | |
| 3.35 mm | 48 | l . | 1 |
| 2 mm | 39 | | 1 |
| 1.18 mm | 34 | | |
| 600 µm | 28 | | |
| Hole | Description | | |
| ви5 | Sandy GRAVEL | | |
| Depth | | | |
| 5.50 -5.95 | | | |
| Туре |] . | | |
| В | | | |
| Test Performed | Uniformity | Coefficient = 35 | |
| Wet | <u> </u> | | · · |

| j | | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



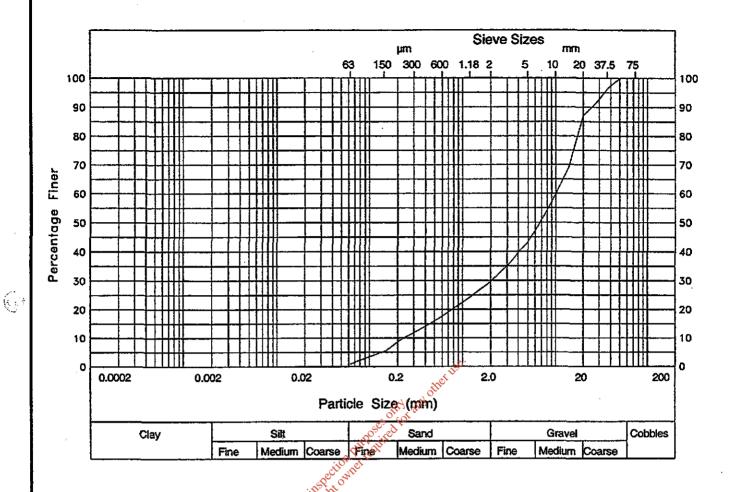
| Dariela Ota | For Ohite | | 1 |
|----------------|----------------|-------------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 63 mm Conser | 100 | 600 µm | 79 |
| 50 mm 🖰 | 98 | 425 µm | 77 |
| 37.5 ma | 97 | 300 µm | 75 |
| 28 mm | 97 | 212 µm | 73 |
| 20 mm | 96 | 150 µm | 53 |
| 14 mm | 95 | 75 µm | 20 |
| 10 mm | 94 | 63 µm | 6 |
| 6.3 mm | 92 | | |
| 5 mm | 91 | | |
| 3.35 mm | 89 | | |
| 2 mm | 87 | | |
| 1.18 mm | 83 | | |
| Hole | Description | | |
| TP01 | Silty gravelly | y SAND | |
| Depth | | | |
| 0.50 -0.60 | | | |
| Туре |] | | |
| <u>B</u> _ | } | | |
| Test Performed | Uniformity (| Coefficient = 2.6 | |
| <u>Wet</u> | <u> </u> | | |

| | M | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



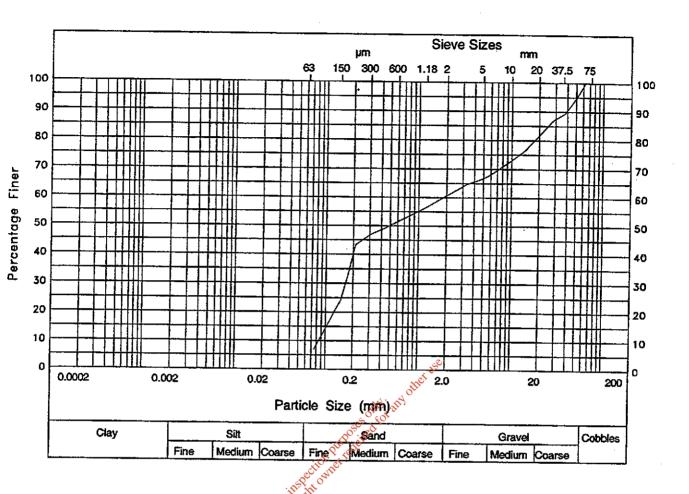
| Particle Size | % Passing | Particle Size | % Passing |
|----------------|-------------------------------------|------------------|-----------|
| 50 mm | O ¹⁵ E ¹¹ 100 | 425 µm | 29 |
| 37.5 mm | Offic 99 | 300 µm | 24 |
| 28 mm | 91 | 212 µm | 15 |
| 20 mm | 87 | 150 µm | 7 |
| 14 mm | 76 · | 75 µm | 3 |
| 10 mm | 67 | 63 µm | 1 |
| 6.3 mm | 58 | | |
| 5 mm | 56 | 1 | |
| 3.35 mm | 50 | İ | |
| 2 mm | 44 | | |
| 1.18 mm | 39 | | |
| 600 µm | 32 | | |
| Hole | Description | | · |
| TP02 | SAND and GRAVEL | | |
| Depth | | | |
| 1.00 -1.10 | | | |
| Туре | 7 | | |
| B | | | |
| Test Performed | Uniformity | Coefficient = 41 | |
| Dry | | | |

| | , · | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



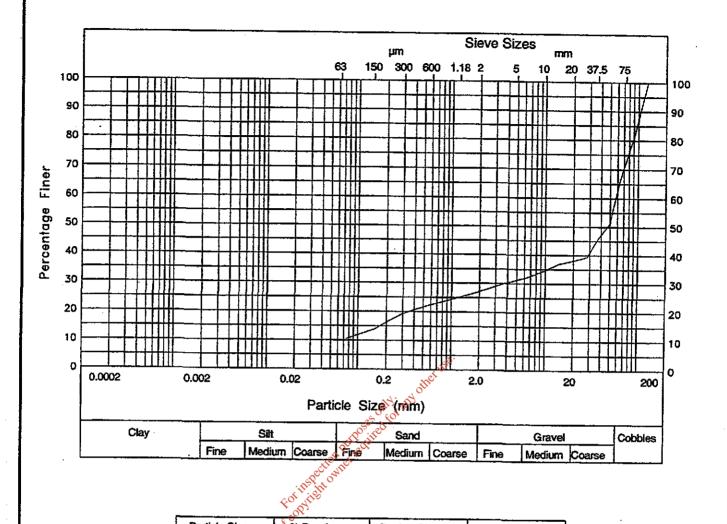
| | FORMITE | | |
|---------------------|--------------|-----------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 50 mm 500 mm 500 mm | 100 | 425 µm | 15 |
| 37.5 ma 🖰 | 97 | 300 µm | 12 |
| 28 mm | 92 | 212 µm | 9 |
| 20 mm | 87 | 150 µm | 5 |
| 14 mm | 69 | 75 µm | 2 |
| 10 mm | 60 | 63 µm | 1 |
| 6.3 mm | 48 | | |
| 5 mm | 43 | | |
| 3.35 mm | 37 | } | |
| 2 mm | 30 | 1 | |
| . 1.18 mm | 24 | | |
| 600 µm | 18 | | |
| Hole | Description | | |
| TP02 | Sandy GRAVEL | | |
| Depth | | | |
| 3.20 -3.40 | 1 | | |
| Туре | | | |
| 8 . | | | |
| Test Performed | Uniformity C | oefficient = 42 | |
| Dry | <u> </u> | · | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



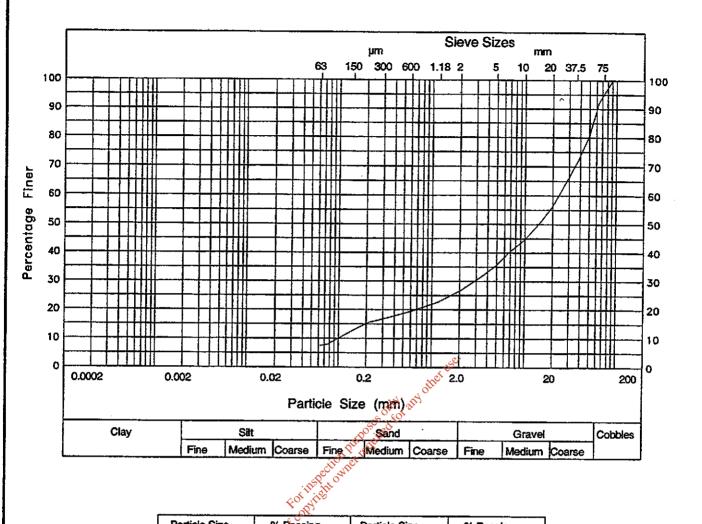
| | FORMITE | | |
|----------------|---------------|------------------|-----------|
| Particle Size | % Rassing | Particle Size | % Passing |
| 63 mm | OTSET 100 | 600 μm | 52 |
| 50 mm | 95 | 425 µm | 49 |
| 37.5 mm | 89 | 300 µm | 47 |
| 28 mm | 87 | 212 µm | 43 |
| 20 mm | 82 | 150 µm | 25 |
| 14 ma | 76 | 75 µm | 7 |
| 10 mm | 73 | | |
| 6.3 mm | 69 | | |
| 5 mm | 67 | | |
| 3.35 mm | 65 | | |
| 2 mm | 61 | • | İ |
| 1.18 mm | 56 | • | |
| Hole | Description | | |
| TP03 | Very gravelly | SAND | |
| Depth | | | |
| 0.60 -0.80 | | | |
| Туре |] | | |
| В | | | |
| Test Performed | Uniformity (| Coefficient = 22 | |
| Dry | <u> </u> | | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|--------------------|-----------|
| 90 mm cons | 81 | 1.18 mm | 25 |
| 63 mm 💍 | 66 | 600 µm | 22 |
| 50 mm | 51 | 425 µm | 21 |
| 37.5 mm | 46 | 300 µm | 19 |
| 28 mm | 39 | 212 µm | 17 |
| 20 mm | 38 | 150 µm | 14 |
| 14 mm | 37 | 75 µm | 11 |
| 10 mm | 35 | | |
| 6.3 mm | 32 | | 1 |
| 5 am | 31 | | |
| 3.35 mm | 29 | | |
| 2 mm | 27 | | |
| Hole | Description | <u>-1</u> | <u></u> |
| TP03 | Silty sandy G | RAVEL | |
| Depth |] | | |
| 1.80 -2.00 | | | |
| Туре | 1 | | |
| | | | |
| Test Performed | Uniformity (| Coefficient not ap | plicable. |
| Dry | <u> </u> | · | |

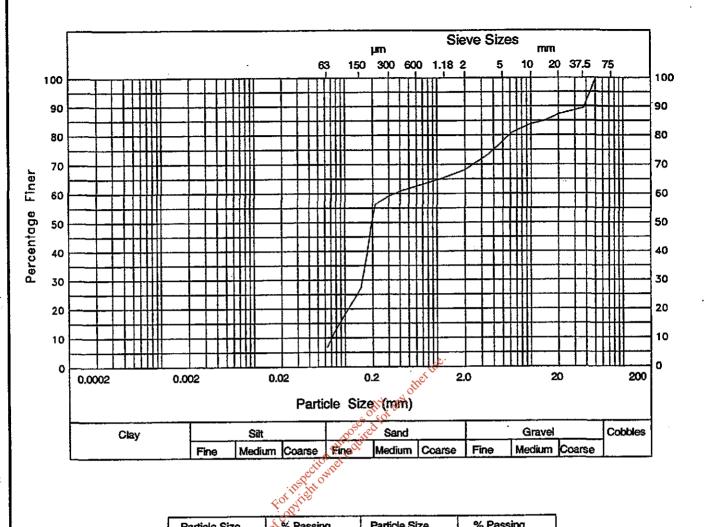
| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



Ç.

| Particle Size | % Bassing | Particle Size | % Passing |
|----------------|---------------|-------------------|-----------|
| 90 mm | 100 100 96 | 2 mm | 27 |
| 75 mm | 96 | 1.18 mm | 23 |
| 63 mm | 92 | 600 μm | 19 |
| 50 mm | 81 | 425 µm | . 18 |
| 37.5 mm | 72 | 300 mm | 17 |
| 28 mm | 65 | 212 µm | 15 |
| 20 mm | 56 | 150 µm | 13 |
| 14 mm | 50 | 75 µm | 8 |
| 10 mm | 45 | 63 µm | 8 |
| 6.3 mm | 39 | | |
| 5 mm | 36 | | |
| 3.35 mm | 31 | | |
| Hole | Description | | <u>'</u> |
| TP04 | Silty sandy G | RAVEL | |
| Depth | | | |
| 0.50 -0.60 | _ | | |
| Гуре | | | |
| B | <u> </u> | | |
| Test Performed | Uniformity | Coefficient = 237 | |
| Wet | | | |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |



| | 1962 | | |
|----------------|---------------|-------------------|-----------|
| Particle Size | & % Passing | Particle Size | % Passing |
| 50 mm Conse | 100 | 300 µm | 59 |
| 37.5 mm C | 89 | 212 µm | 56 |
| 20 mm | 87 | 150 µm | 27 |
| 14 mm | 85 | 75 µm | 12 |
| 10 mm | 84 | 63 μm | 7 |
| 6.3 mm | 81 | | |
| 5 mm | 78 | | |
| 3.35 mm | 73 | | |
| 2 mm | 68 | | İ |
| 1.18 mm | 65 | | |
| 600 µm | 63 | | |
| 425 µm | 61 | - | |
| Hole | Description | | |
| TP04 | Clayey very s | ravelly SAND | |
| Depth | | | |
| 3.90 -4.10 | | | • |
| Туре | | | |
| В | | | |
| Test Performed | Uniformity | Coefficient = 5.0 | l . |
| Dry | <u> </u> | | |

| | | FUITE |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |

Our Ref : EFS/033223

Your Ref:

18 August 2003

Mr A Garne Geotech Specialists Ltd Carewswood Castlemartyr County Cork Ireland



TES Bretby

PO Box 100 Ashby Road Burton-upon-Trent Staffordshire DE15 OXD

Telephone: 01283 554400 Facsimile: 01283 554422

E-mail: enquiries@tes-bretby.co.uk

Dear Mr Garne

SOILS ANALYSIS - Dublin Waste

Please find attached analytical results for the samples from the above site.

An invoice for this work will follow under separate cover.

If appropriate, samples covered by this report will be saved until approximately 17/09/03 when they will be discarded. Please call 01283 554403 for an extension of this date. Please be aware that from 1 January 2003 our policy for the retention of paper based laboratory records and analysis reports will be 3 year

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if you require any further information.

Yours sincerely

i Hannah

J Hannah Project Co-ordinator 01283-554403



ENCLOSURE E AY TI AY TI AT FOR IRPORTION PHILOSES ON THE INTY OFFER I Consent of copyright owner required for any other i GEOENVIRONMENTAL LABORATORY TEST RESULTS

TES Report

TES Report

TES Report

ALControl Geochem Report

EFS/033223

EFS/032527

EFS/034319

03-B02557



Çiri)

Point Load Test Data Project: Dublin Waste to Energy Project No.: KD3116 Test Date: 25-Jul-03

| | Kemarks | | |
|----------------------|-------------------|-----------------------------|-------------------------|
| | 00 | T × ® | Мра |
| | Correction | Factor | (De/50) ^{0.45} |
| | <u>s</u> | P/De ² | Mpa |
| :- :- :- :- | Failure Loa | | (KN) |
| 1 | Eduly | Diam | (mm) |
| | Platen Separation | dth D (initial) D (fallure) | (mm) (mm) |
| - 31 | Core/Lump | | (mm) |
| | Test | Direction Diam/W | (PL/PD/R) |
| | Rock Description | | |
| - 31 | Bottom | Depth | (mBGL) |
| | Top | Depth | (mBGL) |
| | Borehole | | |

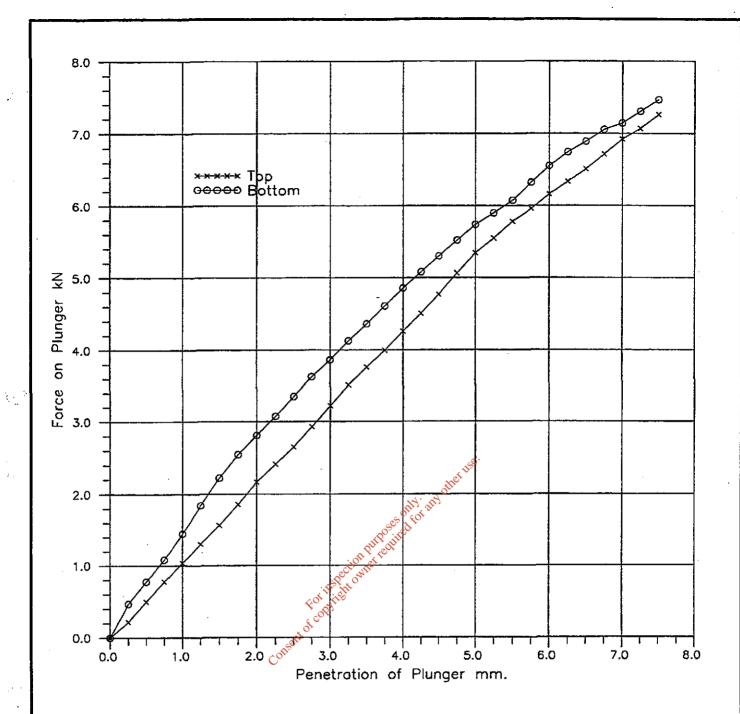
Diametric Tests

| BR6 | 36.34 | Grey limestone | ~ | 78 | 78 | 71 | 71 | . 35.5 | 7.0 | 1.2 | 9.8 | |
|------|-------|----------------|---|-------------------|----|-----|-----|--------|-----|-----|-----|-----------------------------|
| BR6 | 36.44 | Grey Ilmestone | œ | 78 | 78 | 75 | 7.5 | 22.0 | 3.9 | 1.2 | 4.8 | |
| BR7A | 37.35 | Grey Limestone | æ | 7.8 | 84 | £2 | 73 | 35.0 | 9:9 | 1.2 | 8.0 | |
| BR8 | 41.60 | Grey limestone | ~ | 78 | 78 | 73 | 73 | 0.5 | 0.1 | 1.2 | 0.1 | fracture along calcite vein |
| BR9 | 44.95 | Grey Limestone | æ | 9 ⁷ 78 | 78 | 7.3 | 73 | 24.5 | 4.6 | 1.2 | 5.6 | |
| BR10 | 38.70 | Grey Limestone | œ | 8276 | 82 | 7.5 | 75 | 15.5 | 2.8 | 1.2 | 3.4 | |
| | | | | * °0 | | | | | | | | |

Axial Tests

| | | | | | 20 | ر بر | | | | | | | |
|------|-------|---------|-----------|---|----|----------------|---------------------|------|------|-----|-----|-----|-----------------------------|
| BR6 | 36.44 | Grey Li | Limestone | 8 | 78 | 99 ,70, | 53 | 72.5 | 31.5 | 6.0 | 1.1 | 6.4 | |
| BR7A | 37.45 | Grey | Imestone | R | 78 | 12501 | 47 | 68.3 | 28.0 | 6.0 | 1.0 | 6.3 | |
| BR8 | 41.60 | Grey | Imestone | R | 78 | 5162 | ∂ _S 47 | 68.3 | 0.4 | 0.1 | 1,0 | 0.1 | fracture along calcite vein |
| BR10 | 38.70 | Grey | Limestone | R | 78 | 99 | ્ર [©] 053 | 72.5 | 16.5 | 3.1 | 1.1 | 3.3 | |

| Sam | ple De | tails | | Test | Data | | | | | | | | |
|------|----------------|--|----------------|---------------------------------------|-------------------|-------------------------|-------------------------|----------------------|--|-----------|---------------------|--|--|
| Hole | Depth | Description | Length Dia. | Test Date | ₩ % | γ _b Mg/m³ | Strain at Failure | Test Time secs | At 50% Secant Mod. E MN/m² | Daine | UCS Value MPa | NOTES (Failure Mode, Orientation etc.) | |
| BR8 | 42.7- 43.00 | | 155.2 75.5 | 14/08/03 | 0.3 Nat | 2.67 | | 295 | | | 37.5 | | |
| | | | | | | | | | | | | | |
| 2 | | | | | - | - | | | The state of the s | | | , | |
| | | | | | | ž | of Use. | | - Andrews - Andr | | | | |
| | | | | Rection Prince | Poses of Required | est and | | | | | | | |
| | | C | God God God | n n n n n n n n n n n n n n n n n n n | | | | | | | | | |
| | | | | | | | | | - | | | | |
| | | | | | | | | | | | | | |
| Th | | | | nish Iona | A (1001) | | Amplied - | brace Ber | te 0.5 to 1 | MPn/n- | | | |
| Kem | arks | Tests performed and reported in All testing performed along core Moisture condition (w%) - A | axis unless | otherwise | stated in | the note | s. | | E U.S W I | WIF at SC | u. | V 441 | |
| Lab | orato | y - Uniaxial Compression Test Summary | Projec | t Dublin | Waste | to Ener | 9 y | | | Con | itract | Form 44/ | |
| Ф | | Mechanics | 1 | | | | | | | She | et | | |



Hole : TP8

Depth : 0.80 -1.00

Type : 8

Method : Remoulded 2.5kg

Test Type :Unsoaked Material Ret 20mm:9.1 %

Surcharge :13.6Kg
Bulk Density :1.36 Mg/m3

Moisture Content :30 %

Dry Density :1.05 Mg/m3

Description
Slightly clayey sandy GRAVEL

CBR Value at Penetration %

2.5mm 5.0mm

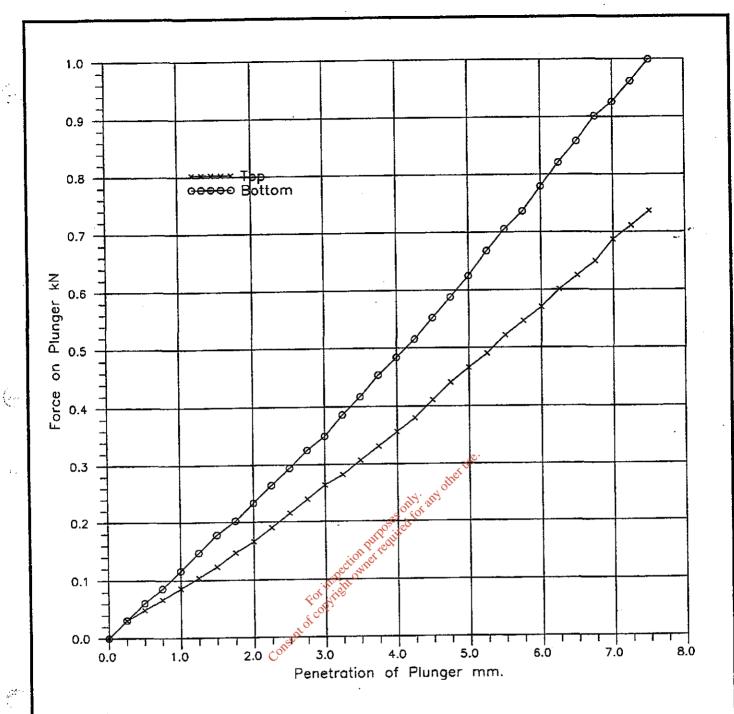
Top 20 27 Btm 25 29

CBR Penetration/Force Plot

Project dublin waste to energy

Contract KD3116x

Figure



Hole : TP06 Depth : 0.80 -1.00

Type : B

Method : Undisturbed 2.5kg

Test Type :Unsoaked Material Ret 20mm:19 %

Surcharge :13.6Kg Bulk Density :1.98 Mg/m3

Moisture Content :21 %

Dry Density :1.64 Mg/m3

Description
Clayey sandy GRAVEL

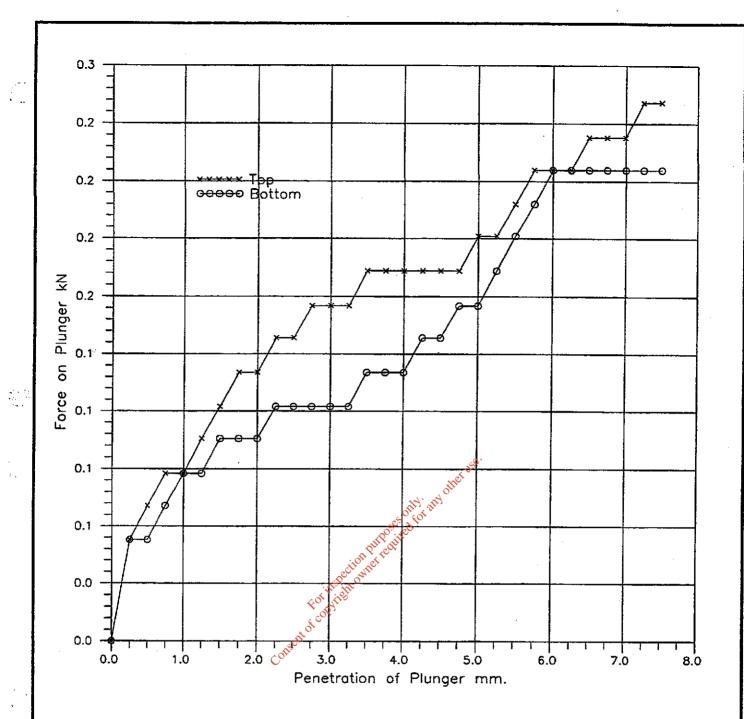
CBR Value at Penetration %

2.5mm 5.0mm

Top 1.6 2.3

Btm 2.2 3.1

| CBR Penetration/Force Plot | Project dublin waste to energy | Contract | KD3116x |
|----------------------------|--------------------------------|----------|---------|
| GEOTECH . | · | Figure | |



Hole : BH4

Depth : 0.50 -1.00

Type : B

Method : Remoulded 2.5kg

Test Type :Unsoaked

Material Ret 20mm:4.9 % Surcharge :13.6Kg

Bulk Density :2.22 Mg/m3 Moisture Content :14 %

Dry Density :1.95 Mg/m3

Description
Clayey sandy GRAVEL

CBR Value at Penetration %

2.5mm 5.0mm

Top 1.0 0.9

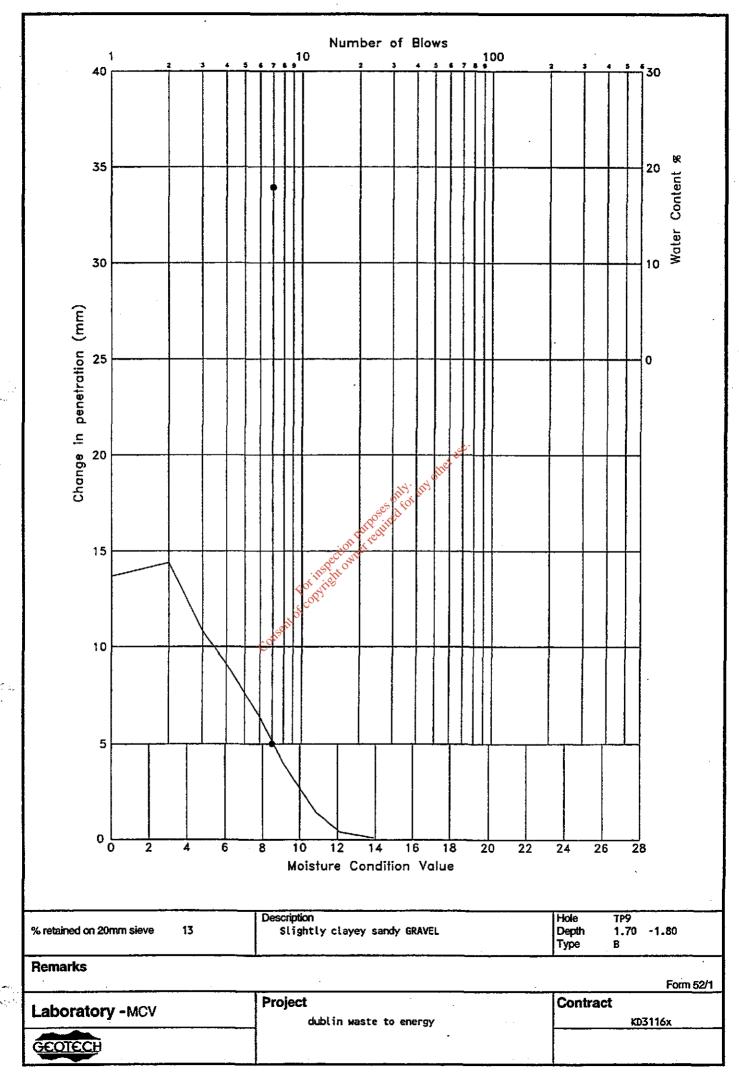
Btm 0.8 0.7

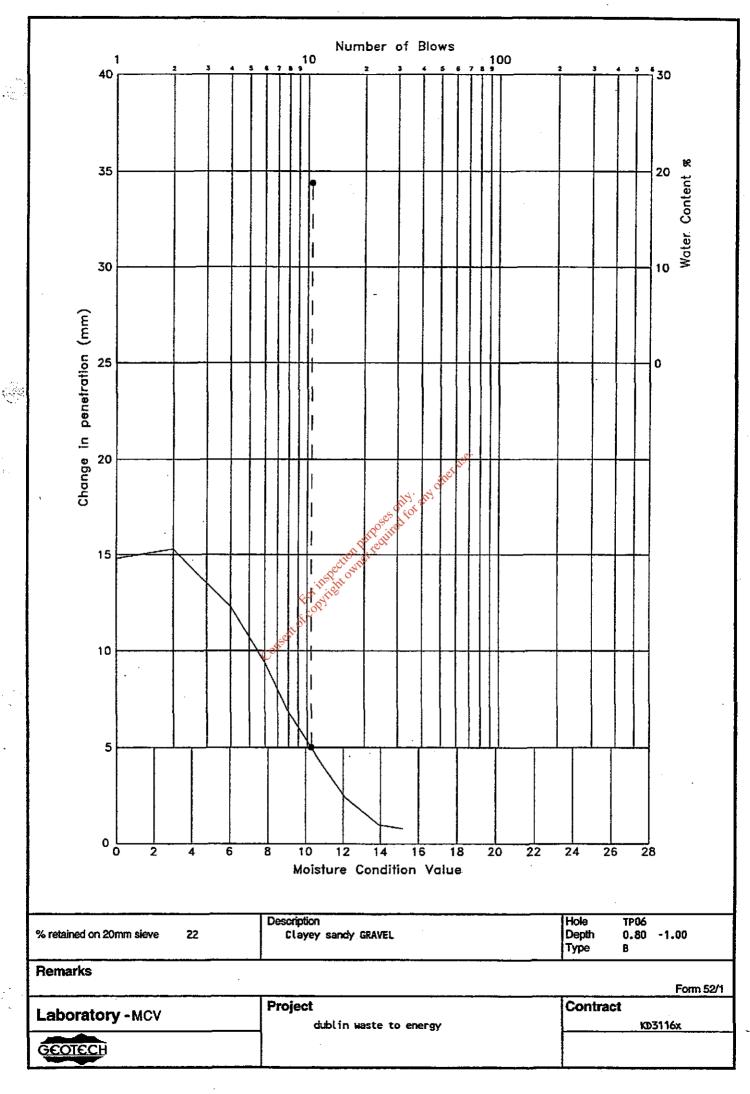
CBR Penetration/Force Plot

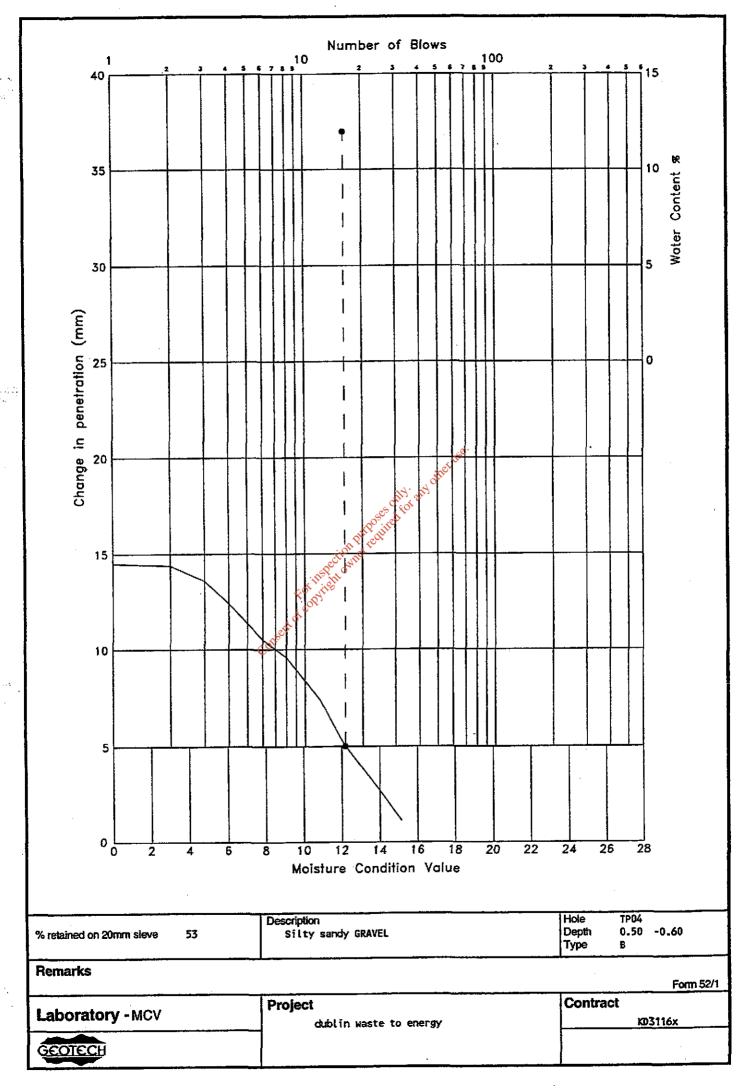
Project dublin waste to energy

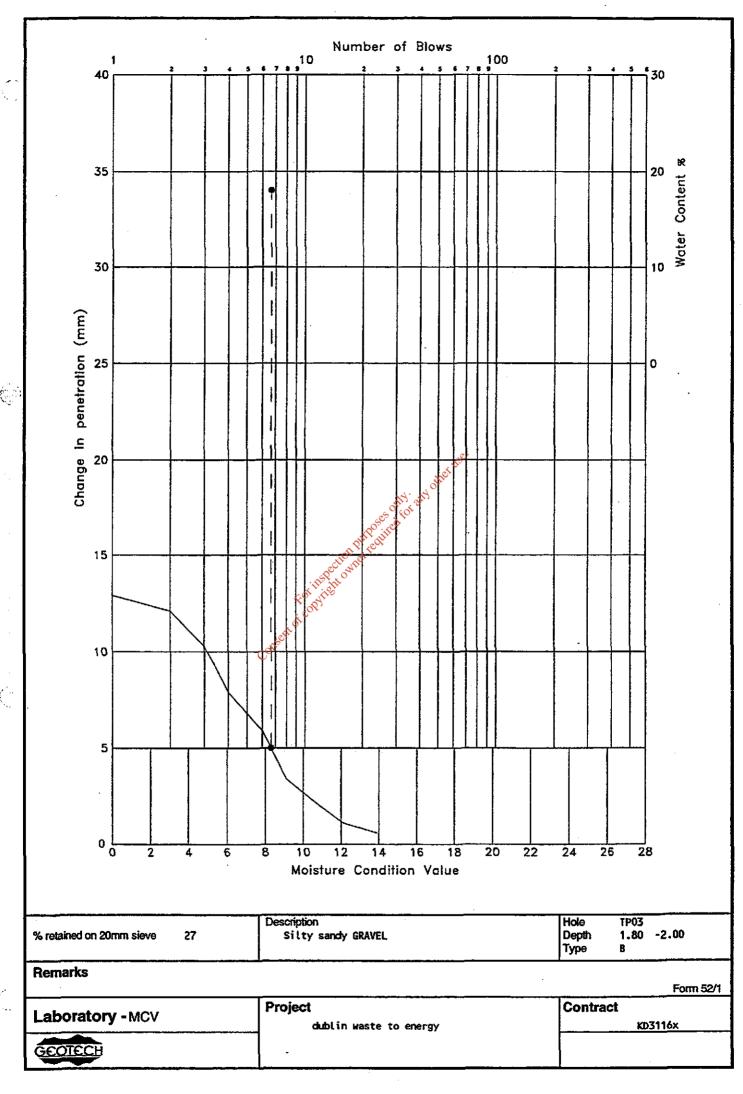
Contract KD3116x

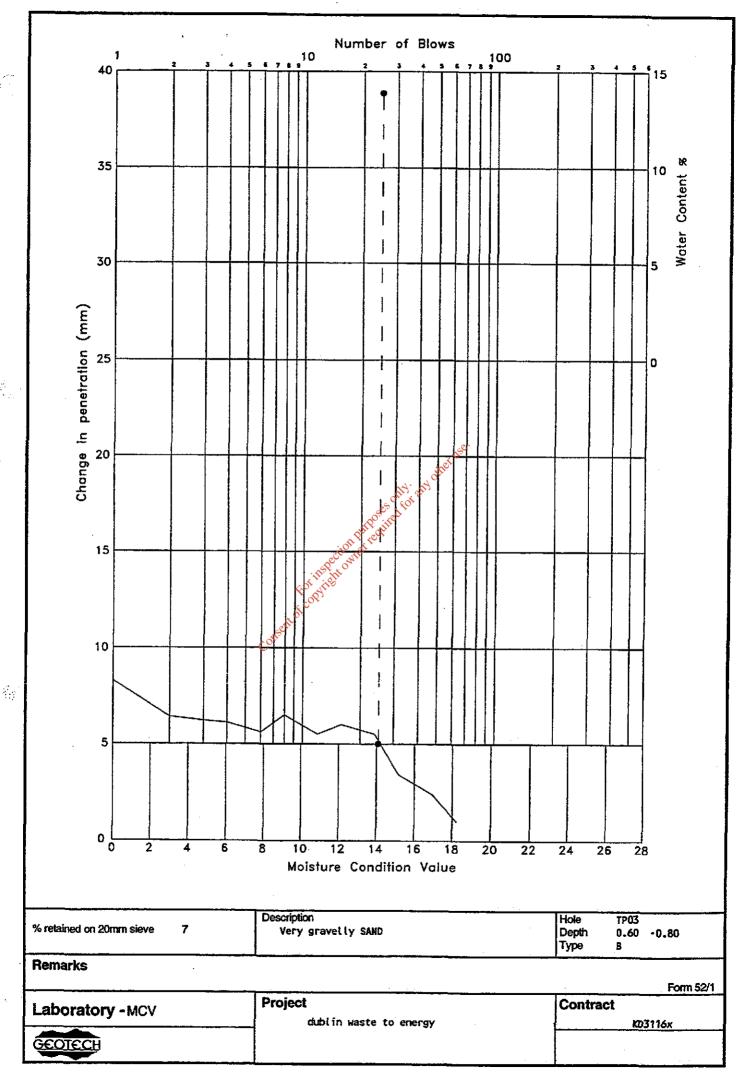
Figure

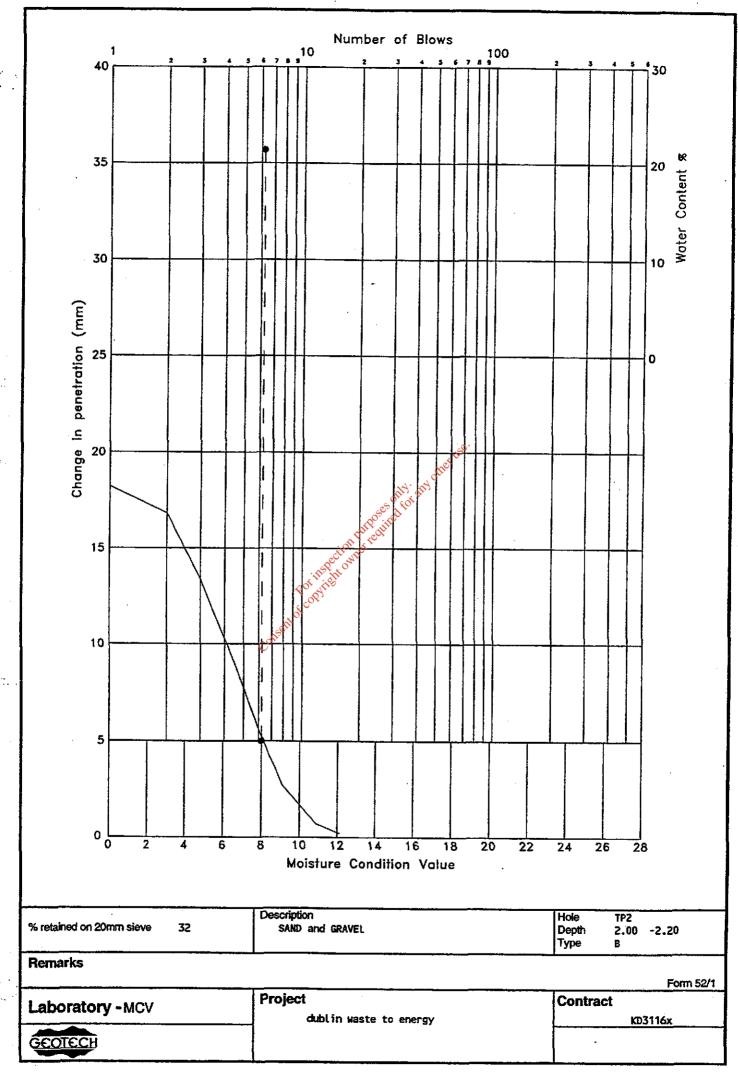


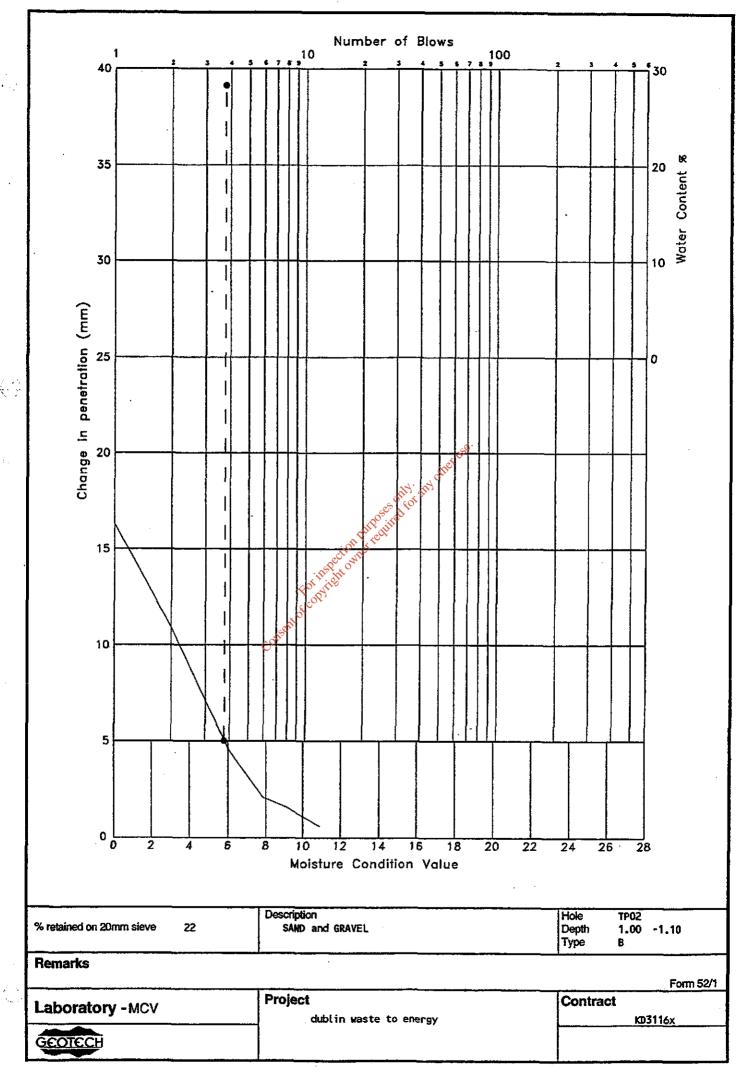


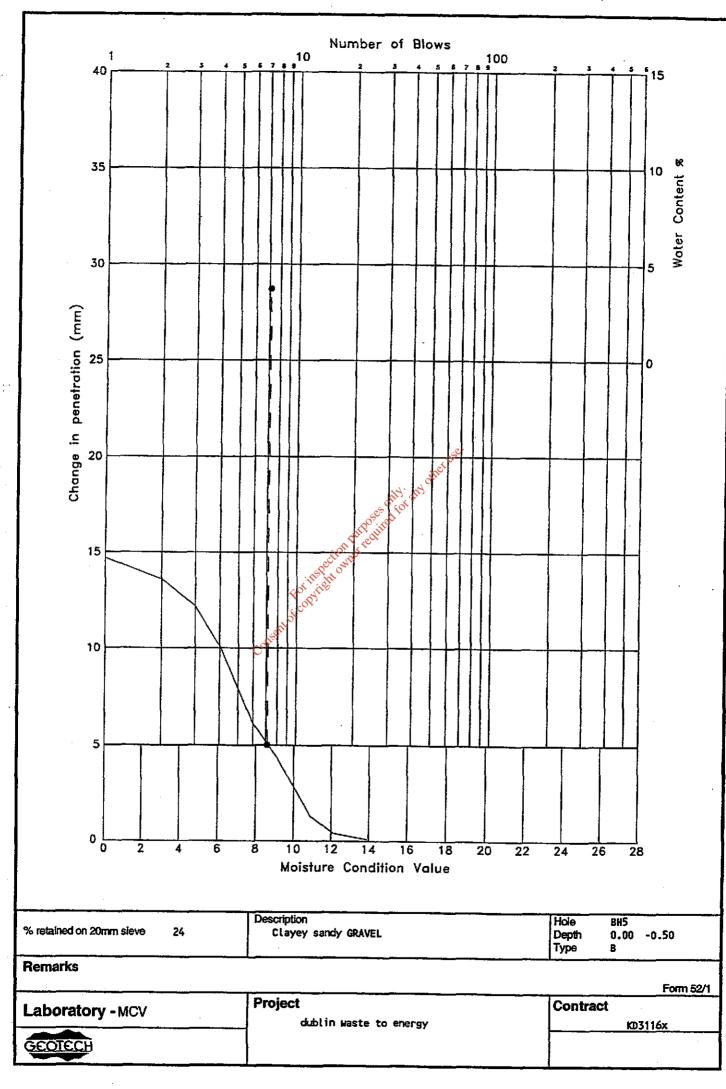


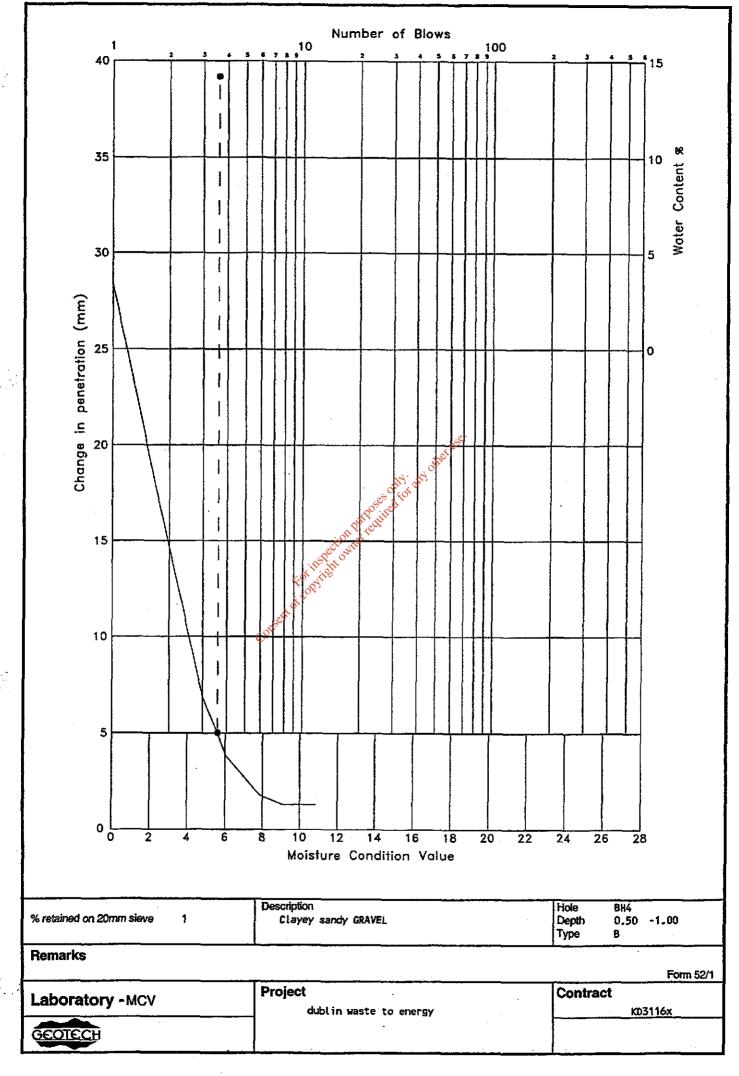


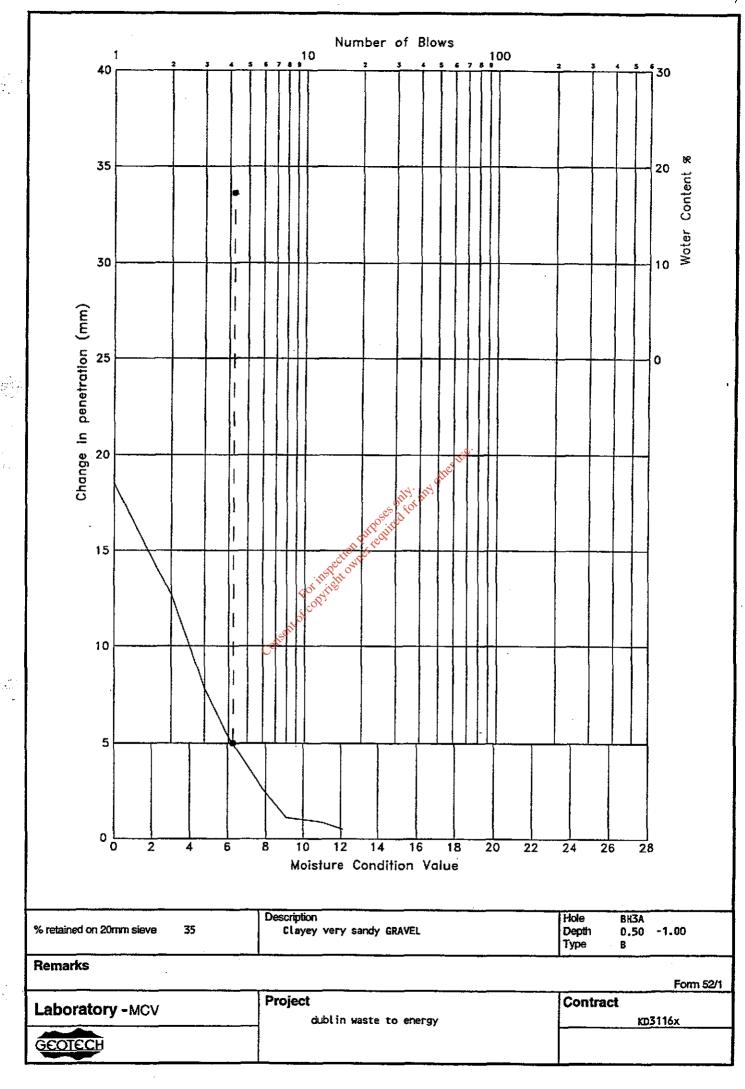


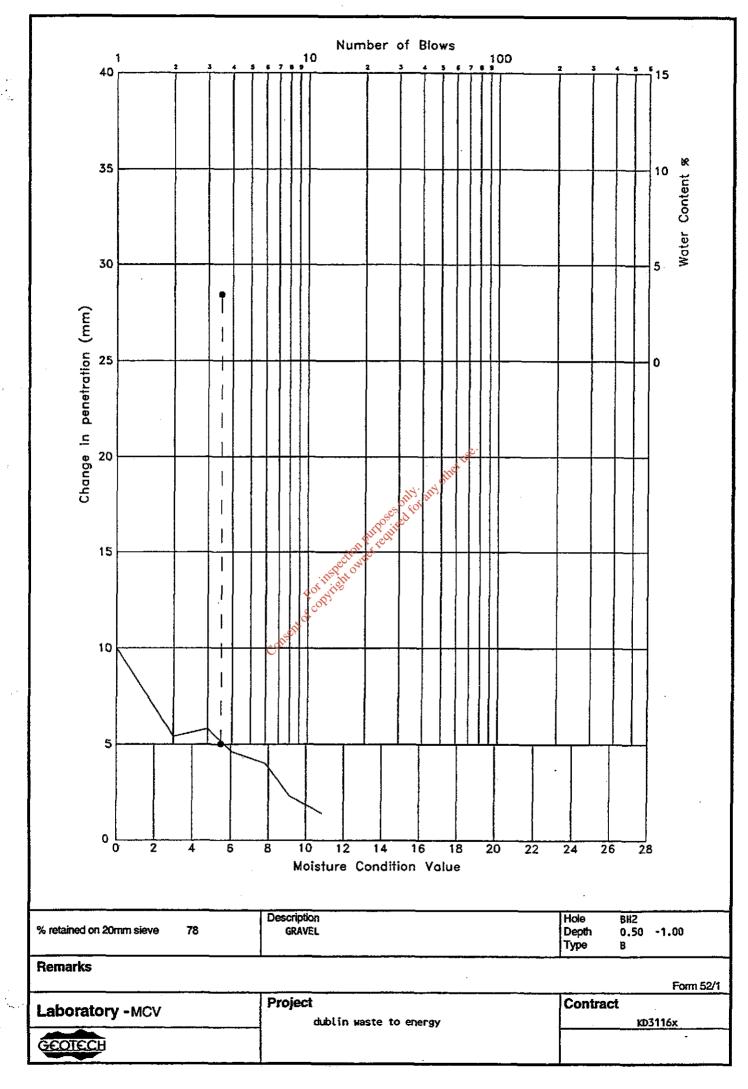


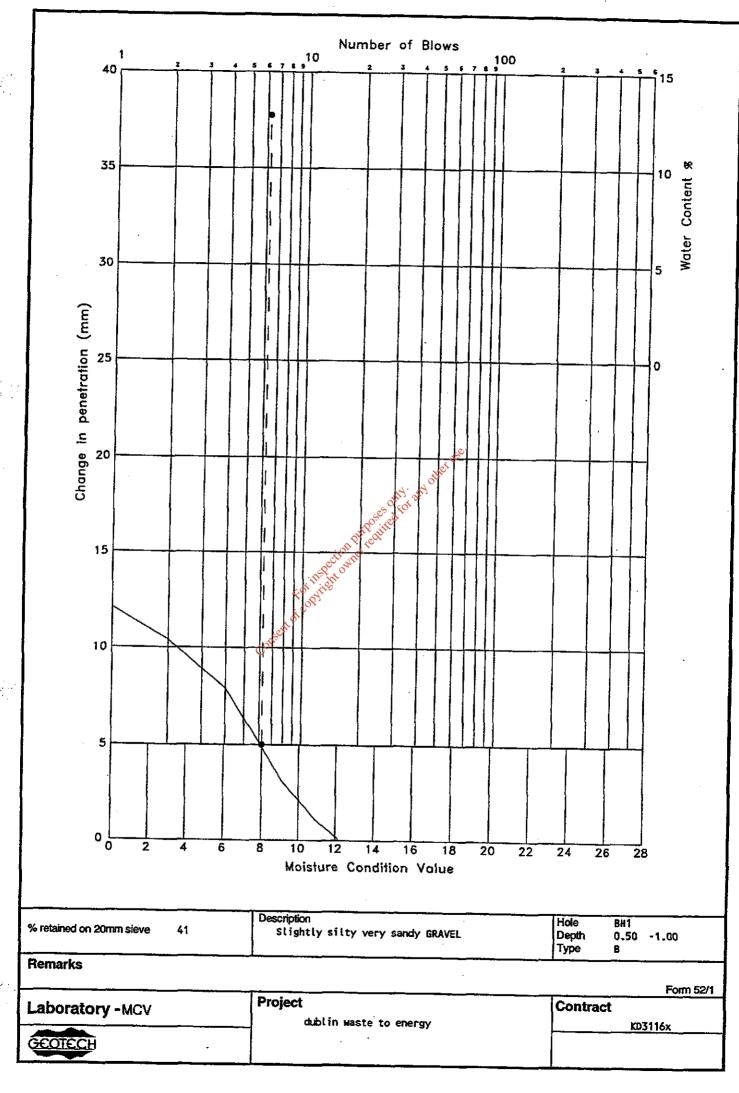












| | | | | | hwor | n3 | | | | | | | | | |
|------|---------------|------|-------------------------------------|-------------------------|-------------|------------------|-------------------|---------------------|-------------------------|--------------|----------------------------|---------------------------------|-----------------------------|----------------------------|-------|
| Hole | Depth | Туре | Description | CBR Top | CBR Base | CBR Top w% | CBR Base w% | CBR Surch kg. | γ _b Mg/m³ | Comp Type | w% (Opt) <nat></nat> | γ _d (max) Mg/m | ρ s Mg/m ³ | % ret 20/ 37.5 mm | MCV |
| 3H1 | 0.50- 1.00 | В | Slightly silty very sandy GRAVEL | | | | | | 2.12 | MCV | 13 | 1.88 | | 41 | 8.0 |
| 345 | 0.50- 1.00 | В | GRAVEL | | | | | | 2.33 | MCV | 3.4 | 2.25 | | 78 | 5.5 |
| внза | 0.50- 1.00 | B | Clayey very sandy GRAVEL | | | | | | 2.07 | MCV | 17 | 1.77 | | 35 | 6.3 |
| 3H4 | 0.50- 1.00 | В | Clayey sandy GRAVEL | 1.0 | 0.8 | 13 | 14 | 13.6 | 2.22 | 2.5kg MCV | 14 | 1.95 1.94 | | 5 1 | 5.6 |
| iHS | 0.00- 0.50 | 8 | Clayey sandy GRAVEL | | | | | | 2.27 | NCV | 3.7 | 2.19 | | 24 | 8.6 |
| P02 | 1.00- 1.10 | В | SAND and GRAVEL | | | | | | 1.94 | MCV | 28 | 1.52 | | 22 | 5.8 |
| rP2 | 2.00- 2.20 | В | SAND and GRAVEL | | | | | | 1.96 | MCV | 21 | 1.61 | | 32 | 8.0 |
| P03 | 0.60- 0.80 | В | Very gravelly SAND | | | | ₩. | 15°. | 2.11 | ису | 14 | 1.86 | | 7 | 14_1 |
| P03 | 1.80- 2.00 | В | Silty sandy GRAVEL | | | ses alfor | अप्ते श्री | | 2.11 | MCV | 18 | 1.79 | | 27 | 8.3 |
| P04 | 0.50- 0.60 | В | Silty sandy GRAVEL | _జ ర్ | on Purpo | Milies | : | | 2.05 | MCV | 12 | 1.83 | | 53 | 12.2 |
| P06 | 0.80- 1.00 | В | Clayey sandy GRAVEL & | k instright opytight | on purple | | | | 2.02 | MCV | 19 | 1.70 | | 22 | 10.3 |
| P8 | 0.80- 1.90 | В | Slightly clayey sandy | 27 | 29 | 31 | 30 | 1 | 1.36 | 2.5kg | | 1.05 | | 9 | |
| PΫ | 1.70- 1.80 | В | Slightly clayey sandy GRAVEL | | | | | | 2.03 | MCV | 18 | 1.72 | | 13 | 8.5 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | - | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Rema | rks | | | | | | | | | | | | | Form | n 6/2 |

dublin waste to energy

Compaction, CBR & Project MCV Summary

Laboratory -

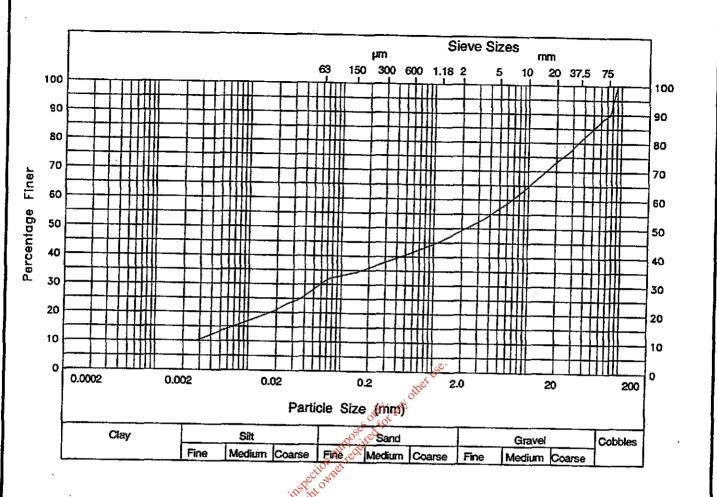
GEOTECH

EPA Export 25-07-2013:19:24:16

KD3116x

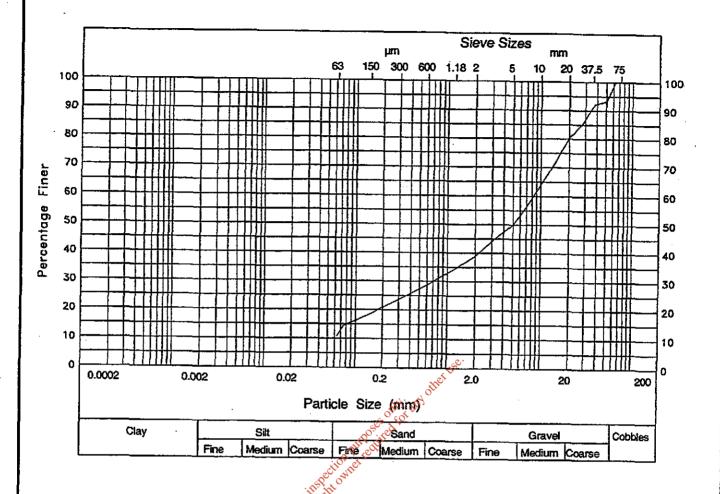
Contract

Sheet



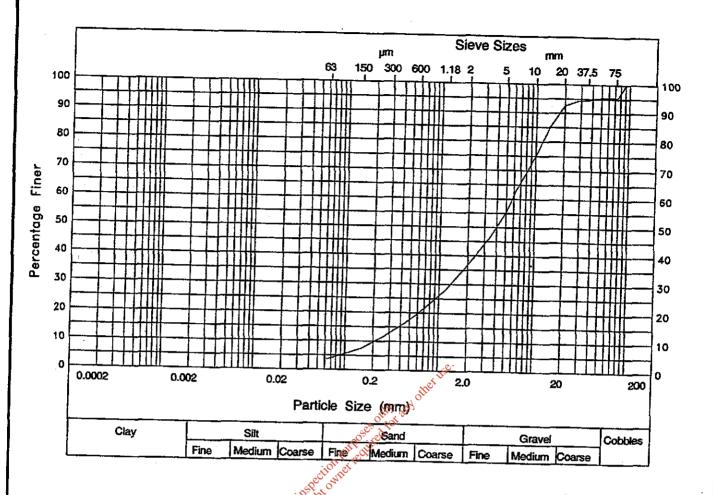
| Particle Size | % Passing | Particle Size | % Passing |
|---------------|---------------|--------------------|------------|
| 90 mm | 100 90 | 2 mm | 49 |
| 75 mm 💍 | 90 | 1.18 mm | 46 |
| 63 mm | 88 | 600 µm | 42 |
| 50 mm | 85 | 425 µm | 40 |
| 37.5 mm | 81 | 300 µm | 38 |
| 28 mm | 77 | 212 µm | 36 |
| 20 mm | 73 | 150 µm | 34 |
| 14 mm | 69 | 75 µm | 32 |
| 10 mm | 65 | 63 µm | 31 |
| 6.3 mm | 59 | 36 µm | 25 |
| 5 mm | 57 . | 26 µm | 23 |
| 3.35 mm | 53 | 19 µm | 20 |
| iole | Description | | |
| TP9 | Slightly sand | y gravelly CLAY | |
| Depth |] | , • | |
| 2.80 -3.10 | | | |
| Гуре |] | | |
| В | j | | |
| est Performed | Uniformity (| coefficient not ap | olicable. |
| Drv | | The ap | h: ions:c: |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Form 25/4 Contract KD3116x |
|---------------------------------|--------------------------------|----------------------------|
| GEOTECH | · | Sheet |



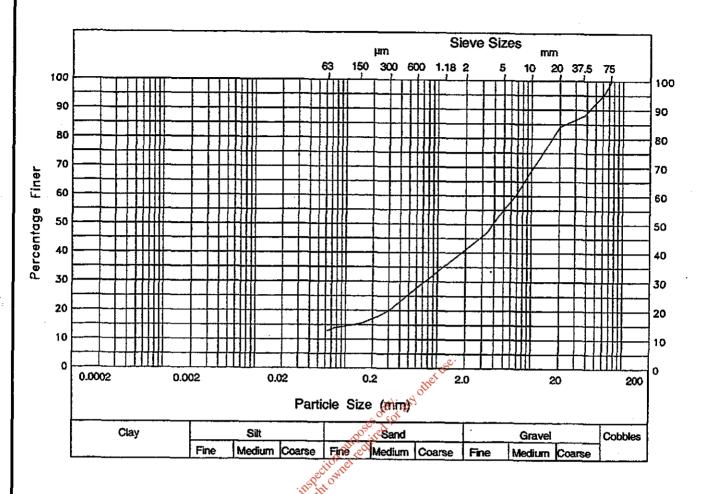
| | Fording | | |
|----------------|----------------|--------------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 63 mm | 93 | 600 μm | 29 |
| 50 mm 💍 | 93 | 425 µm | 26 |
| 37.5 mm | 92 | 300 µm | 24 |
| 28 mm | 85 | 212 µm | 21 |
| 20 mm | 80 | 150 µm | 19 |
| 14 mm | 72 | 75 µm | 14 |
| 10 mm | 64 | 63 µm | 11 |
| 6.3 mm | 54 | | |
| 5 man | 50 | | |
| 3.35 mm | 45 | | |
| 2 mm | 39 | | |
| 1.18 mm | 34 | | |
| Hole | Description | | |
| TP9 | Slightly claye | ey sandy GRAVEL | |
| Depth |] - , , | ,, | |
| 1.70 -1.80 | | | |
| Туре | | | |
| В | | | |
| Test Performed | Uniformity (| coefficient not ap | plicable. |
| Drv | | <u> </u> | |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |



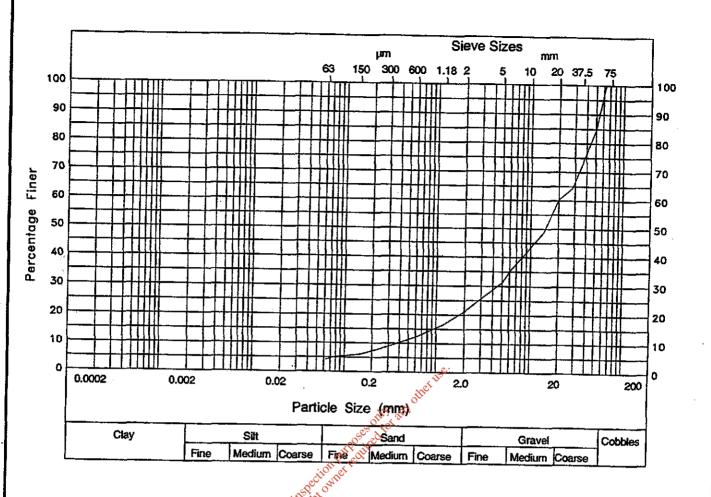
| Particle Size | % Passing | Davida O | T |
|----------------|------------------------------|---------------|-----------|
| | 78 Fassing | Particle Size | % Passing |
| 90 mm | Jen 100 | 2 mm | 37 |
| 75 mm C | 100 95 | 1.18 mm | 28 |
| 03 mm | 95 | 600 µm | 20 |
|) 50 mm | 95 | 425 µm | 16 |
| 37.5 mm | 95 | 300 µm | 13 |
| 28 mm | 94 | 212 µm | 10 |
| 20 mm | 93 | 150 µm | 7 |
| 14 mm | 85 | 75 µm | 4 |
| 10 mm | 75 | 63 µm | 4 |
| 6.3 mm | 63 | | j |
| 5 mm | 55 | | |
| 3.35 mm | 46 | 1 | İ |
| Hole | Description | | L |
| TP8 | Slightly clayey sandy GRAVEL | | |
| Depth |] | ,, | |
| 4.00 | ĺ | | |
| Туре | 1 | | |
| В. | | | |
| Test Performed | Uniformity Coefficient = 28 | | |
| Dry | | | |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |



| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|--------------------|-----------|
| 75 mm | 100 96 | 600 µm | 28 |
| 63 mm (| 96 | 425 µm | 24 |
| 37.5 am | 88 | 300 µm | 20 |
| 28 sm | 86 | 212 µm | .17 |
| 20 mm | 84 | 150° µm | 15 |
| 14 mm | 76 | 75 µm | 14 |
| 10 mm | 69 | 63 μm | 13 |
| 6.3 mm | 59 | | Ì |
| 5 mm | 55 | | |
| 3.35 mm | 47 | | İ |
| 2 mm | 41 | 1 | 1 |
| 1.18 mm | 35 | | |
| Hole | Description | | |
| TP8 | Slightly clay | ey sandy GRAVEL | |
| Depth |], ., , | | |
| 1.80 -2.00 | | | |
| Туре | 7 | | |
| B | | | |
| Test Performed | Uniformity | Coefficient not ap | plicable. |
| Dry | | | |

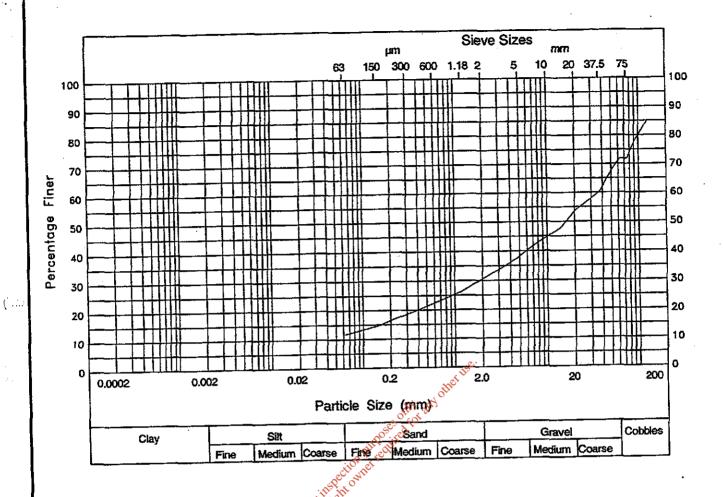
| | · · · · · · · · · · · · · · · · · · · | Form 25/4 |
|---------------------------------|---------------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | - | Sheet |



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| | For Viel | | |
|----------------|---------------|------------------|-------------|
| Particle Size | % Passing | Particle Size | % Passing |
| 63 mm | 100 85 | 600 µm | 12 |
| 50 mm | № 85 | 425 µm | 11 |
| 27.2 MBD | 74 | 300 µm | 9 |
| 28 mm | 64 | 212 µm | 8 |
| 20 mm | 60 | 150 µm | 6 |
| 14 mm | 49 | 75 µm | 5 |
| 10 mg | 43 | 63 µm | 4 |
| 6.3 mm | 36 | 1 | • |
| 5 mm | 31 | | |
| 3.35 mm | 27 | | |
| 2 mm | 21 | | |
| 1.18 mm | 16 | | |
| Hole | Description | | |
| TP07 | Slightly clay | ey sandy GRAVEL | |
| Depth |] | -,, | |
| 3.40 -4.00 | | • | |
| Туре | | | |
| B | | | |
| Test Performed | Uniformity (| Coefficient = 53 | |
| Dry | | | |

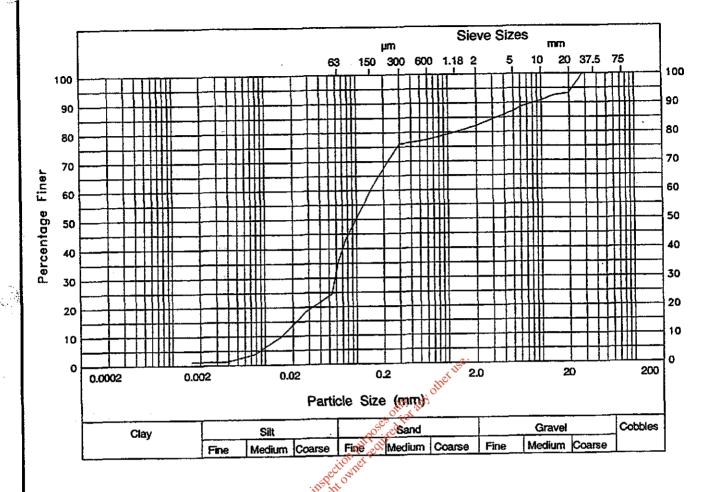
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |



| | Fordite | | |
|----------------|--------------|-----------------|-------------|
| Particle Size | % Passing | Particle Size | % Passing |
| 90 mm | 78 | 2 mm | 30 |
| 90 mm 75 mm | 72 | 1.18 mm | 26 |
| 63 mm | 72 | 600 mm | 22 |
| 50 mm | 68 | 425 µm | 20 |
| 37.5 mm | 60 | 300 km | 19 |
| 28 mm | 57 | , 212 µm | 17 |
| 20 mm | 54 | 150 µm | 15 |
| 14 mm | 48 | 75 µm | 12 |
| 10 ma | 45 | 63 µm | 12 |
| 6.3 mm | 41 | İ | |
| 5 mm | 38 | | |
| 3.35 mm | 35 | | |
| Hole | Description | | |
| TP07 | Clayey sandy | GRAVEL | |
| Depth | | | |
| 2.80 -3.00 | | | |
| Туре | | | |
| В | <u> </u> | | |
| Test Performed | Uniformity | Coefficient not | applicable. |
| Vet | <u> </u> | | |

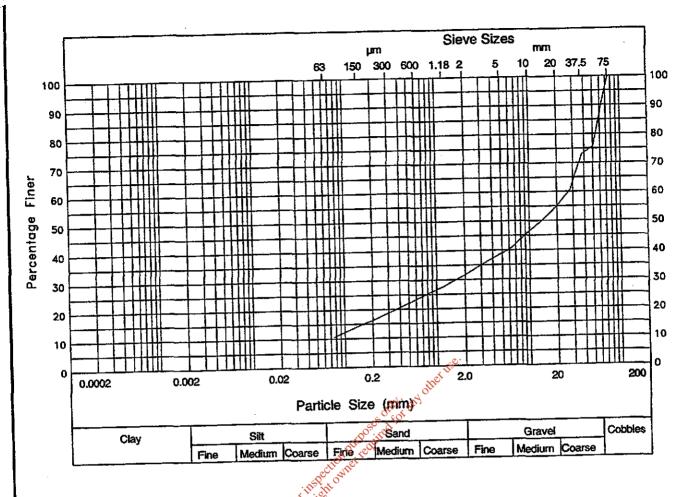
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet . |

Form 25/4



| Particle Size | % Passing | Particle Size | % Passing |
|----------------|--------------|------------------|-------------|
| 28 mm | 100 93 | 212 µm | 69 |
| 20 mm | 93 | 150 µm | 61 |
| 14 mm | 93 | 75 µm | 43 |
| 10 mm | 91 | 63 μm | 36 |
| 6.3 mm | 89 | 54 µm | 24 |
| 5 mm | 87 | 28 µm | 18 |
| 3.35 mm | 85 | 15 µm | 10 |
| 2 mm | 82 | | |
| 1.18 mm | 80 |] | 1 |
| 600 µm | 78 | | |
| 425 µm | 77 | ĺ | |
| 300 km | 76 | | |
| lole | Description | | |
| TP06 | Sandy slight | ly gravelly CLAY | |
| Depth | | | |
| 3.50 -3.70 | | | |
| Гуре | 7 | | |
| В | | | |
| Test Performed | Uniformity | Coefficient not | applicable. |
| Dry | <u> </u> | | |

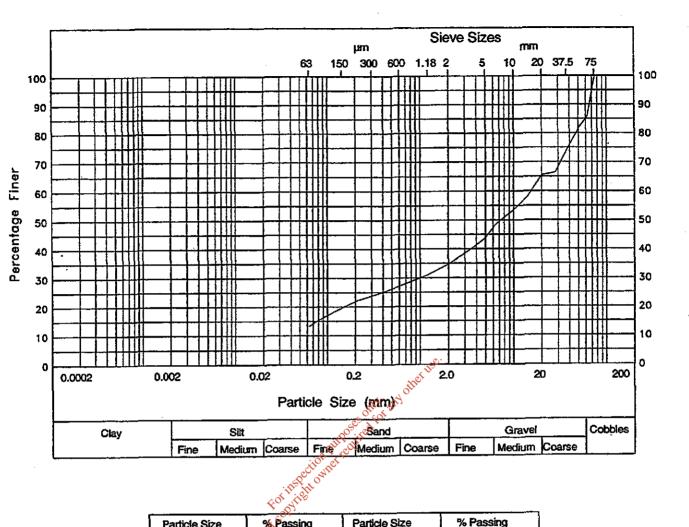
| | • | Form 25/4 |
|---------------------------------|--------------------------------|---------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | | Sheet |



| | FOTOFILE | | · |
|----------------|--------------|--|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 75 mm | 100 | 1.18 mm | 28 |
| 63 mg | 90 | 600 pm | 23 |
| 50 mm | 76 | 425 μm | 21 |
| 37.5 mm | 73 | 300 μm | 19 |
| 28 mm | 61 | 212 µm | 17 |
| 20 mm | 55 | 150 Am | 15 |
| 14 mm | 50 | 75 µm | 11 |
| 10 mm | 47 | | 1 |
| 6.3 mm | 41 | | |
| 5 mm | 39 | | |
| 3.35 mm | 36 | ļ | |
| 2 mm. | 32 | | <u> </u> |
| Hole | Description | . | |
| TP06 | Clayey sandy | GRAVEL | |
| Depth | 1 | | • |
| 0.80 -1.00 | _ | | ÷ |
| Туре | | | |
| В | | | |
| Test Performed | Uniformity | Uniformity Coefficient not applicable. | |
| Drv | <u> </u> | | |

| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
|---------------------------------|--------------------------------|------------------|
| GEOTECH | | Sheet |

Form 25/4

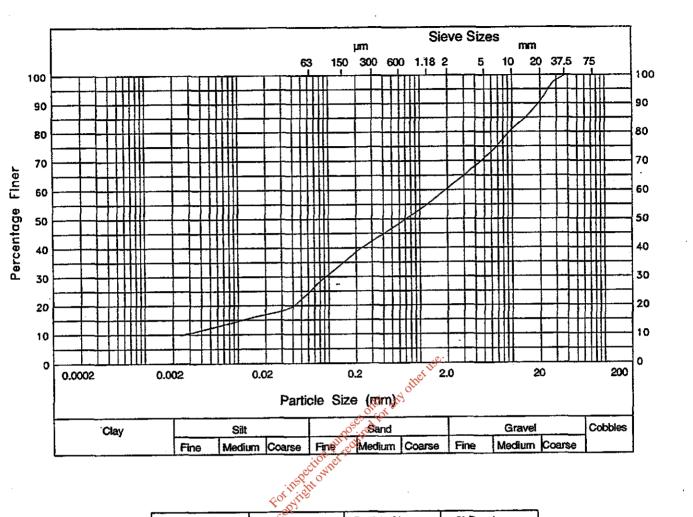


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| | <u> </u> | | 3 |
|----------------|--|---------------|-----------|
| Particle Size | % Passing | Particle Size | % Passing |
| 75 mm | 900 100 86 | 1.18 mm | 31 |
| 63 mm 🔗 | 86 | 600 µm | 27 |
| 50 mm | 82 | 425 µm | 25 |
| 37.5 mm | 74 | 300 µm | 24 |
| 28 mm | 66 | 212 µm | 22 |
| 20 mm | 65 | 150 µm | 20 |
| 14 mm | 58 | 75 µm | 15 |
| 10 mm | 53 | 63 µm | 13 |
| 6.3 mm | 48 | | |
| 5 mm | 44 | j | |
| 3.35 mm | 39 | 1 | · . |
| 2 mm | 35 | | |
| Hole | Description | | |
| TP05 | Clayey sandy | GRAVEL | |
| Depth | 1 | | |
| 2.80 -3.00 | <u> </u> | | |
| Type | 1 | | |
| 8 | | | |
| Test Performed | Uniformity Coefficient not applicable. | | |
| Drv | | | |

| | | Form 25/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | <u>-</u> | Sheet |



| Particle Size | % Passing | Particle Size | % Passing |
|----------------|---------------|--------------------|------------|
| 37.5 mm | 100 | 300 µm | 42 |
| 28 mm | 98 | 212 µm | 39 |
| 20 mm | 91 | 150 µm | 35 |
| 14 mm | 85 | 75 µm | 28 |
| 10 mm | 81 | 63 µm | 25 |
| 6.3 mm | 74 | 41 µm | 20 |
| 5 mm | 71 | 30 pcm | 18 |
| 3.35 mm | 66 . | 16 µm | 16 |
| 2 mm | 61 | | \ |
| 1.18 mm | 55 | | • |
| 600 µm | 48 | 1 | · i |
| 425 µm | 45 | · | |
| Hole | Description | | |
| TP05 | Black mottled | i grey sandy grave | lly CLAY |
| Depth | | | |
| 0.70 -0.80 | | | |
| Гуре | | | |
| <u>B</u> | | | |
| Test Performed | Uniformity | Coefficient not a | pplicable. |
| Drv | | | |

| | | FOITI 20/4 |
|---------------------------------|--------------------------------|------------------|
| Laboratory - Particle Size Plot | Project dublin waste to energy | Contract KD3116x |
| GEOTECH | <u> </u> | Sheet |



TEST REPORT SOIL SAMPLE ANALYSIS



1257

TES Report No. EFS/033223

Site: Dublin Waste

Geotech Specialists Ltd Carewswood Castlemartyr County Cork Ireland

The 7 samples described in this report were scheduled for analysis by TES Bretby on Wednesday, 6 August 2003. The analysis was completed by Monday, 18 August 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Tables of TPH Chromatograms (5 Pages)
Table of Report Notes (1 Page)

On behalf of

TES Bretby : U tours

Hannah

Project Co-ordinator

Date of Issue: 18/08/03

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby, P.O. Box 100, Burton-on-trent, DE15 0XD Tel: 01283 554400 Fax: 01283 554422 TES Bretby is a division of Mowlern Environmental Sciences Group Registered in England Number 77628

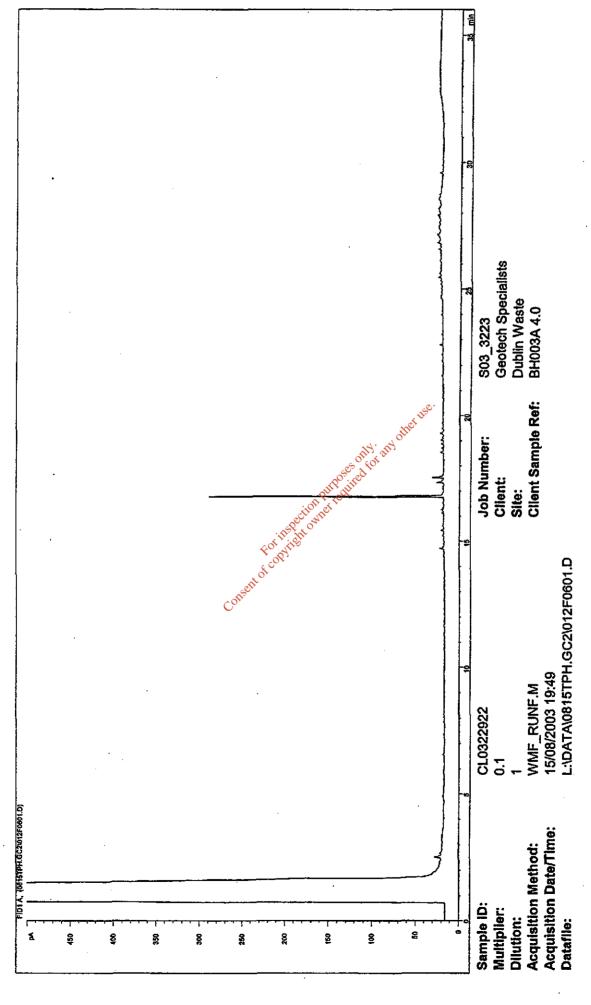
= TES Bretby = Report 03322: Control Page Sheet 1/1

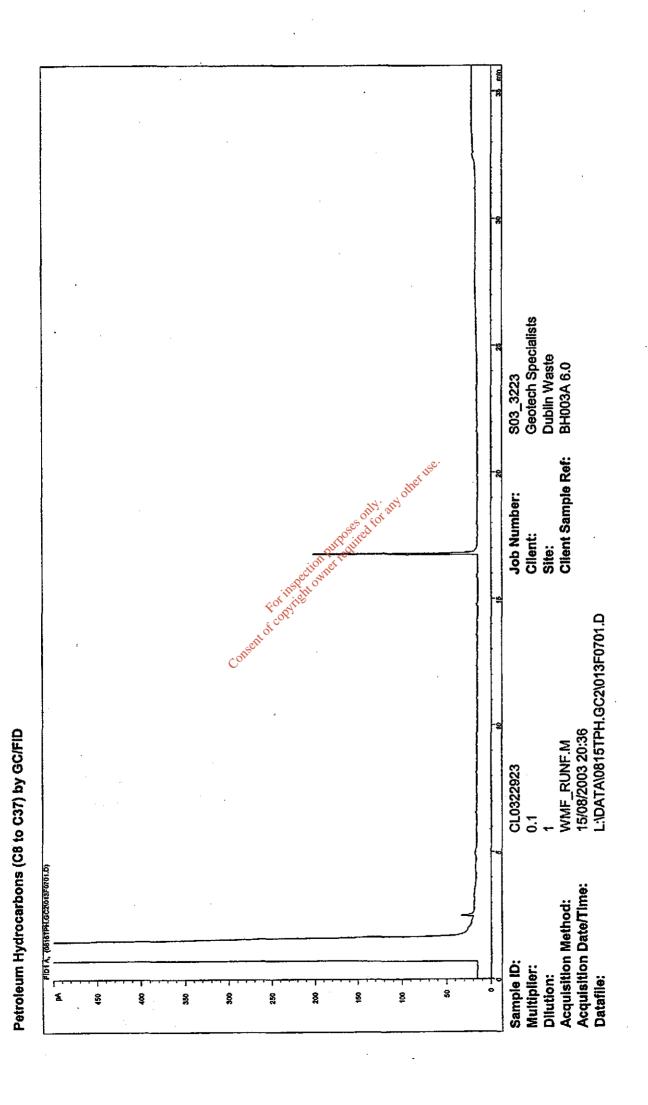
| | Units: | mg/kg | mg/kg | mg/kg | mg/kg | Н | тр/ка | 1 | \vdash | mg/kg | | mg/kg | \blacksquare | mg/kg | ву/вш | | mg/kg |
|-------------------|---------------------------------------|-------------|-------------------|------------|---------------------|--------------|---------------|-------------|------------|--------------|---------------|---------------|----------------|-----------------|----------------|-----------------|--------------|
| | Method Codes: | BGCN22 | ELESULP | ICPACIDS | ICPMSS | υ | ICPMSS | Ş | တ္သ | ICPMSS | ICPMSS | | ICPMSS | N28 | ICTSCN28 F | 3 | SCNCR6 |
| | Detection Limits: | - | 8 | 10 | 0.5 | 0.1 | 0.5 | 0.5 | 0.5 | 0.10 | | | 3.0 | - | 2 | 10 | 0.1 |
| | UKAS Accredited: | yes | yes | yes | yes | | yes | yes | yes | yes | _ | | ves | yes | yes | yes | 7 |
| TES ID Number CL/ | Cilent Sample Description | | Elemental Sulphur | | Arsenic (MS) | | Chromium (MS) | Copper (MS) | Lead (MS) | Mercury (MS) | | Selenium (MS) | Zinc (MS) | CN- (total) | Sulphide | PAH (screening) | Chromium vi. |
| 0322922 | BH003A 4.0 | | | | OTIS | | | | | | | | | | | | |
| 0322023 | BH003A 6.0 | | | | <u> </u> | ot o | | | | | | | | | | | |
| 0322924 | BH005 0.5 | | | | | koj Coj | | - | | | | | | | | | |
| 0322925 | BH005 1.2 | Ş | <20 | 1850 | 10.40 | 0.44 | % 23.6 | 32.6 | 104.2 | 0.12 | 18.6 | 1.3 | 107.4 | ⊽ | | 5020 | 0.3 |
| 0322926 | BH005 5.5 | | | | | 0 | citic | | | | | | | | | | |
| 0322920 | TP008 0.8 | ٧ | 69 | 811 | 13.60 | 0.24 | 15 8.0; | 99.0 | 51.5 | 0.28 | 41.8 | 1.23 | 448.8 | ⊽ | \$ | 82 | 60.1 |
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| TES | S TES Bretby | Client Name | ame | Geotect | Geotech Specialists | sts | | | | | S | Soils Sa | mple A | Sample Analysis | | | 172 |
| 1 | | Contact | | Mr A Garne | 9 | | | | | | | | | | | | |
| Bretby | Burton-Trent, Staffordshire, DE15 0XD | | | | | | | | | | Date Printed | ted | | 18 Augu | 18 August 2003 | | |
| | Tel +44 (0) 1283 554400 | | | | <u>ב</u> | Dublin Wasta | ofe | | | · | Report Number | umber | | EF | EFS/033223 | UKAS | SI |
| | Pgx +44 (0) 1283 554422 | | | |) 2 | | וייי | | | 1 | Table Number | mber | | | + | 1252 | N § |
| | | | | | | | | | | | Page Number | nber | | | 1 of 2 | | |

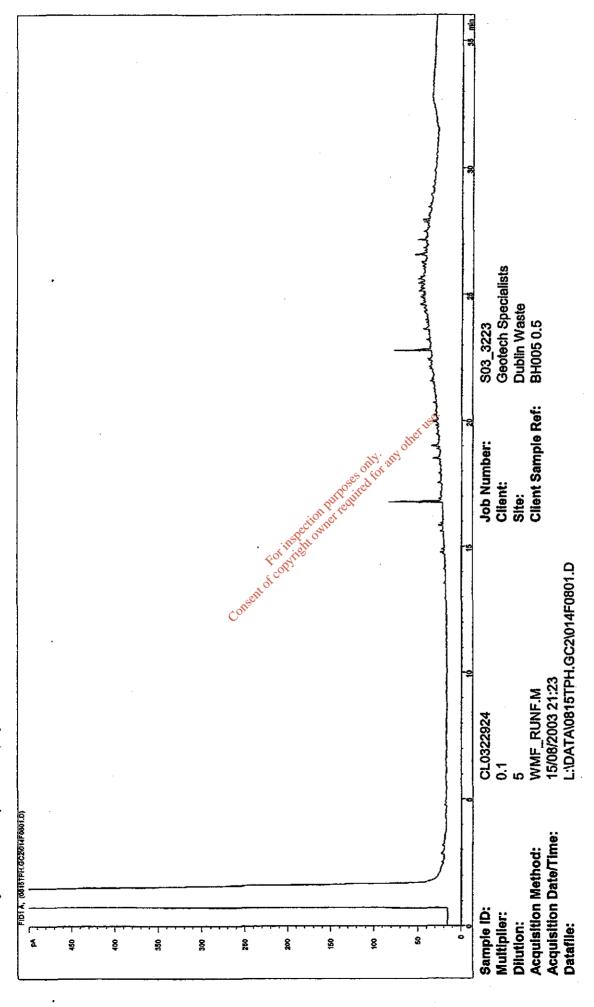
| | Units | | ma/ka | nt Units | mo/ko | ma/ko | | - | - | | | | | | | - |
|------------|--|-------------|------------|------------|------------------------------------|--------------|-------------|----------|---------|--------------|---------------------------------------|---------|--|----------------|---------------------------|-----------|
| | Method Codes: | SCNCR6 | TPHFID | WSLM3 | WSLM4 | ICPBOR | | | | | | | | | | |
| | Detection Limits: | 9'0 | 10.0 | | 0.5 | 0,5 | | | | - | | | | | | |
| | UKAS Accredited: | yes | yes | yes | yes | uo | | | | | | | | | | |
| TES II | | | TPF | | Pi | | | | | | | | | · | | |
| Number C | Client Sample Description | niocyanate. | GCFID (AR) | pH units | nenol Index | Boron. | | | | | | | | | | |
| - - | | | | | | | | | <u></u> | | · · · · · · · · · · · · · · · · · · · | | | | | |
| 0322922 | BH003A 4.0 | | 47 | | | | | - | - | | | | | | | |
| 0322923 | BH003A 6.0 | | <10.0 | | C | | | - | | | | | | | | |
| 0322924 | BH005 0.5 | | 815 | | Ons | | | | | | | | | | | |
| 0322925 | BH005 1.2 | 0.1 | | 10.6 | 7.6 | 200 | | | | | | | | | - | |
| 0322926 | BH005 5.5 | | 132 | | | çoi co | | | | | | | | | | |
| 0322920 | TP008 0.8 | <0.5 | | 8.5 | <0.5 | d'il | ્રદ્ધ | | | | | | | | | |
| 0322921 | TP008 1.8 | | 149 | | | O. T. | otic * C | | | | | | | | | |
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| 153 | TES Bretby PO Box 100, Bretby Business Park, | Contact | 2 | Mr A Garne | Geolecii opecialists Mr A Garne | <u>s</u> | | | | | Solls | ample 1 | Solis Sample Analysis | | | · · · · |
| Brothy | Burtopor-Ireal Staffordshire, DE15 0XD | | | | | | | | | 1 2 2 | 11-4-4 | | | | \(\frac{\frac{1}{1}}{1}\) | ф () |
| ם ב | | | | | | | , | | | Date Printed | Nimbor | | 18 Aug | 18 August 2003 | | |
| | Env 444 (N) 1283 554423 | | | | ono | Dublin Waste | aste | | | inday F | Tell in the | | בי בי בי בי בי בי בי בי בי בי בי בי בי ב | 2(033223 | TESTIN | n |
| | 776666 FORT (A) 664 YES | | | | | i | | | | Lable | Table Number | | | - | 1252 | _ |
| | | | | , | | | | | | Page Number | tumber | | | 2 of 2 | | |

Geotech Specialists Dublin Waste TP008 1.8 S03_3223 Site: Client Sample Ref: Job Number: Cllent: L:\DATA\0815TPH.GC2\011F0501.D WMF_RUNF.M 15/08/2003 19:02 CL0322921 FID1A, (08157PH:GCZN011F0501.D) Acquisition Date/Time: Datafile: Acquisition Method: Sample ID: Multiplier: Dilution: 15 8 \$ 당 \$ 300 95 2 8 \$ ş

Petroleum Hydrocarbons (C8 to C37) by GC/FID







S03_3223 Geotech Specialists Dublin Waste BH005 5.5 Client: Site: Client Sample Ref: Job Number: WMF_RUNF.M 15/08/2003 22:56 L:\DATA\0815TPH.GC2\016F1001.D CL0322926 0.1 FIDIA, (0015TPH.GCZ0010F1001.D) Acquisition Method: Acquisition Date/Time: Datafile: Sample ID: Multiplier: Dilution: **₹** 1 90 200 . 22 8 250 8 \$ **\$** 8 8

Petroleum Hydrocarbons (C8 to C37) by GC/FID

Report Notes

Soil/Solid analysis specific:

Results expressed as mg/kg unless stated otherwise S04 analysis not conducted in accordance with BS1377 Water Soluble Sulphate on 2:1 water:soil extract AR denotes analysis conducted on the As Received sample # co-eluted with benzo(b)fluoranthene ## co-eluted with Indeno(123-cd)pyrene BTEX analysis expressed as ug/kg As Received Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:

Results expressed as mg/l unless stated otherwise

Oil analysis specific:

Results expressed as mg/kg unless stated otherwise S.G. expressed as g/cm²@ 15°C

Filter analysis specific:

Results expressed as mg on filter unless stated otherwise

VOC analysis specific:

Explanatory notes for data flagging U = undetected above reporting limit

J = concentration at instrument was below lowest calibration standard

E = concentration at instrument was above top cationation standard

B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:

Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specifical

Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:

CH denotes Chrysotile

CR denotes Crocidolite

AM denotes Amosite

NADIS denotes No Asbestos Detected in Sample

NBFO denotes No Bulk fibres Observed

T Trace

L Low (2-15%)

M Medium (15-50%)

H High (>50%)

General notes:

A this analysis was subcontracted to another laboratory

\$ Within laboratory tolerances

\$\$ unable to analyse due to nature of sample

¥ Results for guidance only, possible interference

& Blank corrected

LS insufficient sample for analysis

Intf Unable to analyse due to interferences

N.D Not determined

N.R Not recorded

N.Det Not detected

Req Analysis Requested, see attached sheets for results

* denotes this result not UKAS accredited on this sample

> Raised detection limit due to nature of sample

Our Ref : EFS/032527

Your Ref: 9 July 2003

Mr A Garne Geotech Specialists Ltd Carewswood Castlemartyr County Cork Ireland



Geotech Specialists Limited TES

1 4 JUL 2003

TES Bretby

PO Box 100 Ashby Road Burton-upon-Trent Staffordshire DE15 0XD

Telephone: 01283 554400 Facsimile: 01283 554422

E-mail: enquiries@tes-bretby.co.uk

Dear Mr Garne

SOILS ANALYSIS - Dublin Waste

Please find attached analytical results for the samples from the above site.

An invoice for this work will follow under separate cover.

If appropriate, samples covered by this report will be saved until approximately 06/08/03 when they will be discarded. Please call 01283 554403 for an extension of this date.

Please be aware that from 1 January 2003 our policy for the retention of paper based laboratory records and analysis reports will be 3 year

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if your require any further information.

Yours sincerely

J Hannah

J Hannah
Project Co-ordinator
01283-554403



TEST REPORT SOIL SAMPLE ANALYSIS



1252

TES Report No. EFS/032527

Site: Dublin Waste

Geotech Specialists Ltd Carewswood Castlemartyr County Cork Ireland

The 3 samples described in this report were scheduled for analysis by TES Bretby on Wednesday, 25 June 2003. The analysis was completed by Wednesday, 9 July 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained this report:

Table 1 Main Analysis Results Table of Report Notes (1 Page)

On behalf of
TES Bretby: James
J Hannah Project Co-ordinator

Date of Issue: 09/07/03

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby, P.O. Box 100, Burton-on-trent, DE15 0XD Tel: 01283 554400 Fax: 01283 554422 TES Bretby is a division of Mowlem Environmental Sciences Group Registered in England Number 77628

TES Bretby = Report 03252' Control Page Sheet 1/1

| mg/kg | - 1 | | yes | Chromium vi. | 6 | <0.1 | <0,1 | | | | | | | | | | | | | | | | | | (- | 7r 7 | KAS | 1262 | |
|--------|---------------|--------------------|-------------------|---------------------------|---------------|---------------|---------------|-----|-------|------|----------|----------------------|-----|-----------|------|-----|----|----|--|--|---|--|---|-----------------------|----------------|--|-------------------------|-------------------------|-------------|
| mg/kg | 2000 | 21 | yes | PAH (screening) | ଛ | 108 | 125 | | | | | | | | | | | | | | | | | | \\ \frac{1}{1} | | | | |
| mg/kg | 10 June 1 | 1 | yes | Sulphide | 16 | <5 | 91 | | | | | | | | | | | | | | | | | s S | | 9 July 2003 | EFS/032527 | 1 | 1012 |
| mg/kg | CI SCINCO | - | yes | CN- (total) | ٧ | دا | ₽ | | | | | | | | | | | | | | | |] . | Analysi | | 8 | 9 | | |
| mg/kg | _ | 3.0 | yes | Zinc (MS) | 66.1 | 292.6 | 381.4 | | | | | | | | | | | | | | | | | amble / | | | | | |
| mg/kg | CHMSS | 0.5 | yes | Selenium (MS) | 1.04 | 1.82 | 1.70 | | | | | | | | | | | | | | - | | ֓֞֟֜֜֟֝֟֝֟֝֟֝֟֟֝֟֟ ֓֓֓֞֓֓֓֓֞֓֓֞֓֞֞֞֓֓֓֓֞֓֓֓֓֓֓֓֓֓֓ | Soils Sample Analysis | | nted | lumber | ımber | mber |
| mg/kg | CPMSS | 0.5 | 96/ | Nickel (MS) | 29 | 23.8 | 52.4 | | | | | | | | | | | | | | | | | | | Date Printed | Report Number | Table Number | Page Number |
| mg/kg | CPMSS | 0,10 | 79S | Mercury (MS) | 0.21 | 69.0 | 0.49 | | | | | | | | | | | | | | | | | | | | | | |
| mg/kg | CPMSS | 0.5 | yes | Lead (MS) | 30.6 | 479.2 | 822.6 | | | | | | | | | | 15 | j. | | | | | | | | | | | |
| mg/kg | ICPMSS | 0.5 | yes | Copper (MS) | 65.3 | 42.4 | 189.5 | | | | <u>~</u> |) وجو ايم. الأ | 000 | łoż Y. | dily | Oli | | | | | | | | | | | | | |
| mg/kg | ICPMSS | 0.5 | yes | Chromium (MS) | 20.5 | 17.5 | 58.3 | OS) | oil o | A Pi | ie Ne | gar | | | | | | | | | | | | | | | Cacto. | 2010 | |
| mg/kg | ICPMSS | 0.1 | 798 | Cadmium (MS) | 0.13 | 1.26 | (S) | yir | | | | | | | | | | | | | | | | lists | | | Dublin Macta |) v | |
| то/ко | | | | Arsenic (MS) | 12.10% | 13.50 | 23.2 | | | | | | | | | | | | | | | | ֓֞֞֜֜֜֜֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֓֡֓֓֓֓֡֓֜֝֡֓֓֡֓֡֓֡֓֡ | Geotech Specialists | пе | | 2 | 3 | |
| mg/kg | ICPACIDS | 2 | YBS | | 683 | 8350 | 7180 | | | | | | | | | | | | | | | | | Geoter | Mr A Game | | | | |
| mg/kg | ELESULP | 8 | 798 | Elementa! Sulphur | 48 | 21 | 9Z\$ | | | | | | | | | | | | | | | | | ате | ٠ | | | | |
| mg/kg | | | | Cyanide (Free) | ⊽ | ⊽ | ⊽ | | | | | | | | | | | | | | | | | Cilent Name | Contact | | · | | |
| Unite: | Method Codes: | Detection Limits : | UKAS Accredited : | Client Sample Description | TP001 1.2-1.6 | TP004 1,2-1,4 | TP007 0,7-0.8 | | | | | | | | | | | | | | | | | TES Brothy | | Burton-on-Trent, Staffordshire, DE15 0XD | Tel +44 (0) 1203 554400 | Fax +44 (0) 1283 554422 | |
| | | | | TES ID Number CL/ | 0318338 | 0318337 | 0318338 | | | - | | <u> </u> | | | | | | | | | | | | グゴト | | Brethy | | | |

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|------------------------------------|------------------|---------------------------|---------------|---------------|---------------|---------|----------|----------|-----|-----|------|--------------|-------|-------|----|-----|------|--|--|---|-----------------------|------------------------------------|--|-------------------------|-------------------------|-------------|
| | | | | | | | | | | | | | + | 1 | | | | | | | sis | | 9 July 2003 | EFS/032527 | 1 | 2 of 2 |
| | | | _ | | | | | | | | | | | | | | _ | | | _ | ple Analy | | | | | |
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| | | | _ | | | | | | | | - | | | | | | | | | | | | Date Printed | Report Number | Table Number | Page Number |
| | | | _ | | | | | | | | | | | | - | | | | | | | | | | | |
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| | | | | | SOL | ĘG G | ol V. | 100 | | | | | | | | | | | | | alists | | | Dublin Weeto | | |
| mg/kg ICPBOR 0.5 | Н | <u> </u> | 0.9 | Ċ. | 7: | | | | | | | _ | | | | | | | | | Geotech Specialists | au. | | Ē | 3 | |
| mg/kg WSLM4 0.5 | yes | Phenol Index | <0.5 | <0.5 | <0.5 | | | <u>_</u> | | | | _ | | | | | | | | | Geote | Mr A Garne | | | | |
| PH Units WSLM3 | ves | pH units | 9.5 | 8.4 | 9.0 | | | | | | | | | | | | • | | | | dame | 4. | • | | | |
| SCNCR6 | yes | | <0,5 | <0.5 | <0,5 | | | | | | | | | ŀ | | | | | | | Client Name | Contact | <u> </u> | | | |
| Method Codes: Detection Limits: | UKAS Accredited: | Client Sample Description | TP001 1.2-1.6 | TP004 1.2-1.4 | TP007 0.7-0.8 | | | | | , | | | | | | | | | | | | FO Box 100, Brettly Business Park, | Burton-on-Trent, Staffordshire, D£15 0XD | Tel +44 (0) 1283 554400 | Fax +44 (0) 1283 654422 | |
| | | TES ID Number CL/ | 0318338 | 0318337 | 0318338 | | | | | | | | | | | | | | | | TEC | 7 | Bretby | | | |

Report Notes

Soll/Solid analysis specific:

Results expressed as mg/kg unless stated otherwise S04 analysis not conducted in accordance with BS1377 Water Soluble Sulphate on 2:1 water soil extract AR denotes analysis conducted on the As Received sample # co-duted with berzo(b)fluoranthene ## co-duted with Indeno(123-cd)pyrene BTEX analysis expressed as ug/kg As Received Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:

Results expressed as mg/l unless stated otherwise

Oil analysis specific:

Results expressed as mg/kg unless stated otherwise S.G. expressed as g/cm³@ 15°C

Filter analysis specific:

Results expressed as mg on filter unless stated otherwise

VOC analysis specific:

Explanatory notes for data flagging

U = undetected above reporting limit

J = concentration at instrument was below lowest calibration standard

E = concentration at instrument was above top calibration standard

B = compound was detected in method blank

Gas (Tedlar bad) analysis specific:

Results expressed as ug/I unless stated otherwise

Air (Carbon tube) analysis specific:

Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:

CH denotes Chrysotile

CR denotes Crocidolite

AM denotes Amosite

NADIS denotes No Asbestos Detected in Sample

NBFO denotes No Bulk fibres Observed

T Trace

L Low (2-15%)

M Medium (15-50%)

H High (>50%)

General notes:

A this analysis was subcontracted to another laboratory

\$ Within laboratory tolerances

\$\$ unable to analyse due to nature of sample

¥ Results for guidance only, possible interference

& Blank corrected

LS insufficient sample for analysis

Intf Unable to analyse due to interferences

N.D Not determined

N.R Not recorded

N.Det Not detected

Req Analysis Requested, see attached sheets for results

* denotes this result not UKAS accredited on this sample

> Raised detection limit due to nature of sample

Our Ref : EFS/034319

Your Ref: 21964 31 October 2003

Mr M Kelley Geotech Specialists Ltd Hartwell Upper Kill County Kildare Eire



TES Bretby

PO Box 100 Ashby Road Burton-upon-Trent Staffordshire DE15 OXD

Telephone: 01283 554400 Facsimile: 01283 554422

E-mail: enquiries@tes-bretby.co.uk

Dear Mr Kelley

SOILS ANALYSIS - Dublin Waste

Please find attached analytical results for the samples from the above site.

An invoice for this work will follow under separate cover.

If appropriate, samples covered by this report will be saved until approximately 28/11/03 when they will be discarded. Please call 01283 554403 for an extension of this date. Please be aware that from 1 January 2003 our policy for the retention of paper based laboratory records and analysis reports will be 3 years

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if you require any further information.

Yours sincerely

J Elstub

Project Co-ordinator

01283-554403



TEST REPORT SOIL SAMPLE ANALYSIS



1051

TES Report No. EFS/034319

Site: Dublin Waste

Geotech Specialists Ltd Hartwell Upper Kill County Kildare Eire

The 2 samples described in this report were scheduled for analysis by TES Bretby on Friday, 17 October 2003. The analysis was completed by Friday, 31 October 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Brethy laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of TPH Chromatogram (1 Page)
Table of Report Notes (1 Page)

On behalf of TES Bretby : J Elstub

Project Co-ordinator

Date of Issue: 31/10/03

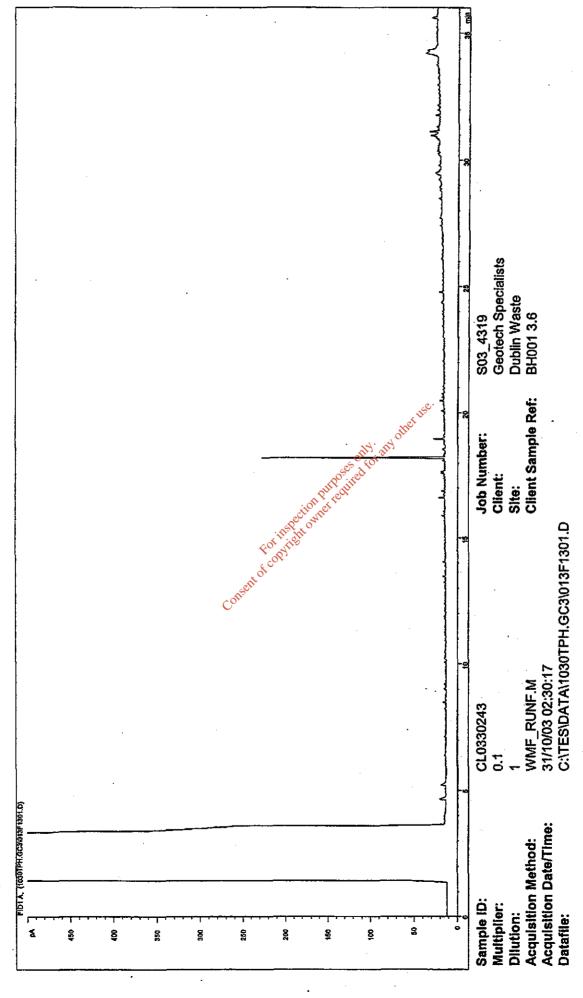
Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

= TES Bretby Report 0343 Control Pag Sheet 1/

| SCNCR8 | +- | +- | 100 | Thiocyanate. | | <0.5 | | | | | | | | | | | | | | | | | Ç | | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | JKAS | 1252 | |
|------------------|---------------|-------------------|-------------------|---------------------------|-----------|--------------|-----|--------|------|-----------------|----|-------|-----|------|-----|------|----|----|-----|--|--|--|-----------------------|--|---|-------------------------|-------------------------|-------------|
| mg/kg SCMCB8 | | VAC | 4.00 | Chromium vi. | | c 0.1 | | | | | | | | | | | | | | | | | 3,000 | 1 | | ב | | |
| mg/kg PAHSCIW | 40 | ļ. |) AGG | PAH (screening) | · | 99 | | | | | | | | | | | | | | | | | S | | 31 October 2003 | EFS/034319 | - | 1 of 2 |
| mg/kg | 5 | . Case | CD. | Sulphide | | 14 | | | | | | | | | | | | | · | | | | Anaivsi | • | 31 Octo | ă | | |
| mg/kg | 1 | 1 | VES | CN- (total) | | ₩. | | | • | . ا | | | | | | | | | | | | | Soils Sample Anaivsis | • | | | | |
| mg/kg | " | 100 | ABS | Zinc (MS) | | 320.9 | | | | | | | | | | | | | | | | | Soils S | | nted | Number | umber | ımber |
| mg/kg | 0.5 | 995 | AGA | Selenium (MS) | | 1.10 | | | | | | | | | | | | | | | | | | | Date Printed | Report Number | Table Number | Page Number |
| By/Bu | 0.5 | 200 | NG A | Nickel (MS) | | 24.9 | | | | | | | | | | | | | | | | | | | | | | |
| mg/kg | 0 10 | 200 | Ves | Mercury (MS) | | 0.34 | | | | | | | | | | | 2 | ŞÓ | ne. | | | | | | | | | |
| mg/kg | 0.5 | 0.00 | Yes | Lead (MS) | | 178.6 | | | | | | | Jos | . હે | joi | , Mi | 30 | | | | | | | İ | | | | |
| mg/kg | | | Yes | Copper (MS) | | 27.5 | | ! ! | | g5P | jo | o Più | edi | | | | | | | | | | | ı | | 0400 | ase | |
| mg/kg | 200 | 2.0 | yes | Chromium (MS) | | 19.2 | يون | K K | or) | ki ^q | | | | | | | | | | | | | ilists | | | Dublin Moote | * | |
| mg/kg | 101 | 1.0 | yes | Cadmium (MS) | | 0.90 | No. | | | | | | | | | | | | | | | | Geotech Specialists | Jey | | - | ב ב | |
| mg/kg | _ | 0,0 | Yes | Arsenic (MS) | | 12.80 | | | | | | | | | | | | | | | | | Geotec | Mr M Kelley | | | | |
| mg/kg | 5 | 2 | y88 | SO4 (acid sol) | | 13100 | | | | | | | | | | | | | | | | | lame | | | | | |
| mg/kg | BGCNZZ | 1 | yes | Cyanide (Free) | | ₹ | | | | | | | | | | | | | | | | | Client Name | Contact | <u> </u> | | | |
| | Method Codes: | Detection Limits: | UKAS Accredited : | Cilent Sample Description | BH001 3.6 | BH002 4.0 | | | | | | | | | | | | | | | | | _ | TES Bretby PO Box 100, Bretby Business Park, | Burton-on-Trent, Stellerdshire, DE15 0XD | Tel +44 (0) 1283 594480 | Fex +44 (0) 1283 554422 | |
| | | | | TES ID Number CL/ | 0330243 | 0330244 | | | | | | | | | | | | | ٺ | | | | F | | D | | | |

| | | | i i | | | | | | | | | | | | | | | | 375 1000 | | - (* * *) | UKAS | 1252 | ! ! |
|----------------------------------|------------------|---------------------------|----------|-----------|------|--------------|----|------|--------------|-----------------|------|------|---------|------|---------|--|--|------------------|-----------------------|-------------|----------------------|---------------|-------------------------|-------------|
| | | | | | | | | | | | | | | | | | | | incie | 610 610 | 31 October 2003 | EFS/034319 | - | 2012 |
| | | | | | | | | | | | | | | | | | | | Soile Comple Analysis | | | | | |
| | | | | | | | | | | | | | | | | | | | Colle | | Date Printed | Report Number | Table Number | Page Number |
| | | | | | | | | | | | | | | | | | | | | | 1 | i c | 1 | 100 |
| | | · · | | | | | | | | چې | only | k al | 60 A | es s | e. O | | | | | | | | | |
| | - | | | | ÇÓ | Just Odri | 67 | ONIC | ato et te | Ni ¹ | | | | | | | | | | | | Monto | vaste | |
| ICPBOR 0.5 | no | Boron. | Coti | P.V. | S. C | Ori | | | | - | | | | | | | | - - | Geotech Specialists | | | 4.6 | Dubilii waste | |
| 4 | <u> </u> | Phenol index | | <0.6 | | | | | | | | | | | | | | | Contor | Mr M Kellev | | | | |
| WSLM3 | Yes | pH units | | 9.6 | | | | | | | | | | | | | | | domo | | | | | |
| -IFI | | TPH GCFID (AR) | 22 | | | | | | | | | _ | | | | | | | Client Name | 100,000 | | | | |
| Method Codes: Detection Limits: | UKAS Accredited: | Cilent Sample Description | BH0013.6 | BH002 4.0 | | | | | | | | | | | | | | | | TES Bretby | | | Fax +44 (0) 1283 554422 | |
| | | TES ID Number CLJ | 0330243 | 0330244 | | | | | | | | | - | | | | | 1 | | 153 | Brothw | | | |



Report Notes

Soil/Solid analysis specific:

Results expressed as mg/kg unless stated otherwise S04 analysis not conducted in accordance with BS1377 Water Soluble Sulphate on 2:1 water.soil extract AR denotes analysis conducted on the As Received sample # co-eluted with benzo(b)fluoranthene ## co-eluted with indeno(123-cd)pyrene BTEX analysis expressed as ug/kg As Received Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:

Results expressed as mg/l unless stated otherwise

Oil analysis specific:

Results expressed as mg/kg unless stated otherwise S.G. expressed as g/cm³@ 15°C

Filter analysis specific:

Results expressed as mg on-filter unless stated otherwise

VOC analysis specific:

Explanatory notes for data flagging U = undetected above reporting limit

J = concentration at instrument was below lowest calibration standard

E = concentration at instrument was above too calibration standard

B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:

Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specific:

Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:

CH denotes Chrysotile
CR denotes Crocicolite
AM denotes Amosite
NADIS denotes No Asbestos Detected in Sample
NBFO denotes No Bulk fibres Observed
T Trace
L Low (2-15%)
M Medium (15-50%)
H High (>50%)

General notes:

* this analysis was subcontracted to another laboratory

\$ Within laboratory tolerances

\$\$ unable to analyse due to nature of sample \$ Results for guidance only, possible interference

& Blank corrected

1.S insufficient sample for analysis

Intf Unable to analyse due to interferences

N.D Not determined

N.R Not recorded

N.Det Not detected

Req Analysis Requested, see attached sheets for results

* denotes this result not UKAS accredited on this sample

P Raised detection limit due to nature of sample



ALcontrol Laboratories (Dublin)

18a Rosemount Business Park, Ballycoolin, Dublin 11 Ireland

Tel: +353 (0) 1 8829893 Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client:

Geotech Specialists Ltd

Carewswood Castlemartyr Co.Cork

Geotech Specialists Limited 2 1 AUG 2003

Attention:

Ronan Lynam

Date:

15 August, 2003

Our Reference:

03-B02557

Your Reference:

DUBLIN WASTE KD3116

Location:

for analysis on Wednesday, A total of 2 samples was received 30 July 2003. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Signed

Site Manager

Compiled By

Natalie Duncan

Client Ref: DUBLIN WASTE KD3116 Client Contact: Ronan Lynam Sample Type: SOIL Location: ALcontrol Laboratories ireland Test Schedule Checked By Client: Geotech Specialists Ltd GCMS GRAVIMETRIC Natural Moisture Content Ref Number: 03-B02557 Date of Receipt: 30/07/2003

Plastic tub Plastic tub

UNKNOWN

TP9 (0.7-0.9m) TP2 (1.0-1.1m)

03-802557-S0004-A01

Dioxins*

PIV

Other ID

Sample Identity

ALcontrol Reference

Turnaround: 7 days

Detection Method

UKAS Accredited

* SUBCONTRACTED TO OTHER I ARGRATORY / ** GAMME ES ALLINOTES -----

Notes: NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

| | iterim |
|---|--------|
| f | 드 ㄱ |

ALcontrol Laboratories Ireland

Table Of Results

Validated

Ref Number: 03-B02557

Client: Geotech Specialists Ltd

Date of Receipt: 30/07/03 (of first sample)

Sample Type: SOIL

Location:

Client Contact: Ronan Lynam

Client Ref: DUBLIN WASTE KD3116

| | | | | | _ | | | | _ | | | | | _ | | | | |
|------------------------------------|--|--------------------|-------------------|-------------------------------------|---------------------|--|--|---|-------|-----|---|---|---|---|---|---|-----------|--|
| | Method Detection Limit | ion Limit | n/a | <0.1% | | - | - | | | | _ | - | + | - | + | - | \dagger | |
| | UKAS Accredited | dited | | | | | | | | | | - | | + | + | | + | |
| ALcontrol Reference | Sample Identity | Other ID | Dioxins* | Natural Moisture Content ನ್ | Consent of copyride | for his constitution of the constitution of th | | | | | | | | | | | | |
| 03-802557-50004 03-802557-50005 | 57-50005 TP2 (1.0-1.1m) UNKNOWN Done 23.4 57-50005 TP2 (1.0-1.1m) UNKNOWN Done 23.4 57-50005 TP2 (1.0-1.1m) UNKNOWN Done 23.4 67-50005 TP2 (1.0-1.1m) UNKNOWN Done 23.4 Notes: METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCLIMISTANCES BEYOND CHIRCAGES | UNKNOWN UNKNOWN | Done Done HWAYS A | 14.6 23.4 23.4 CHIEVABLE C | WE TO VARI | | MISTANCE CONTRACTOR OF THE PROPERTY OF THE PRO | See of the see of the | S a c | COL | | | | | | | | |

Checked By

Natalie Duncan

Appendix

Consent of copyright owner required to the copyright

APPENDIX

- 1. Results are expressed as mg/kg dry weight unless otherwise stated, excluding analyses in (2) below.
- 2. Leach tests, cyanide, phenols by MS, hexavalent chrome, flash point, acid soluble sulphides, TPH by IR and volatiles are performed on wet soil as received, and results are expressed as mg/kg of wet soil or mg/I of Leachate of specified leach test. Ammoniacal nitrogen and total phenols by HPLC are performed on wet sample but are then re-calculated and expressed as mg/kg of dry soil.
- 3. ICP metals results are analysed using a screening program and the data is accurate to within 20%
- 4. The Majority of analyses are run to an accuracy of 10%, but this may be improved upon if legally defensible data is required.
- 5. A sub sample of all samples received will be retained free of charge for two months for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or thereof until the client cancels the request for sample storage.
- 6. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but the turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
- 7. Please note that we take no responsibility for any test performed by subcontractor's (marked with an asterisk).
- 8. Asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD-no fibres present. If asbestos is detected then identification & quantifications is carried out by sub-contractor. If a sample is suspected of containing asbestos then drying & crushing will be suspended on the sample until the asbestos result is known. If asbestos is present then no analysis requiring dry sampling will be undertaken.
- 9. NDP-No determination possible due to insufficient / unsuitable sample.



SCIENTIFIC ANALYSIS LABORATORIES LTD.

Mediock House, New Elm Road, Manchester M3 4JH Telephone: 0161-827 1400

Fax: 0161-827 1414

Job 37310E/Dioxins

Dioxin and Furan Analysis For

ALcontrol Geochem Ireland

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Rosemount Business Park,

Date of Sample Receipt: 31/07/03

Date(s) of Sample Testing: 31/07/03 - 11/08/03

Date of Issue of Report: 11/08/03



Scientific Analysis Laboratories Ltd.

Certificate of Analysis

All analytical results contained within have been obtained in accordance with the Laboratory's standard operating procedures contained in SAL SOP #1

Any deviations from these standard operating procedures are described in the following text.

Report written by.....Signature/date.

Report checked by......Signature/date.

Director

Job 37310E/Dioxins

Scientific Analysis Laboratories Ltd.

Report Checking Form

| CHECK ONLY OF THE ORIGINAL OF | SIGNED/DATE |
|---|----------------|
| CLIENT ID vs LAB ID CHECKED CHIERT | To 1/5/07 |
| DETECTION LIMITS CHECKED | 11/0 |
| QUALITY CONTROL DATA CHECKED | D 11/9/0 |
| SAMPLE TEQs TRANSPOSED TO SUMMARY CORRECT | TLY //C/03 |
| SAMPLE NARRATIVES CHECKED | Ty 11/8/0 |
| ID OF TARGET COMPOUNDS | 6 1/1/07 |
| SELECTED ANALYTE CONCNS. CHECKED FROM RAW | DATA (5 1/6/03 |
| TRACKING FORMS CHECKED | 65 11K/v |

Sample Data Pack, JOB # 37310E

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|-----------------|-------|

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- 2.5 Sample data and results presentation
- 3.6 Toxic Equivalent Factors
- 4.7 Data Summary
- 5.8 Sample Number 37310E001, Your Reference "03-B02557-50004-AD1 TP9 (0.7-0.9m)".
- 6.13 Sample Number 37310E002, Your Reference "03-B02557-50005-AD1 TP2 (1.0-1.1m)".
- 7.18 Reagent Blank Narrative
- 8.23 Extraction and Clean Up Procedures
- 9.23 Analytical Procedures
- 10.24 (a) GC Conditions for the Analysis
 (b) Acquisition System Used for Window Standard.
- 11.25 Mass Spectrometer Conditions and Instrumentation Used
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- 19.37 GC Performance Check
- 20.38 GC Performance Check Data DB5-ms Column, 8th August 2003
- 21.39 Sample Log Sheet
- 22.40 SAL Authorised Signatories Register

1.5 Summary of Objectives

Two soil samples were analysed for the seventeen 2,3,7,8 containing chlorinated dibenzo-p-dioxins and chlorinated dibenzo-furans. The concentrations of total tetra-through heptachlorinated dioxin and furan homologues were also determined.

Please note that the data reported here are based on the samples on a 'dried and ground' basis. Analysis and quantitation was performed at SAL via isotope dilution high resolution gas chromatography/ high resolution mass spectrometry according to SAL SOP #1. Tests covered by this report are within the scope of our UKAS accreditation.

The detection limits for these samples were between 0.2 and 0.4 ng/kg per congener, depending upon the specific sample and congeners involved.

Raw data from calibration and sample analyses are archived indefinitely on magnetic tape.

2.5 Sample data and results presentation

This is a brief explanation of the way in which the results are presented for this sample. The sample data pack commences with a sample narrative, this contains any comments upon the data, or any peculiarities observed in the sample's pathway through the laboratory.

Following this is a data summary sheet, this contains the results obtained for the targeted 2378 containing congeners and the "totals" for other chlorinated dioxin and furan isomers present in the sample.

The next page consists of the recovery information for the isotope labelled standards relative to the ¹³C₆-1,2,3,4-TCDD standard added prior to injection. Any comments thought appropriate will appear in the sample narrative.

Finally the sample tracking sheet is included.

"Totals" Determinations

In the case of quantitation of isomers other than the 2378 containing ones the RRFs of the first eluting 2378 isomer of the same degree of chlorination (or homologue group) are used.

Note that the current Toxic Equivalent Factors (TEFs) for the German BGA/UBA, US EPA and European Community/NATO (also known as i-TEF) are listed on the next page and are used to produce a total Dioxin and Furan equivalent amount for all congeners.

3.6 Toxic Equivalent Factors

| Dîoxîn 2,3,7,8-Isomer | | | TEF | |
|------------------------------------|---------------|----------------|---|------------|
| | | BGA/UBA | USEPA | EC |
| 2,3,7,8-TCDD | | 1.0 | 1.0 | 1.0 |
| 1,2,3,7,8-PeCDD | | 0.1 | 0.5 | 0.5 |
| 1,2,3,4,7,8-HxCDD | | 0.1 | 0_1 | 0.1 |
| 1,2,3,6,7,8-HxCDD | | 0.1 | 0.1 | 0.1 |
| 1,2,3,7,8,9-HxCDD | | 0.1 | 0.1 | 0.1 |
| 1,2,3,4,6,7,8-HpCDD | | 0.01 | 0.01 | 0.01 |
| OCDD | | 0.001 | 0.801 | 0.001 |
| Total Dioxin Non-2,3,7,8-Isomer | | | | |
| Summed TCDD | | 0.01 | | |
| Summed PeCDD | | 0.01 | | |
| Summed HxCDD | | 0.01 | | |
| Summed HpCDD | | 0.001 | | |
| Furan 2,3,7,8-Isomer | | | Sesonty any other use. 10.11 0.05 0.1 0.1 | |
| | | | es of for an | |
| 2,3,7,8-TCDF | | 0.1 NIPO | 1110-1 | 0.1 |
| 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF | | 0.1 Pre | ~ 0.05 | 0.05 |
| 1,2,3,4,7,8-HxCDF | • | 0.1cht white | 0.5 | 0.5 |
| 1,2,3,6,7,8-HxCDF | | ill the | 0.1 | 0.1 |
| 1,2,3,7,8,9-HxCDF | ₹° | Signal Control | 0.1 | 0.1 |
| 2,3,4,6,7,8-HxCDF | 80 | ∩ 1 | 0.1 0.1 | 0.1 0.1 |
| 1,2,3,4,6,7,8-HpCDF | sent | 0.01 | 0.01 | 0.01 |
| 1,2,3,4,7,8,9-HpCDF | Consent of co | 0.01 | 0.81 | 0.01 |
| OCDF | | 0.001 | 0.001 | 0.001 |
| Total Furan Non-2,3,7,8-Isomer | , | | | |
| Summed TCDF | | 0.01 | | |
| Summed PeCDF | | 0.01 | | |
| Summed HxCDF | | 0.01 | | |

Please note that the USEPA TEFs now employed correspond exactly with those promulgated by NATO/CCMS and the EC.

0.001

Summed HpCDF

4.7 Data Summary

The EC/NATO/CCMS/i-TE total toxic equivalent amounts for each of the samples are given in the table below. Note that the results are reported in ng/kg for the soil samples.

| SAL Reference | Your Reference | Amount ng/kg I-TE |
|---------------|---------------------------------------|-------------------|
| 37310E001 | 03-B02557-50004-AD1 TP9 (0.7-0.9m) | 2.2 |
| 37310E002 | 03-B02557-50005-AD1 TP2(1.0-1.1m) | 19 |
| 37310EBL | Method Blank | <0.5 |

 U_{2}

1,72.2

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5.8 Sample Narrative, Sample Number 37310E001

Extraction/ Clean up :- No Comments.

Data Acquisition:- No Comments.

Data Analysis: A number of the toxic PCDD/Fs were detected in this sample together with some non-toxic ones.

The internal standard recoveries are acceptable.

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RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number : 37310E001

Date Acquired : 08-Aug-03

Acquired File : A:D0808

Client Id :-

:DB5-ms

Column

Operator | PC File

: D. Wood Instrument : Ultima

: R:\D10X1NV\D0808\sample.005\D0808.DAT File Text : 03-B02557-50004-AD1 TP9 (0.7-0.9m)

| Compound Name | Quantity | Toxic Ec | puivalents | |
|-------------------------|----------|---|--|--------|
| | ng/kg | BGA | USEPA | EC |
| Dioxins | | | | |
| 2,3,7,8-TCDD | N.D. | | | |
| 1,2,3,7,8-PeCDD | N.D. | | | |
| 1,2,3,6,7,8-HxCDD | 1.6 | 0.16 | 0.16 | 0.16 |
| 1,2,3,4,7,8-HxCDD | N.D. | | | |
| 1,2,3,7,8,9-HxCDD | 0.72 | 0.072 | 0.072 | 0.072 |
| 1,2,3,4,6,7,8-HpCDD | 58 | 0.58 | 0.58 | 0.58 |
| OCDD | 440 | 0.44 | 0.44 | 0.44 |
| Total non-targeted iso | ners | • | | |
| TCDD | 4.9 | 0.049 | 0.0 | 0.0 |
| PeCDD | 1.7 | 0.017 | 0.0 | 0.0 |
| HxCDD | 9.4 | 0.094 | 0.0 0.0 0.0 0.0 0.0 0.0 | 0.0 |
| HpCDD | 71 | 0.071 | 1917 2010 | 0.0 |
| Total Dioxins TEQ | | 0.017 0.094 0.071 1.5 HORES 1.5 HORES 1.5 HORES 1.6 HORES 0.082 0.082 0.064 0.11 0.073 | 1.3 | 1.3 |
| Furans | | Specifor let | | |
| 2,3,7,8-TCDF | 0.76 coi | 16 ³⁷⁰ 0.076 | 0.076 | 9.076 |
| 1,2,3,7,8-PeCDF | 0.82 | 0.082 | 0.041 | 0.041 |
| 2,3,4,7,8-PeCDF | 0.64 | 0.064 | 0.32 | 0.32 |
| 1,2,3,4,7,8-HxCDF | 1.15et | 0.11 | 0.11 | 0.11 |
| 1,2,3,6,7,8-HxCDF | 0.73 | 0.073 | 0.073 | 0.073 |
| 2,3,4,6,7,8-HxCDF | 0.75 | 0.075 | 0.075 | 0.075 |
| 1,2,3,7,8,9-HXCDF | N.D. | | | |
| 1,2,3,4,6,7,8-HpCDF | 16 | 0.16 | 0.16 | 0.16 |
| 1,2,3,4,7,8,9-HpCDF | 0.94 | 0.0094 | 0.0094 | 0.0094 |
| OCDF | 45 | 0.045 | 0.045 | 0.045 |
| Total non-targeted ison | ners | | | |
| TCDF | 2.6 | 0.026 | 0.0 | 0.0 |
| PeCDF | 3.7 | 0.037 | 0.0 | 0.0 |
| HxCDF | 12 | 0.12 | 0.0 | 0.0 |
| HpCDF | 27 | 0.027 | 0.0 | 0.0 |
| Total Furans TEQ | | 0.90 | 0.91 | 0.91 |
| Grand Total TEQ | | 2.4 | 2.2 | 2.2 |

TARGETING REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number: 37310E001 Client Id:-

Instrument : Ultima

PC File

Operator : D. Wood : R:\DIOXINV\D0808\sample.005\D0808.DAT

Column :DB5-ms

File Text : 03-802557-50004-AD1 TP4 (0.7-0.9m)

| Compound Name | M1 | M2 | м | 1/M2 | | Retentio | on Time | Area | RRF | Amount |
|-------------------------|-------|---|--------------|---------|--------|------------|----------|--------|------|--------|
| | | | thry | acti | Ok | theory | found | | | |
| Dioxins | | | | | | | | | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.83 | Y | 00:30:06 | 00:29:37 | 111369 | 1.00 | 300.0 |
| 13C 2,3,7,8-TCDD | 332 | 334 | 0.78 | 0.80 | Y | 00:30:38 | 00:30:09 | 25508 | 1.00 | 69.0 |
| 13C 1,2,3,7,8-PeCDD | 368 | 370 | 1.55 | 1.56 | Y | 00:35:52 | 00:35:26 | 25205 | 0.94 | 72.4 |
| 13C 1,2,3,6,7,8-HxCDD | 402 | 404 | 1.24 | 1.19 | Y | 00:40:20 | 00:40:01 | 17345 | 0.63 | 74.0 |
| 1,2,3,6,7,8-HxCDD | 390 | 392 | 1.24 | 1.31 | Υ | 00:40:21 | 00:40:01 | 288 | 1.03 | 1.6 |
| 1,2,3,7,8,9-HxCDD | 390 | 392 | 1.24 | 1.28 | Y | 00:40:44 | 00:40:26 | 114 | 0.91 | 0.7 |
| 13C 1,2,3,4,6,7,8-HpCDD | 436 | . 438 | 1.05 | 1.08 | Y | 00:44:34 | 00:44:10 | 12982 | 0.56 | 63.0 |
| 1,2,3,4,6,7,8-HpCDD | 424 | 426 | 1.05 | 1.03 | Y | 00:44:35 | 00:44:11 | 7007 | 0.93 | 57.8 |
| 13C OCDD | 470 | 472 | 0.89 | 0.87 | Y | 00:49:16 | 00:48:50 | 6939 | 0.33 | 56.3 |
| CCDD | 458 | 460 | 0.89 | 0.91 | Y | 00:49:17 | 00:48:52 | 31458 | 1.03 | 439.5 |
| Furans | | | | | | DD-30-06 | | | | |
| | | | | | Š | <i>det</i> | | | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.83 | and G. | 00:30:06 | 00:29:37 | 111369 | 1.00 | 300.0 |
| 13C 2,3,7,8-TCDF | 316 | 318 | 0.78 | 25× 60× | Y | 00:29:56 | 00:29:26 | 35363 | 1.36 | 70.1 |
| 2,3,7,8-TCDF | 304 | 306 | 0.780 | | Y | 00:29:57 | 00:29:27 | 283 | 1.06 | 0.8 |
| 13C 1,2,3,7,8-PeCDF | 352 | 354 | 1 355 | ×1.52 | Y | 00:34:27 | 00:34:00 | 31982 | 1.19 | 72.7 |
| 1,2,3,7,8-PeCDF | 340 | 354 342 342 386 or 169 376 or 169 | 101,55 | 1.53 | Y | 00:34:28 | 00:33:58 | 249 | 0.95 | 8.0 |
| 2,3,4,7,8-PeCDF | 340 | 342 | ° of .55 | 1.60 | Y | 00:35:34 | 00:35:08 | 188 | 0.92 | 0.6 |
| 13C 1,2,3,4,7,8-HxCDF | 384 | 386 | 0.51 1.24 | 0.50 | Y | 00:39:12 | 00:38:48 | 24763 | 0.84 | 79.3 |
| 1,2,3,4,7,8-HxCDF | 374 | 376 00 | 1.24 | 1.35 | Y | 00:39:12 | 00:38:48 | 283 | 1.07 | 1.1 |
| 1,2,3,6,7,8-HxCDF | 374 | 378 | 1.24 | 1.26 | Y | 00:39:21 | 00:38:59 | 204 | 1.13 | 0.7 |
| 2,3,4,6,7,8-HxCDF | 374 | 420 | 1.24 | 1.29 | Y | 00:40:04 | 00:39:44 | 170 | 0.91 | 0.8 |
| 13C 1,2,3,4,6,7,8-HpCDF | 418 👏 | 420 | 0.46 | 0.42 | Y | 00:43:06 | 00:42:45 | 10222 | 0.57 | 47.9 |
| 1,2,3,4,6,7,8-HpCDF | 408 | 410 | 1.05 | 1.00. | Y | 00:43:07 | 00:42:46 | 2029 | 1.27 | 15.7 |
| 1,2,3,4,7,8,9-HpCDF | 408 | 410 | 1.05 | 1.00 | Y | 00:45:28 | 00:45:02 | 70 | 0.73 | 0.9 |
| 13C OCDD | 470 | 472 | 0.89 | 0.87 | Y | 00:49:16 | 00:48:50 | 6939 | 0.33 | 56.3 |
| OCDF | 442 | 444 | 0.89 | 0.90 | Y | 00:49:42 | 00:49:15 | 2926 | 0.93 | 45.4 |

RECOVERY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E001 Client 1d :-

Date Acquired : 08-Aug-03 Acquired File : A:D0808

Operator : D. Wood Instrument : Ultima Column :DB5-ms

PC File : R:\DIOXINV\D0808\sample.005\D0808.DAT File Text : 03-B02557-50004-AD1 TP9 (0.7-0.9m)

| Compound Name | Recovery % | Standard Addition / ng |
|-------------------------|---|------------------------|
| Dioxins | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDD | 69 | 1.00 |
| 13C 1,2,3,7,8-PeCDD | 72 | 1-00 |
| 13C 1,2,3,6,7,8-HxCDD | 74 | 1-00 |
| 13C 1,2,3,4,6,7,8-HpCDD | 63 | 1.00 |
| 13C OCDD | 56 | 1-00 - |
| Furans | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDF | 70 | 1.00 |
| 13C 1,2,3,7,8-PeCDF | 73 | 1.00 |
| 13C 1,2,3,4,7,8-HxCDF | 79 | 1.00 1.00 the fire |
| 13C 1,2,3,4,6,7,8-HpCDF | 48 | 1.00 Mer |
| 13C OCDD | 56 | N4.00 |
| | 79 48 56 For its pection for its pection of copyright or | Hude techined for t |

SAL Sample Tracking Form: Issue 6

PLEASE INITIAL AND DATE ALL ENTRIES

| Job Number_ | 37310 | Sample Num | ber <u>001</u> | Analysis_ | PCODIF | | |
|--------------------|--|--|---------------------------------------|---|--|--|-----------------|
| ********** | ###################################### | ********** | Sample Extra | action | ****** | <u> </u> | ************* |
| Weight/Volum | ne Extracted | 10.00 | <u>s</u> | · / · · · / · · · · · · · · · · · · · · | | OS 08:03 | PDU |
| PCCD/F Inter | nal Standard id/Lo | ot #/VolumeEl |)F957/32461-(| 33/46 | <u>3</u> .L | 05·08·03 | PSU |
| PCB Internal | Standard id/Lot #/ | Volume | | | | | |
| Extraction Me | thod/Solvent/Volu | me_SOXHL | et tou | JENYE | 300ml | 08.08.03 | PSU |
| Extraction Sta | rt <u>16:00</u> | 05.08.03 | RSU End | 09:00 | | <u>ර</u> ූරු දිර | PON |
| Additional Co | mments | | | | | | |
| | | | | | | | |
| | | _ | | | / | | |
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| | | *************************************** | Extract Clea | n-up | **************** | 00000000000000000000000000 | *************** |
| Clean-up 1 | COMBINATIO | N COLUM | _ | a lise. | | 06.08.03 | PSM |
| | FLORISIL C | | | aly any other | - | 06.08.03 | PSU |
| | | | 703es | ed for a | | | |
| - | | | ction puricul | | · | | |
| Additional Cor | uments | | inspect wife | | | | |
| | | in the state of th | Rite | | <u></u> | | <u></u> |
| | | nsent of | | | ······································ | | · · |
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| Instrument(| XTIMA | Analyte | Roole | Injectio | <u>m 494585</u> | প্র প্রত্য | الل |
| Instrument | ······································ | Analyte | | Injectic | onn | | |
| Instrument | | Analyte | | Injectio | ַת | : | |
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| Method | SALLY (DIO | x 1~1) | | | | 10/08/0 | <u>in</u> |
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| - | | , | | | | | |
| | | | | | | | |
| Additional Con | nments | | · · · · · · · · · · · · · · · · · · · | | | | |
| | | | | | | <u> </u> | |
| SAL STF v.6 | • | Report 373 | 10E/Dioxins | Page 12 of 40 | | Issued 15 | /11/02 |

6.13 Sample Narrative, Sample Number 37310E002

Extraction/ Clean up :- No Comments.

Data Acquisition:- No Comments.

Data Analysis: - All bar one of the toxic PCDD/Fs were detected in this sample together with some non-toxic ones.

The internal standard recoveries are acceptable.

Consent of copyright owner required for any other use.

RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number: 37310E002

Client Id :-

:DB5-ms

Column

Operator

Date Acquired : 08-Aug-03 : D. Wood

Acquired File : A:D0808 Instrument : Ultima

PC File

: R:\DIGXINV\D0808\sample.006\D0808.DAT

File Text : 03-802557-50005-AD1 TP2 (1.0-1.1m)

| Compound Name | Quantity | Toxic | Equivalents | |
|-------------------------|------------------|-------------|--|----------------------|
| | ng/kg | BGA | USEPA | EC |
| Dioxins | | | | |
| 2,3,7,8-TCDD | N.D. | | | |
| 1,2,3,7,8-PeCDD | 1.3 | 0.13 | 0.64 | 0.64 |
| 1,2,3,6,7,8-HxCDD | 13 | 1.3 | 1.3 | 1.3 |
| 1,2,3,4,7,8-HxCDD | 3.3 | 0.33 | 0.33 | 0.33 |
| 1,2,3,7,8,9-HxCDD | 5.3 | 0.53 | 0.53 | 0.53 |
| 1,2,3,4,6,7,8-HpCDD | 380 | 3.8 | 3.8 | 3.8 |
| OCDD | 3600 | 3.6 | 3.6 | 3.6 |
| Total non-targeted iso | mers | | | |
| TCDD | 23 | 0.23 | 0.0 | 0.0 |
| PeCDD | 28 | 0.28 | 0.0 | , 15° 0.0 |
| HXCOD | 1 9 0 | 1.9 | 0.0 | 71 ^{c1} 0.0 |
| HpCDD | 450 | 0.45 | Onio any | 0.0 |
| Total Dioxins TEQ | otal Dioxins TEQ | | IIPOSES OF FOR | 10 |
| Furans | - | Dection of | 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 | |
| 2,3,7,8-TCDF | 5.9 | ON 0:591 | 0.59 | 0.59 |
| 1,2,3,7,8-PeCDF | 17 | 1.3 0.66 | 0.86 | 0.86 |
| 2,3,4,7,8-PeCDF | 6.9 | ్0.69 | 3.5 | 3.5 |
| 1,2,3,4,7,8-HxCDF | 13 ngen | 1.3 | 1.3 | 1.3 |
| 1,2,3,6,7,8-HxCDF | 6.6 COV | 0.66 | 0.66 | 0.66 |
| 2,3,4,6,7,8-HXCDF | 7-6 | 0.76 | 0.76 | 0.76 |
| 1,2,3,7,8,9-Hxcor | N.D. | | | |
| 1,2,3,4,6,7,8-HpCDF | 89 | 0.89 | 0.89 | 0.89 |
| 1,2,3,4,7,8,9-HpCDF | 16 | 0.16 | 0.16 | 0.16 |
| OCDF | 330 | 0.33 | 0.33 | 0.33 |
| Total non-targeted ison | ners | | | |
| TCDF | 58 | 0.58 | 0.0 | 0.0 |
| PeCDF | 53 | 0.53 | 0.0 | 0.0 |
| HXCDF | 110 | 1.1 | 0.0 | 0.0 |
| HpCDF | 13 | 0.013 | 0.0 | 0.0 |
| Total Furans TEQ | | 9.2 | 9.0 | 9.0 |
| Grand Total TEQ | | 22 | 19 | 19 |

TARGETING REPORT (Sally Version 6.7)

Client Id :-

Column

Job Number

: 37310E

Sample Number : 37310E002

Acquired File : A:D0808

Operator

Date Acquired : 08-Aug-03

: D. Wood Instrument : Ultima : R:\DIOXINV\D0808\sample.006\D0808.DAT

PC File File Text

: 03-802557-50005-AD1 TP2 (1.0-1.1m)

| Compound Name | M1 | M2 | M' | 1/H2 | | Retentio | xn Time | Area | RRF | Amount |
|-------------------------|-------------|--|-----------|--------|------|----------|----------|-------|------|--------|
| | | | thry | acti | 0k | theory | found | | | |
| Dioxins | | | | | | | | | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.86 | Y | 00:30:06 | 00:29:43 | 35168 | 1.00 | 300.0 |
| 13C 2,3,7,8-TCDD | 332 | 334 | 0.78 | 0.83 | Y | 00:30:38 | 00:30:12 | 8670 | 1.00 | 74.3 |
| 13C 1,2,3,7,8-PeCDD | 368 | 370 | 1.55 | 1.57 | Y | 00:35:52 | 90:35:30 | 8016 | 0.94 | 72.9 |
| 1,2,3,7,8-PeCDD | 356 | 358 | 1.55 | 1.40 | Y | 00:35:53 | 00:35:31 | 90 | 0.88 | 1.3 |
| 13C 1,2,3,6,7,8-HxCDD | 402 | 404 | 1.24 | 1.28 | Y | 00:40:20 | 00:40:04 | 4289 | 0.63 | 58.0 |
| 1,2,3,6,7,8-HxCDD | 390 | 392 | 1.24 | 1.23 | Y | 00:40:21 | 00:40:05 | 586 | 1.03 | 13.2 |
| 1,2,3,4,7,8-HxCDD | 39 0 | 392 | 1.24 | 1.39 | Y | 00:40:13 | 00:39:58 | 124 | 0.88 | 3.3 |
| 1,2,3,7,8,9-HxCDD | 390 | 392 | 1.24 | 1.29 | Y | 00:40:44 | 00:40:30 | 206 | 0.91 | 5.3 |
| 13C 1,2,3,4,6,7,8-HpCDD | 436 | 438 | 1.05 | 1.10 | Y | 00:44:34 | 00:44:14 | 2551 | 0.56 | 39.2 |
| 1,2,3,4,6,7,8-HpCDD | 424 | 426 | 1.05 | 1.04 | Y | 00:44:35 | 90:44:15 | 8988 | 0.93 | 377.3 |
| 13C OCDD | 470 | 472 | 0.89 | 0.85 | Y g | 00:49:16 | 00:48:54 | 1092 | 0.33 | 28.1 |
| OCDD | 458 | 460 | 0.89 | 0.91 | YUSC | 00:49:17 | 00:48:55 | 40980 | 1.03 | 3636.6 |
| _ | | | | · so | ine, | | | | | |
| Furans | | 426 472 460 328 318 306 354 354 343 343 343 343 | ड on | ot any | | | | | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | . 78° | 0.86 | Y | 00:30:06 | 00:29:43 | 35168 | 1,00 | 300.0 |
| 13C 2,3,7,8-TCDF | 316 | 318 | QUI 0.078 | 0.69 | Ý | 00:29:56 | 00:29:32 | 12655 | 1.36 | 79.5 |
| 2,3,7,8-TCDF | 304 | 306 JUN | Ø 0.78 | 0.67 | Y | 00:29:57 | 00:29:33 | 791 | 1.06 | 5.9 |
| 13C 1,2,3,7,8-PeCDF | 352 | 306 dion 354 Perion 354 Perion 342 Perion | 1.55 | 1.44 | Y | 00:34:27 | 00:34:04 | 11402 | 1.19 | 82.1 |
| 1,2,3,7,8-PeCDF | 340 | 342,1971 | 1.55 | 1.51 | Y | 00:34:28 | 00:34:02 | 1851 | 0.95 | 17.2 |
| 2,3,4,7,8-PeCDF | 340 | 342 | 1.55 | 1.58 | Y | 00:35:34 | 00:35:12 | 725 | 0.92 | 6.9 |
| 13C 1,2,3,4,7,8-HxCDF | 20/ | X 300 | 0.51 | 0.55 | Y | 00:39:12 | 00:38:52 | 6859 | 0.84 | 69.6 |
| 1,2,3,4,7,8-HxCDF | 374 Sent | 376 | 1.24 | 1.28 | Y | 00:39:12 | 00:38:53 | 920 | 1.07 | 12.5 |
| 1,2,3,6,7,8-HxCDF | 324 | 376 | 1.24 | | Y | 00:39:21 | 00:39:03 | 509 | 1.13 | 6.6 |
| 2,3,4,6,7,8-HxCDF | 374 | 376 | 1.24 | | Y | 00:40:04 | 00:39:48 | 475 | 0.91 | 7.6 |
| 13C 1,2,3,4,6,7,8-HpCDF | 418 | 420 | 0.46 | 0.45 | Y | 00:43:06 | 00:42:50 | 2328 | 0.57 | 34.5 |
| 1,2,3,4,6,7,8-HpCDF | 408 | 410 | 1.05 | 1.03 | Y | 00:43:07 | 00:42:51 | 2636 | 1.27 | 89.4 |
| 1,2,3,4,7,8,9-HpCDF | 408 | 410 | 1.05 | 1.08 | Y | 00:45:28 | 00:45:06 | 267 | 0.73 | 15.8 |
| 130 0000 | 470 | 472 | 0.89 | 0.85 | Y | 00:49:16 | 00:48:54 | 1092 | 0.33 | 28.1 |
| OCDF | 442 | 444 | 0.89 | 0.87 | Y | 00:49:42 | 00:49:20 | 3378 | 0.93 | 333.1 |

RECOVERY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E002 Client Id :Date Acquired : 08-Aug-03 Acquired File : A:D0808

Operator : D. Wood Instrument : Ultima Column :DB5-ms

PC File : R:\DIOXINV\D0808\sample.006\D0808.DAT File Text : 03-B02557-50005-AD1 TP2 (1.0-1.1m)

| Compound Name | Recovery % | Standard Addition / ng |
|-------------------------|------------|---|
| Dioxîns | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDD | 74 | 1.00 |
| 13C 1,2,3,7,8-PeCDD | 73 | 1.00 |
| 13C 1,2,3,6,7,8-HxCDD | 58 | 1.00 |
| 13C 1,2,3,4,6,7,8-HpCDD | 39 | 1.00 |
| 13C OCDD | 28 | 1.00 |
| Furans | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDF | 79 | 1_00 |
| 13C 1,2,3,7,8-PeCDF | 82 | 1.00 |
| 13C 1,2,3,4,7,8-HxCDF | 70 | 1_00 |
| 13C 1,2,3,4,6,7,8-HpCDF | 35 | 1.00 Mer |
| 13C OCDD | 28 | 1.00 |
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| | | it Positied |
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SAL Sample Tracking Form: Issue 6

PLEASE INITIAL AND DATE ALL ENTRIES

| Job Number_ | 37310 | Sample Number | 002 | Analysis | PCOOLE | | |
|--|---|-----------------|----------------|--------------------|--|---------------------------------------|---------------------------------|
| 64,90000000000000000000 | ************************************** | Sa | mple Extra | tion | | | -4 |
| Weight/Volum | e Extracted | و00:00 | | | | ८ € ८ ₽ ८ ७ | POU |
| PCCD/F Inter | nal Standard id/I | ot #/VolumeEDF9 | 57/32461-83 | 3 <u>/46</u> | <u>zul</u> | 02.08.03 | PON |
| PCCD/F Internal Standard id/Lot #/Volume _EDF957/32461-83/46 | | Asu | | | | | |
| Extraction Me | thod/Solvent/Vol | ume_SOXHLET | TOW | ENE | 300ml | Q2-08-03 | POU |
| | | r | | | | Cp.08-03 | POA |
| Additional Co | mments | | - | | | | |
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| Additional Col | mments | of its gitt out | <i>y</i> | | | <u> </u> | |
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| Instrument | <u>. </u> | Analyte | | Injectio |)n | | |
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| | , j | | Quantitatio | n | | s_] | |
| Method | Salh | | | | | 1083 | 100 |
| | | · . | | | | | |
| | | | | | | | |
| Additional Co | mments | | | | | | |
| | | | ··- | | | | |
| SAL STF v.6 | - | Report 37310F | /Dioxine P | 200 17 of 40 | | Issued 15 | /11/02 |

1200

7.18 Reagent Blank Narrative

Extraction/ Clean up :- No Comments.

Data Acquisition:- No Comments.

Data Analysis: This reagent blank contains a limited number of the target congeners. It is reported as <0.5 ng/kg I-TEQ in the data summary.

The internal standard recoveries are acceptable.

Consent of copyright owner required for any other use.

RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number : 37310EBL

Date Acquired : 08-Aug-03

Acquired File : A:D0808

Client id :-

Operator

: D. Wood

Instrument : Ultima

Column :DB5-ms

PC File File Text : R:\DIOXINV\D0808\sample.004\D0808.DAT

: Method Blank

| Compound Name | Quantity ng/kg | Toxic Equi BGA | ivalents USEPA | EC |
|----------------------------|-------------------|-------------------|-------------------|-------------|
| Dioxins | 19/19 | DOM | COLLY | EC |
| | | | | |
| 2,3,7,8-TCDD | N.D. | | | |
| 1,2,3,7,8-PeCDD | N.D. | | | • |
| 1,2,3,6,7,8-HxCDD | 0.16 | 9.016 | 0.016 | 0.016 |
| 1,2,3,4,7,8-HxCDD | N.D. | | | • |
| 1,2,3,7,8,9-HxCDD | N.D. | | • | |
| 1,2,3,4,6,7,8-HpCDD | 1.6 | 0.016 | 0.016 | 0.016 |
| OCDD | 4.2 | 0.0042 | 0.0042 | 0.0042 |
| Total non-targeted isomers | ; | | | • |
| TCDD | N.D. | | .Ø)* | |
| PeCDD | 1.2 | 0.012 | 0.0 rise. | 0.0 |
| HxCDD | 0.56 | 0.0056 | 0.00 | 0.0 |
| Нрсоо | N.D. | only. | वार्ष | |
| Total Dioxins TEQ | N.D. Lordinger | 0.054 ired fo | 0.036 | 0.036 |
| Furans | | Johner 1 | | |
| 2,3,7,8-TCDF | N.D. Corningly | | | |
| 1,2,3,7,8-PeCDF | N.D. COP | | | |
| 2,3,4,7,8-PeCDF | N.D.XO | | | |
| 1,2,3,4,7,8-HxCDF | N. Ber | | | |
| 1,2,3,6,7,8-HxCDF | W.D. | | | |
| -1-1-1-10 111001 | N.D. | | | |
| 1,2,3,7,8,9-HxCDF | N.D. | | | |
| 1,2,3,4,6,7,8-HpCDF | 1.3 | 0.013 | 0.013 | 0.013 |
| 1,2,3,4,7,8,9-HpCDF | N.D. | | | |
| OCDF | 1.9 | 0.0019 | 0.0019 | 0.0019 |
| Total non-targeted isomers | | | | |
| TCDF | 1.6 | 0.016 | 0.0 | 0.0 |
| PeCDF | 0.62 | 0.0062 | 0.0 | 0.0 |
| HxCDF | 2.5 | 0.025 | 0.0 | 0.0 |
| HpCDF | N.D. | | | |
| Total Furans TEQ | | 0.062 | 0.015 | 0.015 |
| Grand Total TEQ | | 0.12 | 0.051 | 0.051 |

TARGETING REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number : 37310EBL

Client Id :-

Column

:085-ms

Operator

Date Acquired : 08-Aug-03

Acquired File : A:D0808

: D. Wood

: Ultima Instrument

PC File

: R:\DIOXINV\D0808\sample.004\D0808.DAT

File Text

: Method Blank

| Compound Name | N1 N2 M1/N2 Ret | | Retentio | Retention Time | | RRF | Amount | | | |
|-------------------------|-----------------|------------------------------------|--------------|----------------|--------------|-----------------------|----------|--------|------|-------|
| | | | thry | actl | Ok | theory | found | | | |
| Dioxins | | | | | | | | | ÷ | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.85 | Y | 00:30:06 | 00:29:34 | 148320 | 1.00 | 300.0 |
| 13C 2,3,7,8-TCDD | 332 | 334 | 0.78 | 0.84 | Y | 00:30:38 | 00:30:04 | 34908 | 1.00 | 70.9 |
| 13C 1,2,3,7,8-PeCDD | 368 | 370 | 1.55 | 1.50 | Y | 00:35:52 | 00:35:23 | 34363 | 0.94 | 74.1 |
| 13C 1,2,3,6,7,8-HxCDD | 402 | 404 | 1.24 | 1.21 | Y | 00:40:20 | 00:39:51 | 24700 | 0.63 | 79.2 |
| 1,2,3,6,7,8-HxCDD | 390 | 392 | 1.24 | 1.07 | Y | 00:40:21 | 00:39:52 | 40 | 1.03 | 0.2 |
| 13C 1,2,3,4,6,7,8-HpCDD | 436 | 438 | 1.05 | 1.11 | Y | 00:44:34 | 00:44:04 | 17824 | 0.56 | 65.0 |
| 1,2,3,4,6,7,8-нрСОО | 424 | 426 | 1.05 | 1.11 | Y | 00:44:35 | 00:44:06 | 270 | 0.93 | 1.6 |
| 13C OCDD | 470 | 472 | 0.89 | 0.88 | Y | 00:49:16 | 00:48:40 | 11071 | 0.33 | 67.4 |
| OCDD | 458 | 460 | 0.89 | 0.80 | Y | 00:49:17 | 00:48:43 | 479 | 1.03 | 4.2 |
| Furans | | | | | | Met 1158. 00:30:06 | | | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.85 | . X 5 | 00:30:06 | 00:29:34 | 148320 | 1.00 | 300.0 |
| 13C 2,3,7,8-TCDF | 316 | 318 | 0.78 | 0.68 | ŞΥ | 00:29:56 | 00:29:23 | 49340 | 1.36 | 73.5 |
| 13C 1,2,3,7,8-PeCDF | 352 | 354 | 1.55 | SO D' | v | 00:34:27 | 00:33:57 | 31591 | 1.19 | 53.9 |
| 13C 1,2,3,4,7,8-HxCDF | 384 | 386 | 1.55 0.51 | 30.51 | Y | 00:39:12 | 00:38:42 | 34139 | 0.84 | 82.1 |
| 13C 1,2,3,4,6,7,8-HpCDF | 418 | 420 | · 22.5(m) | 0.45 | Y | 00:43:06 | 00:42:37 | 22390 | 0.57 | 78.8 |
| 1,2,3,4,6,7,8-HpCDF | 408 | 410 472 444 ^{FO} SO | 8° 15.05 | 0.90 | Y | 00:43:07 | 00:42:38 | 359 | 1.27 | 1.3 |
| 13C OCDD | 470 | 472 | ₩D.89 | D.88 | Y | 00:49:16 | 00:48:40 | 11071 | 0.33 | 67.4 |
| OCDF | 442 | 444 4000 | 0.89 | 0.89 | Y | 00:49:42 | 00:49:05 | 199 | 0.93 | 1.9 |

RECOVERY REPORT (Sally Version 6.7)

Job Number

: 37310E

Sample Number : 37310EBL

Client Id :-

:085-ms

Column

Date Acquired : 08-Aug-03

Acquired File : A:00808 Instrument : Ultima

Operator PC File

: D. Wood

: R:\DIOX1NV\D0808\sample.004\D0808.DAT

File Text

: Method Blank

| Compound Name | Recovery % | Standard Addition / ng |
|-------------------------|-----------------------------------|--------------------------------------|
| Dioxins | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDD | 71 | _ 1.00 |
| 13C 1,2,3,7,8-PeCDD | 74 | 1.00 |
| 13C 1,2,3,6,7,8-HxCDD | 79 | 1.00 |
| 13C 1,2,3,4,6,7,8-HpCDD | 6 5 | 1.00 |
| 13C OCDD | 67 | 1.00 |
| Furans | | |
| 13C 1,2,3,4-TCDD | | |
| 13C 2,3,7,8-TCDF | 73 | 1.00 |
| 13C 1,2,3,7,8-PeCDF | 54 | 1.00 |
| 13C 1,2,3,4,7,8-HxCDF | 82 | 1.00 1.00 1.00 1.00 1.00 |
| 13C 1,2,3,4,6,7,8-HpCDF | 79 | 1.0g\(\) |
| 13C OCDD | 67 | 1600 |
| | 82 79 67 Consent of copyright own | oses edicat |
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SAL Sample Tracking Form: Issue 6

PLEASE INITIAL AND DATE ALL ENTRIES

| Job Number 37309 310 336 449 | _Sample Numbe | er BLK A | nalysis_ | PCODIF + P | C8 (MHO15) | - |
|---|---------------------------|---|--|---|---|--------------------------------|
| | <u></u> | Sample Extraction | " " | ********************* | 14 40 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | ********** |
| Weight/Volume Extracted | THIMBLE | | | * | QE-08-03 | RSU |
| PCCD/F Internal Standard id/Lot | #/VolumeED] | F957/32461-83/ <u>4+</u> | <u> </u> | 3. | 05.08.03 | Ръч |
| PCB Internal Standard id/Lot #/Vo | olume PCBW | H012 07070 | 03/A | 20,1 | OS-08-03 | PBU |
| Extraction Method/Solvent/Volume | SOXHLET | Dom: Hex | une | econt | os. 08-03 | POU |
| Extraction Start 16:00 | 05.08.03 F | SH End (| <u> </u> | | Ø€-08-03 | Pan |
| Additional Comments | | | | | | |
| | | - | | | | |
| · | | | | - · · · · · · · · · · · · · · · · · · · | | |
| ************************************** | | | | | | |
| | I | Extract Clean-up | | | | ****************************** |
| Clean-up 1 COMSINATIO | | - | other use | | Ø-0€-03 | PSu |
| Clean-up 2 FLORISIL (| | solid. | any | | OF-08-03 | PSU |
| Clean-up 3 | | or Politic | | - | | |
| Additional Comments | | Jectic Wiler | | *** | | |
| | 7-0 | jigh | | · | | |
| · | asent of cor | - · · · · · · · · · · · · · · · · · · · | | | | |
| | Cops | FIRE | | | | |
| *************************************** | | GC/MS Analysis | 7+ 40+20+ 542 22 4 | *************************************** | ************************************* | ******** |
| Instrument OLTIMA | | Pcoolf | Injectic | n 1958Lp | 08 8 63 | 700 |
| Instrument | | | | | | |
| Instrument | Analyte | | _Injectio | | | |
| THIS OF STREET | Analyte | | _Injectio | n | | |
| *************************************** | ************************* | | ************************************** | **************** | **************** | |
| | | Quantitation | | | (m) cool A | 2767 |
| Method SALLY (DIOXIN) | <u> </u> | | | <u> </u> | 1010810 | , , , |
| | · · | | | | | |
| | | | | | | |
| Additional Comments | | | | | | |
| | Report 37316 | DE/Dioxins Page | 22 of 40 | | | |
| SAL STF v.6 | refore 2121 | | VI 40 | | Issued 15 | /11/02 |

8.23 Extraction and Clean Up Procedures

Each sample was processed in accordance with the procedures defined in SAL SOP #1. In summary an accurately weighed 10g aliquot of the 'dried and ground' soil sample was placed into a Soxhlet thimble that was then spiked with labelled internal standards. The samples were extracted with 300 mls of toluene for in excess of sixteen hours.

A method blank was prepared in the same way.

Following extraction, the toluene was reduced to incipient dryness in vacuo, prior to reconstitution in ca 5 ml hexane and purification by elution through a column combining sulphuric acid impregnated silica, potassium hydroxide impregnated silica and anhydrous sodium sulphate. The entire eluate from this column was further purified via activated Florisil column chromatography and then concentrated to near-dryness prior to GC/MS analysis.

Immediately prior to analysis by GC/MS nonane spiked with recovery standard 13 C₆-1,2,3,4-TCDD and nonane were added to the samples and the blank (see the sample tracking form for the respective amounts). An aliquot of this solution was then injected onto the GC/MS system.

9.23 Analytical Procedures

The analytical methods may be summarised as follows,

4

Stable isotopically labelled internal standards are added at known concentration to the samples prior to extraction and clean up.

A standard solution containing the known first and last eluting isomers of the tetra, penta, hexa and hepta furans is injected onto the GC/MS system with ions monitored for all the homologues. This allows the setting up of appropriate acquisition windows for the more specific multi-group data acquisition for the sample analysis. The resulting elution windows are incorporated into the multi group acquisition tables.

Following this, another standard solution containing the 2378 TCDD native compound and the known close eluting isomers is injected. This permits the ability of the column to identify 2378-TCDD to be evaluated.

Two masses each are monitored for each native and isotopically labelled congener, this allows the isotope ratio to be checked with the theoretical value as additional confirmation of the compound's identity. Note that although the mass spectrometer is operated at 10,000 resolving power there are still other compounds which may survive the clean up and may be close enough in mass to yield a response in the dioxin or furan channels. To aid in identification of these interferences two other QA masses are monitored, firstly the molecular ion species for polychlorinated diphenyl ethers which yield fragments in their mass spectra of exactly the same mass as the furans, if a response is observed in this channel coincident with the furan masses then the peaks are discarded if appropriate. Secondly, as part of the system's performance checks, a "lock mass" from perfluorokerosene (present in the batch inlet throughout the entire GC run) is monitored and scanned to compensate for any mass drift during the run. Use is made of this feature to monitor the lock mass before it has been used to correct for drift. This trace would, if no large components were present, appear as a continuous line, however, if a large (many nanograms/micrograms) peak elutes from the GC column the ion source sensitivity is suppressed and a negative going "peak" will be seen. If such a peak coelutes with possible interferences they may also be discarded, (see each sample's narrative).

Standards of both the isotopically labelled and native 2378 containing congeners of interest are injected sequentially, starting with the least concentrated. The composition of these are given later. The resulting target results and relative response factors are given.

All 2378 containing native congeners are quantitated by isotope dilution methods relative to their carbon-13 labelled internal standards. For quantitation of the "totals" of all non-2378 containing congeners, the relative response factor is assumed to be the same as for the first eluting native 2378 congener of the same homologue group. For example, non-2,3,7,8-chlorinated PeCDFs are quantified using the RRF derived for 1,2,3,7,8-PeCDF.

As a check upon the efficiency of the extraction/clean up, ¹³C₆-1,2,3,4-TCDD was added to the samples immediately prior to injection onto the GC/MS system. This is also used to help evaluate the method detection limit in the case where no peak is detected for one of the targeted analytes. A recovery table is printed in each sample's report.

A nonane blank is injected prior to sample analysis. This blank must contain no target isomers above noise before the analysis of samples can continue.

The sample log sheet for the job is given at the end of the report.

10.24 (a) GC Conditions for the Analysis, Acquisition System Used for Window Standard.

Column 60m J&W DB5-ms, 0.25u film thickness, 0.25mm i.d., head pressure 30 p.s.i.

Program 140° C for 4 minutes, then 15 C°/min to 220° C, then 1.5 C°/min to 240° C, hold for 2 minutes, then 4 C°/min to 310° C, which is held for 10 minutes.

Injection Conditions Temperature 300 °C, Splittess mode, valve time 2 minutes.

(b) GC/MS Acquisition System, Window Standard

Group Time, 0:01:0 to 0:50:0

Masses Monitored

| Component | Mass | Sample Time(ms) | Delay Time(ms) |
|-----------|----------|-----------------|----------------|
| TCDF | 305.8987 | 40 | 10 |
| PeCDF | 339.8597 | 40 | 10 |
| HxCDF | 373.8208 | 40 | 10 |
| HpCDF | 407.7818 | 40 | 10 |

This test is performed at 1000 resolving power (10% valley definition).

11.25 Mass Spectrometer Conditions and Instrumentation Used

The operating parameters for the mass spectrometer used during sample analysis are listed below.

Resolving Power

10,000 (10% valley definition).

Source Conditions

Electron Energy 30 eV. Trap Current 700 uA.

Source Temperature 250 °C.

Interface Temperatures

280 °C.

Detector Conditions

Amplifier Range 10⁻⁶ Amps Full Scale. Amplifier Response Time 0.01 ms.

Multiplier Voltage 320 volts.

GC/MS system VG Autospec Ultima Mass Spectrometer equipped with HP 5890A Gas Chromatograph. Data system is a VG OPUS. Samples were injected with an HP7673B autosampler.

12.25 Compounds Present in the Window Determination Standard.

| | First eluting isomer | Last eluting isomer |
|-------------|----------------------|---------------------|
| Tetra Furan | 1368 | 1289 |
| Penta Furan | 13468 | 12389 |
| Hexa Furan | 123468 | 123489 |
| Hepta Furan | 1234678 | 1234789 |

Only one isomer exists for the octachiorinated furan and so no standard is necessary to define the acquisition window.

Please note that 1,2,8,9-TCDE elutes after 1,3,4,6,8-PeCDF on the DB-5ms column. On the basis of operator experience, it has been decided that the acquisition windows be set to permit measurement of 1,3,4,6,8-PeCDF, which is far more prevalent in samples than 1,2,8,9-TCDF. The data reported here for "total non-targeted TCDFs" therefore, omits 1,2,8,9-TCDF.

Compounds in Column Performance Standard

The following TCDD isomers:

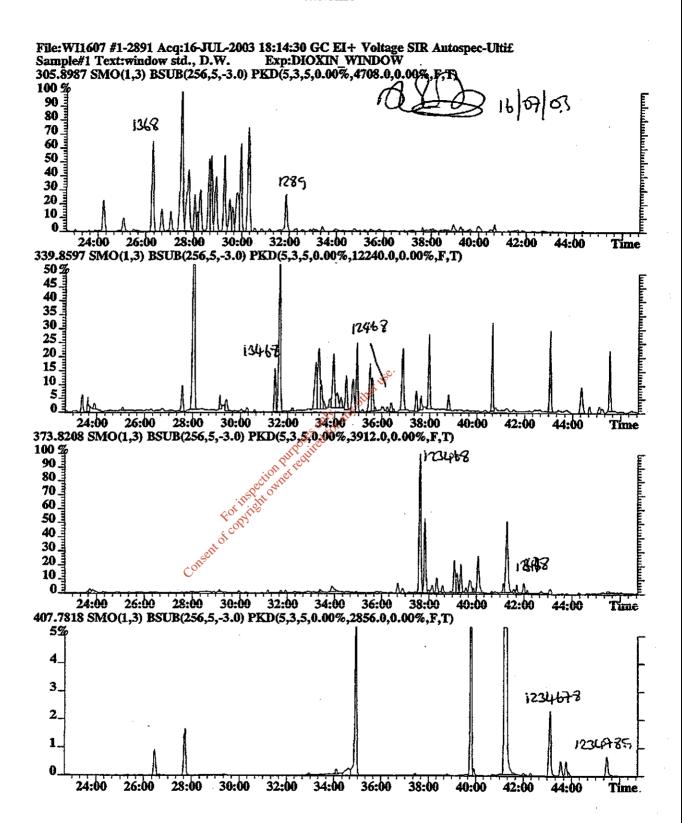
1478, 1234, 1237/1238, 2378, 1278, 1267

Note: The DB5-ms column chosen achieves satisfactory resolution of 2378 TCDF from its close eluting isomers.

EPA protocols require that the separation between 1237/1238 and 2378 TCDD be better than 25% valley, clearly easily achieved on the DB5-ms column used.

Please note that the DB5-ms column employed does not effect satisfactory resolution of 2,3,4,7,8-PeCDF and 1,2,3,7,8,9-HxCDF from their close-eluting isomers. The amount reported for these isomers are therefore the *maximum possible*. The amount of the 2,3,4,7,8-PeCDF may be over reported by as much as 25%, based upon the analysis of five extracts chosen at random that were then confirmed on a polar column.

13.26 Raw Data from the Window Determination Standard, Including Peak Identifications.



14.27 Acquisition Systems Used for Sample Analysis.

Group 1

| Component | Mass | Sample Time(ms) | Delay Time(ms) | | |
|----------------------------|----------|-----------------|-----------------------|--|--|
| PFK | 292.9825 | 10 | 5 Lock Mass Check | | |
| PFK | 292.9825 | 50 | 10 Lock Mass | | |
| TCDF | 303.9015 | 100 | 10 | | |
| TCDF | 305.8987 | 100 | 10 | | |
| ¹³ C TCDF | 315.9419 | 30 | 10 | | |
| ¹³ C TCDF | 317.9389 | 30 | 10 | | |
| TCDD | 319.8965 | 100 | 10 | | |
| TCDD | 321.8936 | 100 | 10 | | |
| ¹³ C6 1234 TCDD | 325.9166 | 30 | 10 Recovery Std. | | |
| ¹³ C6 1234 TCDD | 327.9137 | 30 | 10 Recovery Std. | | |
| ¹³ C 2378 TCDD | 331.9368 | 30 | 10 . | | |
| ¹³ C 2378 TCDD | 333.9339 | 30 | 10 | | |
| CDPE | 375.8364 | 30 | 50 Furan Interference | | |

Group 2

| Component | Mass | Sample Time(ms) | Delay Time(n | ns) |
|-----------------------|------------|--|--------------|--------------------|
| PeCDF | 339.8597 | 100 die 1 | 10 | |
| PeCDF | 341.8567 | 100 | 10 | |
| ¹³ C PeCDF | 351.9000 | | 10 | • |
| ¹³ C PeCDF | 353.8970 | 3000 for arr | 10 | |
| PeCDD | 355.8546 | 36 ¹ 100 | 10 | |
| PeCDD | 357.8516 | ion of 100 | 10 | |
| PFK | 366.9792 | ingle of the state of 100 to 1 | 5 | Lock Mass Check |
| PFK | 366.9792 | in the 50 | 10 | Lock Mass |
| ¹³ C PeCDD | 367.8949 🕎 | 30 30 | 10 | |
| ¹³ C PeCDD | 369.8919 | 30 | 10 | • |
| CDPE | 409.7974 | 30 | 50 | Furan Interference |
| | COUR | | | |
| | | | | |

Group 3

| ₹ | | | • | • |
|-----------------------|----------|-----------------|--------------|--------------------|
| Component | Mass | Sample Time(ms) | Delay Time(1 | ns) |
| HxCDF | 373.8208 | 100 | 10 | |
| HxCDF | 375.8358 | 100 | 10 | |
| ¹³ C HxCDF | 383.8639 | 30 | 10 | |
| ¹³ C HxCDF | 385.8610 | 30 | 10 | |
| HxCDD | 389.8157 | 100 | 10 | |
| HxCDD | 391.8127 | 100 | 10 | |
| PFK | 392.9760 | 10 | 5 | Lock Mass Check |
| PFK | 392.9760 | 50 | 10 | Lock Mass |
| ¹³ C HxCDD | 401.8559 | 30 . | 10 | |
| ¹³ C HxCDD | 403.8529 | 30 | 10 | • |
| CDPE | 445.7555 | 30 | 50 | Furan Interference |
| | | | | |

Group 4

| Component | Mass | Sample Time(ms) | Delay Time(ms) |
|---|--|--|---|
| HpCDF HpCDF 13C HpCDF 13C HpCDF HpCDD HpCDD PFK PFK PFK 13C HpCDD 13C HpCDD CDPE | 407.7818 409.7789 417.8253 419.8220 423.7766 425.7737 430.9729 430.9729 435.8169 437.8140 479.7165 | 100 100 30 30 100 100 10 50 30 30 | 10 10 10 10 10 10 5 Lock Mass Check 10 Lock Mass |
| | 177.7103 | 50 | 50 Furan Interference |

Group 5

| Lock Mass Check Lock Mass |
|------------------------------|
| |

15.29 Dioxin and Furan Calibration Standards Preparation Certificate.

Dioxin/Furan Calibration Standards Preparation Certificate

This certifies that a set of five dioxin/furan calibration standards were prepared in accordance with SAL SOP 2, issue 3.

The batch numbers of the stock dioxin and furan reference standards used in the preparation of the calibrations standards were:

¹³C₆-1,2,3,4-TCDD (080299)

Mixed labelled/native standards CS1-CS5 (EDF-4947), batch numbers 34752-77A, 33384-42B, 35005-04, 3384-42D and 34752-77E respectively.

All the above standards are traceable to certified reference standards purchased from Cambridge Isotope Laboratories.

Signature

Name

Position

Standards prepared by

B

P.Harrington

Dioxin Analyst

Date of Preparation :- CS2: 26/11/01, CS3: 28/06/02, CS1,4,5: 14/08/02.

Standard Codes: - CS1/140802, CS2/261101, CS3/280602, CS4/140802, CS5/140802

Please note that these standards contain ¹³C₁₂-OCDF and are suitable for use in method EN1948 analysis (SAL SOPIc).

The continuing calibration solution, CS3, is in constant use and is exhausted regularly. This standard is prepared on an as needed basis, the current standard being CS3/280602.

******* 170503 PSI

16.30 Initial Calibration Results Table (IC1707)

CALIBRATION RESULTS (Sally Version 6.7)

| File Number | Date (d:m:ye | | File Name | | | | |
|-----------------------|---|-------------------------------|--|--|--|-------------------------|----------|
| 1 2 3 4 5 | 17-Jul- 17-Jul- 17-Jul- 17-Jul- 17-Jul- | 03 R:\D 03 R:\D 03 R:\D | IOXINV\IC1 IOXINV\IC1 IOXINV\IC1 IOXINV\IC1 IOXINV\IC1 | 707\sample 707\sample 707\sample | .003\1C170 .002\1C170 .004\1C170 | 7.DAT 7.DAT 7.DAT | |
| File | 1 | 2 | 3 | 4 | 5 | Average | %s.d. |
| 13C 1,2 | ,3,4-TCDI ,3,4-TCDI | 0 | | | Retent | ion Time Sta | andard |
| | y Standa | | | | | | |
| Amount RF | 91.0 1.00 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RRF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| KKI | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0 |
| 130 2 3 | ,7,8-TCDD | ١ | | | | | jet use. |
| Interna | | | | | | | of 112 |
| Amount | 91.0 | 91.0 | 91.0 | 01 n | O1 n | of | , C |
| RF | 0.847 | 0.718 | 0.784 | 0.848 | 0.920 | off adity | |
| RRF | 0.847 | 0.718 | 0.784 | 0.848 | 91.0 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 0.920 | 0.949 | 0.00 |
| 2,3,7,8 | -TCDD | | | | on Price | × | |
| Analyte | | | | | ection ner | | |
| Amount | 0.5 | 9-1 | 1.8 | 36.0.0 | N182.0 | | |
| RF | 0.005 | 0.103 | 0.023 | 0.4 | 2.16 | 0.553 | |
| RRF | 1.04 | 1.03 | 1 14 | 1.19.00 | 1.08 | 1.10 | 6 |
| | | | | onsentor | | | Ū |
| 13C 1,2, | 3,7,8-Pe | CDD | Č | OTISE | | | |
| Internal | Standa | rd | | | | | |
| Amount | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 0.649 | 0.574 | 0.653 | 0.712 | 0.800 | 0.00 | |
| RRF | 0.649 | 0.574 | 0.653 | 0.712 | 0.800 | 0.690 | 0.00 |
| 1,2,3,7, Analyte | 8-PeCDD | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.020 | 0.435 | 0.090 | 1.84 | 8.84 | 2.25 | |
| RRF | 0.808 | 0.872 | 0.903 | 0.922 | 0.884 | 0.878 | 5 |
| 13C 1,2, | 3,4,7,8-1 | kcDF-T | | | Retentio | n Time Star | rdard |
| 130 1,2, | 3,6,7,8-1 | ixCDD | | | | | |
| Internal | Standar | d | | | | | |
| Amount | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 0.458 | 0.412 | 0.456 | 0.501 | 0.582 | 0.00 | |
| RRF | 0.458 | 0.412 | 0.456 | 0.501 | 0.582 | 0.505 | 0.00 |
| | | | | | | | |

| 1,2,3,6, | .7,8-HxC | DD | | | | | |
|---------------------|------------------|-----------------------|----------|------------|--|--------------|--------|
| Analyte | | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.024 | 0.541 | 0.099 | 2.08 | 10.8 | 2.70 | |
| RRF | 0.971 | 1.08 | 0.987 | 1.04 | 1.08 | 1.03 | 5 |
| 1,2,3,4, | 7,8-HxC | DD . | | | | | |
| Analyte | | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| · RF | 0.021 | 0.411 | 0.099 | 1.82 | 8.50 | 2.17 | |
| RRF | 0.845 | 0.824 | 0.986 | 0.911 | 0.850 | 0.883 | 7 |
| 1,2,3,7, Analyte | 8,9-KxCI | 00 | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.021 | 0.455 | 0.093 | 1.91 | 9.10 | 2.32 | |
| RRF | 0.849 | 0.913 | 0.929 | 0.955 | 0.910 | 0.911 | 4 |
| 13C 1,2, | | ,8-HpCDD-R 8-HpCDD | | | Retenti | on Time St | andard |
| Internal | | · - | | | | | |
| Amount | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 0.323 | 0.272 | 0.307 | 0.336 | 0.401 | 0.80 | |
| RRF | 0.323 | 0.272 | 0.307 | 0.336 | 0.401 | 0.394 | 0.00 |
| 1,2,3,4, Analyte | 6,7,8-Hf | oCDD | | | | of Other Use | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0,4 | of other | |
| RF | 0.022 | 0.465 | 0.093 | | 9.32010 | 2.37 | |
| RRF | 0.899 | 0.932 | 0.927 | 0.978 | 0.932 | 0.934 | 3 |
| | | | | 20272 | 9.320 Por October 19 Po | | |
| 13C OCDD | | | | actio | inet | | |
| Internal | | | | · 15 Porto | 1. | | |
| Amount | 182.0 | 182.0 | 182.0 | VOL195681 | 182.0 | | |
| RF | 0.394 | 0.349 | 0.375 | 90,403 | 0.504 | 0.00 | |
| RRF | 0.197 | 0.175 | 0.187 | §~0.201 | 0.252 | 0.234 | 0.00 |
| OCDD | | | Collegui | | | | |
| Analyte | | | | | | | |
| Amount | 4.5 | 91.0 | 18.0 | 360.0 | 1820.0 | | |
| RF | 0.024 | 0.499 | 0.103 | 2.12 | 10.6 | 2.68 | |
| RRF | 0.980 | 0.999 | 1.04 | 1.07 | 1.06 | 1.03 | 4 |
| 130 1,2, | 3,4-TCD0 |)-R | | | Retentio | n Time Sta | andard |
| 130 1,2, | • | | | | | | |
| Recovery | | | | | | | |
| | 9 1.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| RRF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0 |
| 130 2,3, | | | | | | | |
| Internal | | | | | | | |
| | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 1.07 | 0.904 | 1.03 | 1.07 | 1.15 | 0.00 | |
| RRF | 1.07 | 0.904 | 1.03 | 1.07 | 1.15 | 1.05 | 0.00 |

| 2,3,7,8 Analyte | | | | | | | |
|---------------------|------------|----------|--------------|-----------|---|---------------|--------|
| Amount | 0.5 | 9.1 | 1.8 | 36.0 | 193.0 | | |
| RF | 0.005 | 0.102 | 0.022 | 0.448 | 182.0 2.09 | 0.574 | |
| RRF | 1.00 | 1.02 | 1.09 | 1.13 | 1.05 | 0.534 1.06 | 5 |
| | | | , | | 7.05 | 1.00 | • |
| | 2,3,7,8-Pe | | | | | | |
| Intern | | ard | | | | | |
| Amount | 91,0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 0.750 | 0.673 | 0.849 | 0.890 | 0.934 | 0.00 | |
| RRF | 0.750 | 0.673 | 0.849 | 0.890 | 0.934 | 0.941 | 0.00 |
| 1,2,3,7 | 7,8-PeCDF | | | | | | |
| Analyte | | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.024 | 0.480 | 0.094 | 1.83 | 9.38 | 2.36 | |
| RRF | 0.973 | 0.962 | 0.938 | 0.914 | 0.938 | 0.945 | 2 |
| | | 01702 | 0.750 | 0.714 | 0.730 | 0.745 | ٤ |
| 2,3,4,7 Analyte | ,8-PeCDF | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.023 | 0.467 | 0.090 | 1.80 | 9.12 | 2.30 | |
| RRF | 0.930 | 0.936 | 0.897 | 0.900 | 0.912 | 0.915 | 2 |
| | | | | | | | _ |
| | ,3,4,7,8- | | | | Retentio | n Time Sta | andard |
| - | ,3,4,7,8- | | | | | on Time Sta | A USC |
| | l Standa | | | | | old | , j |
| Amount | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | My any | |
| RF | 0.539 | 0.468 | 0.557 | 0.580 | 0.668 | 600 0 | |
| RRF | 0.539 | 0.468 | 0.557 | 0.580 | 0.668 | ye0.619 | 0.00 |
| 1.2 3 4 | ,7,8-нxcD: | E | | | 91.0 0.668 | | |
| Analyte | | r | | | ectionier | | |
| Amount | 2.3 | 45.4 | 9.1 | 192 O'THE | DO O | | |
| RF | 0.027 | 0.520 | 9.1 0.112 | 102.4 | 910.0 | 2 | |
| RRF | 1.07 | | | 2,100% | 10.4 | 2.64 | _ |
| KKF | 1.07 | 1.04 | 1.12 | 1.09 | 1_04 | 1.07 | 3 |
| 1,2,3,6 | ,7,8-HxCDI | F | وم | insent e | | | |
| Analyte | | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.026 | 0.566 | 0.118 | 2.31 | 11.1 | 2.81 | |
| RRF | 1.05 | 1.13 | 1.18 | 1.15 | 1.11 | 1.13 | 4 |
| 2,3,4,6 Analyte | ,7,8-HxCD1 | . | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.021 | 0.474 | 0.092 | 1.90 | 8.87 | 2.27 | |
| RRF | 0.858 | 0.950 | 0.923 | 0.950 | 0.887 | 0.914 | 4 |
| | | | | | | | |
| 1,2,3,7, Analyte | ,8,9-HxCDF | • | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.015 | 0.336 | 0.066 | 1.31 | 6.59 | 1.66 | |
| RRF | 0.603 | 0.673 | 0.660 | 0.654 | 0.659 | 0.650 | 4 |
| | | | | | | | |

| 130 1,2, | 3,4,6,7, 3,4,6,7, Standa | • | | | Retenti | on Time St | andard |
|---------------------|--------------------------------|-------|---------|--------------|---|------------|--------|
| Amount | 91.0 | 91.0 | 91.0 | 91.0 | 91.0 | | |
| RF | 0.322 | 0.300 | 0.343 | 0.345 | 0.411 | 0.00 | |
| RRF | 0.322 | 0.300 | 0.343 | 0.345 | 0.411 | 8.405 | 0.00 |
| 1,2,3,4, | 6,7,8-нр | CDF | | | | | |
| Analyte | | | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.032 | 0.615 | 0.128 | 2.62 | 12.4 | 3.16 | |
| RRF | 1.27 | 1.23 | 1.28 | 1.31 | 1.24 | 1.27 | 2 |
| 1,2,3,4, Analyte | 7,8,9-llp | CDF | | | | | |
| Amount | 2.3 | 45.4 | 9.1 | 182.0 | 910.0 | | |
| RF | 0.018 | 0.368 | 0.070 | 1.46 | 7.46 | 1.87 | |
| RRF | 0.723 | 0.737 | 0.704 | 0.728 | 0.746 | 0.728 | 2 |
| 13C OCDD | | | | - | | | |
| Internal | Standa | rd | | | | | |
| Amount | 182.0 | 182.0 | 182.0 | 182.0 | 182.0 | | |
| RF | 0.394 | 0.349 | 0.375 | 0.403 | 0.504 | 0.00 | • |
| RRF | 0.197 | 0.175 | 0.187 | 0.201 | 0.252 | 0.234 | 0.00 |
| OCDF Analyte | | | | | | iner use | |
| Amount | 4.5 | 91.0 | 18.0 | 360.0 | 1820.0 | · Morr | |
| RF | 0.021 | 0.462 | 0.098 | 1.83 | 9.49 00 | 2.38 | |
| RRF | 0.856 | 0.925 | 0.988 | 0.924 | 0.9490 | 0.928 | 5 |
| | | | Consent | for jishedin | 0.504 0.252 1820.0 9.49 0114 0.549 110 0.649 110 | | |

17.34 Continuing Calibration Check, 8th August 2003

Standard 'CS3/170503' is injected onto the 60m DB5-ms column prior to sample analysis. The relative response factors are determined for all analytes and must not have changed by more than 25% from the initial values for analysis to proceed.

The differences are reported in the table below and are acceptable.

| Compound Name | Mean RRF | %SD | RRFcc | W elta |
|-----------------------------|----------------|-----------------|----------------|---|
| 2,3,7,8-TCDD | 1.10 | 6 | 1.13 | -3 |
| 1,2,3,7,8-PeCDD | 0.878 | 5 | 0.870 | 1 |
| 1,2,3,6,7,8-HxCDD | 1.03 | 5 | 1.10 | -6 |
| 1,2,3,4,7,8-HxCDD | 0.883 | 7 | 0.847 | 4 |
| 1,2,3,7,8,9-HxCDD | 0.911 | 4 | 1.06 | -16 |
| 1,2,3,4,6,7,8-HpCDD | 0.934 | 3 | 0.974 | -4 |
| OCDD | 1.03 | 4 | 1.03 | 0 |
| 2,3,7,8-TCDF | 1.04 | • | 4.00 | |
| 1,2,3,7,8-PeCDF | 1.06 | 5 | 1.06 | 0 |
| 2,3,4,7,8-PeCDF | 0.945 | 2 | 1.03 | -9 |
| 1,2,3,4,7,8-HxCDF | 0.915 | 2 | 1.07 | -17 |
| 1,2,3,4,7,8-HXCDF | 1.07 | 3 | 1.04 | 3 |
| 2,3,4,6,7,8-HXCDF | 1.13 | 4 | 1.24 | -10 |
| · · · · · | 0.914 | 4 | 1.00 | -10 |
| 1,2,3,7,8,9-HxCDF | 0.650 | 4 | 0.744 | -14 JUS |
| 1,2,3,4,6,7,8-HpCDF | 1.27 | 2 | 1.31 | -3 office |
| 1,2,3,4,7,8,9-HpCDF OCDF | 0.728 | 2 | 0.800 | 11/19/19 |
| | 0.728 0.928 | न नामकृष्टिम | of Purposeries | 3 -10 -10 -14 -3 offet use. |

TARGETING REPORT (Sally Version 6.7)

Date Acquired : 08-Aug-03 Acquired File : A:D0808

Operator : D. Wood Instrument : Ultima Column :DB5-ms

PC File : R:\DIOXINV\D0808\sample.001\D0808.DAT

| Compound Name | Н1 | M2 | M | 1/H2 | | Retentio | on Time | Area |
|-------------------------|----------|---|------------------------------|-------|---------|----------------|----------|----------|
| | | | thry | actl | Ok | theory | found | |
| Dioxins | | | | | | , | • | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | 0.84 | Y | 00:30:06 | 00:29:30 | 227274 |
| 13C 2,3,7,8-TCDD | 332 | 334 | 0.78 | 0.83 | Y | 00:30:38 | 00:30:01 | 165886 |
| 2,3,7,8-TCDD | 320 | 322 | 0.78 | 0.77 | Y | 00:30:39 | 00:30:03 | 18743 |
| 13C 1,2,3,7,8-PeCDD | 368 | 370 | 1.55 | 1.58 | Y | 00:35:52 | 00:35:19 | 162041 |
| 1,2,3,7,8-PeCDD | 356 | 358 | 1.55 | 1.56 | Y | 00:35:53 | 90:35:21 | 70308 |
| 13C 1,2,3,6,7,8-HxCDD | 402 | 484 | 1.24 | 1.21 | Y | 00:40:20 | 00:39:49 | 119228 |
| 1,2,3,6,7,8-HXCDD | 390 | 392 | 1.24 | 1.28 | Y | 00:40:21 | 00:39:50 | 65284 |
| 1,2,3,4,7,8-HxCDD | 390 | 392 | 1.24 | 1.27 | Y | 00:40:13 | 00:39:42 | 50393 |
| 1,2,3,7,8,9-HxCDD | 390 | 392 | 1.24 | 1.27 | Y | 00:40:44 | 00:40:12 | 62893 |
| 13C 1,2,3,4,6,7,8-HpCDD | 436 | 438 | 1.05 | 1.05 | Y | 00:44:34 | 00:44:02 | 87537 |
| 1,2,3,4,6,7,8-HpCDD | 424 | 426 | 1.05 | 1.02 | Y | 00:44:35 | 00:44:03 | 42555 |
| 13C OCDD | 470 | 472 | 0.89 | 0.86 | Y | 00:49:16 | 00:48:38 | 115785 |
| OCDD | 458 | 460 | 0.89 | 0.84 | Y | 00:49:17 | 00:48:39 | 59486 |
| Furans | | | 0.78 0.78 0.78 0.78 | 4. 4g | ther us | o [.] | | |
| 13C 1,2,3,4-TCDD | 326 | 328 | 0.78 | .0.84 | Y | 00:30:06 | 00:29:30 | 227274 |
| 13C 2,3,7,8-TCDF | 316 | 318 | D 780 | 0.68 | Y | 00:29:56 | 00:29:19 | 226840 |
| 2,3,7,8-TCDF | 304 | 306 | JUG (18 | 0.74 | Y | 00:29:57 | 00:29:20 | 23969 |
| 13C 1,2,3,7,8-PeCDF | 352 | 318 306 354 circh 342 periodi 342 periodi | ∞1.55 | 1.46 | Y | 00:34:27 | 00:33:53 | 182700 . |
| 1,2,3,7,8-PeCDF | 340 | 342,000 0W | 1.55 | 1.54 | Y | 00:34:28 | 00:33:55 | 94232 |
| 2,3,4,7,8-PeCDF | 340 | 342 1971 | 1.55 | 1.59 | Y | 00:35:34 | 00:35:01 | 97661 |
| 13C 1,2,3,4,7,8-HxCDF | 384 | 386 | 0.51 | 0.53 | Y | 00:39:12 | 00:38:39 | 146104 |
| 1,2,3,4,7,8-HxCDF | 374 | ₹ 376 | 1.24 | 1.22 | Y | 00:39:12 | 00:38:40 | 75858 |
| 1,2,3,6,7,8-HxCDF | 374 sent | 376 | 1.24 | 1.23 | Y | 00:39:21 | 00:38:50 | 90434 |
| 2,3,4,6,7,8-HxCDF | 3740115E | 376 | 1.24 | 1.19 | Y | 00:40:04 | 00:39:33 | 73153 |
| 1,2,3,7,8,9~HxCDF | 374 | 376 | 1.24 | 1.21 | Y | 00:41:15 | 00:40:44 | 54197 |
| 13C 1,2,3,4,6,7,8-HpCDF | 418 | 420 | 0.46 | 0.44 | Y | 00:43:06 | 00:42:35 | 99240 |
| 1,2,3,4,6,7,8-HpCDF | 408 | 410 | 1.05 | 1.01 | Y | 00:43:07 | 00:42:36 | 64700 |
| 1,2,3,4,7,8,9-HpCDF | 408 | 410 | 1.05 | 1.00 | Y | 00:45:28 | 00:44:53 | 39628 |
| 13C OCDD | 470 | 472 | 0.89 | 0.86 | Y | 00:49:16 | 00:48:38 | 115785 |
| OCDF | 442 | 444 | 0.89 | 0.90 | Y | 00:49:42 | 00:49:03 | 61476 |

18.36 Estimation of Method Detection Limits

The 'CS3' continuing calibration standard responses for the day when this sample was run (using standard CS3/170503) were used to estimate the method detection limits for the targeted analytes. The criteria is a minimum S/N of 2.5:1 for both isotope peaks.

| Analyte | Std Amount(pg) | S/N | Detection Limit(pg) |
|--|---|---|--|
| Dioxins | | | |
| 2,3,7,8-TCDD 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD | 10 50 50 50 50 50 50 | 500:1 2000:1 2000:1 2000:1 2000:1 1500:1 2000:1 | 0.05 0.05 0.05 0.05 0.05 0.08 0.1 |
| Furans | | | |
| 2,3,7,8-TCDF 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF OCDF | 10 50 50 50 50 50 50 50 50 50 100 | 500:1 2000:1 2000:1 2000:1 2000:1 2000:1 1000:1 2000:1 2000:1 | 0.05 0.05 0.05 0.05 0.05 0.05 0.1 0.05 0.1 |

Note that these detection limits are given in pg injected, so the sample detection limits are obtained by using the following equation. The proportion of the sample injected may be determined from the sample tracking form included with each sample report.

Analyte detection limit = Injection detection limit (above)

(portion of sample injected) x (amount sample)

In the case of poor recoveries of the internal standards this amount should be further increased by multiplying by 100/(recovery %).

The detection limits for these samples, where ca 1/30th was injected and recoveries were ca 70% were between 0.2 and 0.4 ng/kg per congener in the soil samples, depending upon the specific sample.

19.37 GC Performance Check

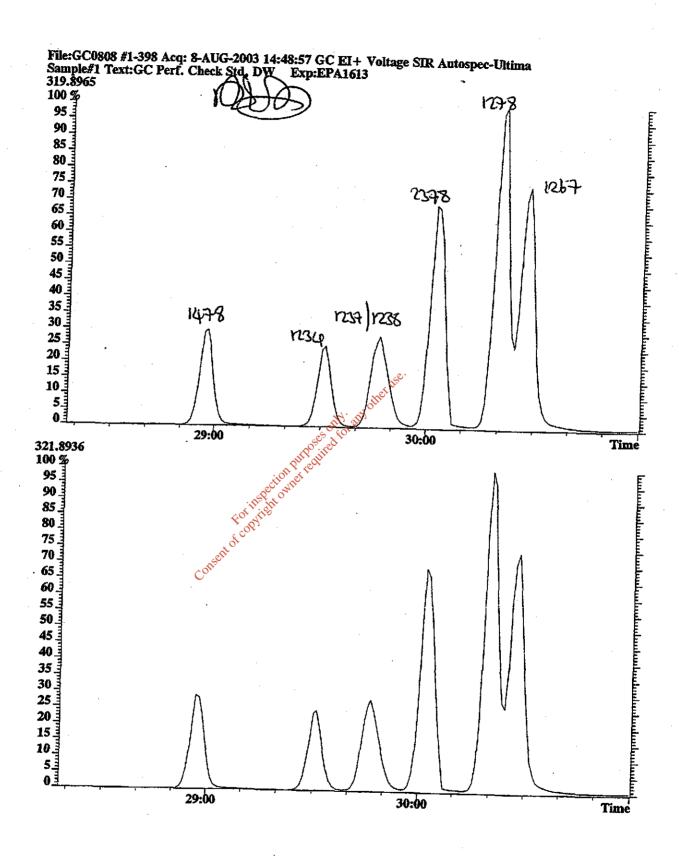
The ability of the GC column used to resolve the known close eluting isomers of the Tetra Dioxins was tested prior to analysis. A performance check standard containing the following isomers is injected. The TCDD traces are given on the following pages.

TCDD isomers contained in the GC Performance Check Standard in elution order.

1,4,7,8 1,2,3,4 1,2,3,7/1,2,3,8 2,3,7,8 1,2,7,8 1,2,6,7

The criterion for acceptance of this test is that the 2,3,7,8 TCDD must be separated by a valley of at least 25% from its nearest neighbours.

Consent of copyright owner required for any other use.





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Report 37310E/Dioxins Page 39 of 40

22.40 SAL Authorised Signatories Register

SAL AUTHORISED SIGNATORIES SPECIMEN SIGNATURES CURRENT AS OF 14-APR-2003, ISSUE: 32 MASTER COPY

| Name | Signature | Initials |
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SAL Authorised Signatories Specimen Schoolsten (14/04/2003)

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| Clifford Rodger | ally | CR |
| Charlottz Riley | C.Bita | CR |
| Graham Small | de firm | 052 |
| Robert Smith | Rhine | Re. |
| Nicola Summers | لازار حسد | NZS |
| Keith Thompson | kilharipan | kТ |
| Leanne Taylor | Waylor | LT |
| Peter Verrechia | PShweshin | PV |
| David Wood | all | Œ |

SAL Anthorized Signatories Specimen Signatures (14/04/2003)

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