Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Daneshill Soils Treatment Facility

FCC Recycling (UK) Limited

Environmental Setting and Installation Design Site Report Addendum

Environmental Permit Variation Application

Prepared by:

Caulmert Limited
14 Farrington Way, Eastwood Link Business Park, Eastwood, Notts NG16 3BF
Tel: 01773 749132
Email: andystocks@caulmert.com
Web: www.caulmert.com

Document Reference: 3982-CAU-XX-XX-RP-V-0304-A0.C1

January 2021

Caulmert
engineering environmental planning

APPROVAL RECORD

Site: Daneshill Landfill Site

Client: FCC Environment Ltd

Project Title: Daneshill Soils Treatment Facility

Document Title: Environmental Setting and Installation Design - Addendum

Document Ref: 3982-CAU-XX-XX-RP-V-0304-A0.C1

Report Status: **Final**

Project Manager: Andy Stocks

Caulmert Limited: 14 Farrington Way, Eastwood Link Business Park, Eastwood, Notts NG16 3BF

Tel: 01773 749132

Author	Kellie-Marie Burston	**Date**	15/01/2021
Reviewer	Andy Stocks	**Date**	15/01/2021
Approved	Andy Stocks	**Date**	15/01/2021

DISCLAIMER

This report has been prepared by Caulmert Limited with all reasonable skill, care and diligence in accordance with the instruction of the above-named client and within the terms and conditions of the Contract with the Client.

The report is for the sole use of the above-named Client and Caulmert Limited shall not be held responsible for any use of the report or its content for any purpose other than that for which it was prepared and provided to the Client.

Caulmert Limited accepts no responsibility of whatever nature to any third parties who may have been made aware of or have acted in the knowledge of the report or its contents.

No part of this document may be copied or reproduced without the prior written approval of Caulmert Limited.

TABLE OF CONTENTS

1. INTRODUCTION 1
1.1 Report Context 1
1.2 Template for Site Condition Reports 1
1.3 Site Details 3
1.4 Site Plans 3
2. CONDITION OF THE LAND AT PERMIT ISSUE 4
2.2 Solid Geology 5
2.3 Drift Geology 5
2.4 Man-made subsurface pathways 5
2.5 Hydrology and Surface Water 6
2.6 Hydrogeology 6
2.7 Landfill Gas Monitoring 7
2.8 Sensitive Sites 7
3. SOURCE TERM CHARACTERISATION 9
3.2 Pollution History 9
3.3 Historic land-uses 9
3.4 Evidence of existing or historic contamination 11
3.5 Baseline soil and groundwater reference data 12
4. PERMITTED ACTIVITY 12
4.2 Proposed Operations 13

APPENDICES

Appendix 1: Site Inspection Record

Appendix 2: ESID Report 2003 SLR Ref.: 4D-197-178/ESID

DRAWINGS

3982-CAU-XX-XX-DR-V-1800: Sensitive Receptors Plan

3982-CAU-XX-XX-DR-V-1801: Site Location Plan

3982-CAU-XX-XX-DR-V-1804: Site Boundary Plan

3982-CAU-XX-XX-DR-V-1805: Proposed Site Layout

1. INTRODUCTION

1.1 Report Context

1.1.1 This report is intended as an addendum to the existing Environmental Setting and Installation Design (ESID) report produced by SLR (SLR Ref.: 4C-197-219/ESID) to support the further development of the Daneshill Landfill Site.

1.1.2 The addendum reflects proposed changes at the site which consists of a soil treatment facility (STF) on a newly constructed compost pad provided with sealed drainage.

1.1.3 The operator proposes to treat a total 29,999 tonnes per annum of hazardous soil at their STF facility and 20,001 of non-hazardous soils which will comprise of biopile remediation, screening and hand-picking of asbestos contaminated soils. The treated soils will be used for the restoration of the wider Daneshill Landfill site. It is anticipated that treatment durations are typically between 8-16 weeks, with the maximum treatment time being 6 months.

1.1.4 STF operations will be situated on a newly constructed treatment pad with an impermeable cover within the footprint of the Daneshill Landfill Site, the location as shown in drawing 3982-CAU-XX-XX-DR-V-1801. Due to condition and integrity, the former concrete pad will be excavated, a GCL layer will be placed down with drainage surrounded by crushed stone and crushed concrete on top. Drainage will ensure that no liquid will run off the pavement other than via the site system, all liquids entering the system shall be collected and pumped to onsite holding tanks. As there is no surface water or foul water drainage on site, all liquids will be held in a storage tank and then tankered for appropriate disposal.

1.2 Template for Site Condition Reports

1.2.1 The EA guidance on Site Condition Reports (horizontal guidance note H5) sets out the requirements to prepare and maintain a site condition report for facilities that are regulated under the Environmental Permitting Regulations over the lifetime of the Site.

1.2.2 A Site Condition Report template is provided within the guidance. The template is divided into sections to be completed at different life stages of the regulated facility:

Sections 1-3 to be completed and submitted with applications for new facilities: This should include a description of the condition of the land at permit issue and a description of permitted activities at the site.

Sections 4-7 to be maintained during the life of the site: This should include a description of any changes to the activities and any changes to the use or production of dangerous substances at the facility. It should also include records of inspections for all pollution prevention measures, pollution incidents that may have had an impact on land and environmental monitoring.

Sections 8-10 to be completed and submitted with surrender applications: This should include a description of site decommissioning and removal of pollution risk and, where relevant, reference data and details of any remediation. Finally, it should include a 'statement of site condition' that is based on the information provided in the previous sections of the report.

1.2.3 To support the permit application to extend the permitted area, sections 1 to 3 of the Environment Agency's Site Condition Report Template is addressed below. The text in *italics* is copied from the template as this is the Environment Agency guidance on what should be included.

1.3 Site Details

1.3.1 The details of the operator and the site are as follows:

Name of the Operator	FCC Recycling (UK) Limited
Activity Address	Daneshill Landfill Site Daneshill Road Loud Nottinghamshire DN22 8RB
National Grid Reference	SK 6755086750

1.3.2 In the context of this report, 'site' refers to all of the land within the proposed permit boundary.

1.3.3 The site will consist of a hazardous and non-hazardous soils treatment facility, the proposed design has 2 x treatment areas for biotreatment and physical screening/hand picking on treatment pads measuring at 3450m^2 and 3500m^2 as well as a separate screening/hand picking area of 4880m^2. The proposed site boundary and treatment layout can be seen in drawing ref: 3982-CAU-XX-XX-DR-V-1805 'Proposed Site Layout Plan' presented within the application. The drawing also offers indicative locations for site infrastructure including access roads, biofilter, site office, weighbridge and the direction of drainage flow.

1.4 Site Plans

(Note: In Part A of the application form you must give us details of the site's location and provide us with a site plan. We need a detailed site plan (or plans) showing:

- *Site location, the area covered by the site condition report, and the location and nature of the activities and/or waste facilities on the site.*
- *Locations of receptors, sources of emissions/releases, and monitoring points.*
- *Site drainage.*
- *Site surfacing*

If this information is not shown on the site plan required by Part A of the application form then you should submit the additional plan or plans with this site condition report.)

1.4.1 Site plans showing details of the site and its surroundings are included as part of the application for the facility. The list of drawings included in this application is provided in the table below.

Drawing number	Drawing title
3982-CAU-XX-XX-DR-V-1800	Sensitive Receptors Plan
3982-CAU-XX-XX-DR-V-1801	Site Location Plan
3982-CAU-XX-XX-DR-V-1802	Odour Monitoring Plan
3982-CAU-XX-XX-DR-V-1803	Dust & Abestos Monitoring Plan
3982-CAU-XX-XX-DR-V-1804	Site Boundary Plan
3982-CAU-XX-XX-DR-V-1805	Proposed Site Layout Plan
3982-CAU-XX-XX-DR-V-1806	Section Drawings

1.4.2 The proposed Soil Treatment Facility site is located within the footprint of Daneshill Landfill Centred which is located approximately 2km east of Lound Village, 6km north-west of Retford and 11km north east from Worksop.

1.4.3 The site is bordered to the north and east by agricultural land and mixed woodland and to the west. South-west are nature reserves and the Daneshill Lakes. The nearest residential dwelling to the site is Daneshill Cottages which lies approximately 75m to the south-west of the site and Loundfield Farm 200m east of the site.

1.4.4 The proposed location of the STF will fall within the current permit boundary of Daneshill Landfill Site, therefore this application is not seeking to extend the permit boundary. The STF shall sit within the southern part of Daneshill Landfill Site development as shown on drawing 3982-CAU-XX-XX-DR-V-1804.

1.4.5 The facility will be limited to accepting wastes that can be treated to a point where they can be used for restoration soils on the landfill in accordance with the approved restoration plan.

1.4.6 The 2004 ESID report details the nearby receptors of the landfill which have been updated within this application to reflect the addition of the STF to the site (Amenity Accidents 3982-CAU-XX-XX-RP-V-0300).

2. CONDITION OF THE LAND AT PERMIT ISSUE

2.1.1 The pathway and receptor term characterisation within the initial ESID remains valid. These sections included: climate, geology, hydrology, hydrogeology and surface water of which have been summarised below.

2.1.2 No natural geological barriers exist for the wider Daneshill Landfill Site, there are occasional bands of clays and silts, however these do not form a continuous barrier. At the time of the May 2004 ESID report by SLR, Phases 1 and 2 of the site had been landfilled and restored for a number of years, these also includes Cells 1, 2, 3, 4, & 5. Cells 6, 7, 8a and 8b were capped and partially restored in 2003, Cell 9B was constructed in 2003 and was currently operational, Cell 9a was planned to be constructed in 2005, with the remaining

cells to be constructed in future years. The Soils Treatment Facility falls under Cells 11 and 12 of the Daneshill Landfill Site, both these cells were destined for landfilling as per the May 2004 ESID 2 'Environmental Site Setting' drawing, however operations did not commence within these cells. These areas are currently unused for any site or storage activities.

2.2 Solid Geology

2.2.1 The proposed Soil Treatment Facility is underlain by drift deposits overlying the Nottingham Castle Formation of the Sherwood Sandstone Group, a review from BGS online mapping portal indicates there are no superficial deposits in the proposed STF area.

2.2.2 The Sherwood Sandstone is underlain by Permian units and the Carboniferous Coal Measures, these have been written in further detail within the 2004 ESID report and remain valid for the STF area. The Sherwood Sandstone consists of approximately 140m of Nottingham Castel Formation and 20m of Lenton Sandstone formation in the vicinity of the site. The Permian Strata comprises of approximately 120m of mudstones, sandstone, dolomitic limestones and breccia. The Carboniferous Coal Measures unconformably underlie the Permo-Triassic strata with a thickness range from 900m to 1300m

2.3 Drift Geology

2.3.1 The STF area is noted to be underlain by First Terrace sand and gravels associated with the River Idle which flows to the east of the site. It is understood that these deposits have also been worked from the western part of the Daneshill site, exposing the underlying Sherwood Sandstone. The First Terrace deposits consists of sands and gravel associated with the River Idle and are of varying and inconsistence thickness. Regionally the Permo-Triassic geological strata dip gently to the east, with successively older deposits outcropping in a westerly direction. The Carboniferous strata are folded and dip gently to the east and west.

2.4 Man-made subsurface pathways

2.4.1 Due to its historic industrial uses of the site, it is anticipated there could be a number of underground utilities including gas, water, electricity services. However, given the nature of the concrete surfacing and its previous land-use with no sealed drainage, it is considered that the proposed STF area is not served with any man-made subsurface pathways.

2.4.2 A review of the 'Site Layout and Waste Deposition' drawing ref ESID 4 from the May 2004 ESID report indicates that there are no sub-surface drains or underground services within Cells 11 and 12. At the time of the drawing, a fence line partitioned these cells from 10b and 10a. Bulk storage tanks, wheel wash, quarantine area and the fuel tanks were all stored on impermeable surfacing within Cell 10b and 10a.

2.5 Hydrology and Surface Water

2.5.1 The 2004 ESID report provides valid surface water quality data for the surrounding off-site hydrology at Daneshill Landfill Site. The landfill site is provided with various drainage ditches to control the hydrological regime of the site, these ditches collect run-off from the site and flow westwards towards Daneshill lakes which eventually drains northwards into the River Idle.

2.5.2 The proposed STF area is located within flat lying land resting on highly permeable sand/gravel and Sherwood Sandstone deposits. A review on the Environment Agency 'Long term flood risk' mapping portal, indicates that the proposed STF area is:

Flood risk from rivers or the sea – VERY LOW RISK with a chance of flooding of less than 0.1%

Flood risk from surface water – VERY LOW RISK with a chance of flooding of less than 0.1%

Flood risk from reservoirs – VERY LOW RISK with a chance of flooding of less than 0.1%

2.5.3 In terms of surface water and drainage management, as the site has not been provided with any sealed drainage to foul sewer networks, the proposed STF area will be provided with subsurface drainage. The drainage will be collected via holding tanks which will be treated for reuse in the biotreatment and any surplus tankered away for further treatment at an appropriate facility. Clean surface waters which falls on impermeable surfacing will be directed towards the varies drainage detail as described above.

2.5.4 Caulmert were appointed to carry out a Flood Risk Assessment (FRA) on land at Daneshill Landfill site which provides a concept of how the site will collect, treat and discharge surface water. The FRA supported the planning application for the proposed Soil Treatment Facility (STF) development under document ref: 3982-CAU-XX-XX-RP-V-C-0300 ' Daneshill Landfill Site Flood Risk & Drainage Strategy' (November 2019). As part of the risk assessment, fluvial features were identified, the local geology and hydrology and the impact of flooding including; surface water, reservoirs and groundwater. Overall, the FRA determined that the proposed development of the Soil Treatment Facility is classed as a 'Less Vulnerable', however, there are some part of the adjacent site which are at some risk of surface water flooding, this will not impact the development proposed. Existing flood risks such as; drainage, groundwater, overland flow and surface runoff are not consisted to pose a significant flood risk impact to the proposed STF. In terms of climate change, the proposed STF is considered to be at low risk.

2.6 Hydrogeology

2.6.1 The Environment Agency classifies the Sherwood Sandstone group as a Principle Aquifer (previously classed as Major Aquifer). Principle Aquifers SPZ 3 Principle Aquifers provide high levels of water storage and support water supply and/or river base flow on a strategic scale. Groundwater flow and quality from the 2004 ESID report provides valid data

regarding hydrogeological characteristics of the site, mapping and contouring indicates that groundwater flow is in a general northerly direction. Routinely monitored groundwater quality and chemographs from the 2004 ESID report indicates that groundwater was previously impacted by non-landfill contamination sources with elevated concentrations of chloride, which has since declined below the drinking water standards (DWS). At the time of monitoring List I and List II (valid testing regime in 2004) was observed from two boreholes which did not indicate any presence of substances in the groundwater.

2.7 Landfill Gas Monitoring

2.7.1 Landfill gas monitoring was regularly undertaken at Daneshill Landfill Site, Appendix ESID 13 from the 2004 ESID report details a summary of monitoring data since January 2001. It was noted that methane concentration around the vast majority of the site were low, with breaches indicated in Phase 1 and 2 areas which reflects the lack of geomembrane lining system. There are no results for gas monitoring at the proposed STF area, this area was not utilised for landfilling activities, therefore gas monitoring was not a requirement.

Surface waters

2.7.2 The closest surface water feature is a stream approximately 460m to the West of the site, which flows North into the River Idle. There are two fisheries in the surrounding area, Clearwater Lake fishery located 1.1km North of the site boundary and Lakeside fisheries located 1.1km north west.

2.7.3 Daneshill Lakes Nature Reserve is located 400m West of the site boundary, in which there are several small lakes where the area is used for recreational use and sailing.

2.7.4 The site is not located within a flood risk zone.

2.8 Sensitive Sites

2.8.1 The Site is centred on national grid reference SK6764786722 within a flat lying land resting on highly permeable sand/gravel and Sherwood Sandstone deposits. A Sensitive Receptor Plan, drawing ref; 3982-CAU-XX-XX-DR-V-1800 details receptors within 500m of the Soil Treatment Facility.

2.8.2 The proposed STF site is in a predominantly agricultural setting of which Loundfield Farm is located 500m to the east. Other nearby residential and domestic dwellings include a few properties and a travellers site located on Daneshill Road. Industrial/ commercial properties such as Retford Ready Mix Limited (concrete suppliers) and Retford Dismantlers (used trucks) are located 330m south and 440m south-south-east from the site. Recreational activities including the Daneshill Sailing Club is located 520m west from the site boundary which utilises the Daneshill Local Nature reserve and lakes as part of its activities.

2.8.3 The site is bound by a number of populated settlements; the village of Lound 1.5km south east, Torworth Village 1.8km west, Mattersey village 2.6km north-north-east and the largest of the four settlements, Ranskill located 1.9km north-west from the site boundary.

2.8.4 A review of the prevailing wind direction has identified that the most dominant wind is from the south-west/south-south-west towards north-east/north-north-east. The wind direction is likely to blow towards Mattersey Village and agricultural fields. Given the distance from the site boundary and the transient nature of odours from site, it is considered that receptors are unlikely to be impacted as odours are likely to dissipate in this distance.

2.8.5 A search within 500m did not locate any Special Protection Areas (SPA's), Specials Areas of Conservation (SAC's), Areas of Outstanding Natural Beauty (AONB), National Nature Reserves (NNR's) RAMSAR Sites, Ancient Woodlands or World Heritage Sites.

2.8.6 There are no Air Quality Management Areas (AQMA's) in the vicinity of the site.

2.8.7 The site is located on river material classified by the Environment Agency as a secondary A aquifer of which is further underlain by the Chester Formation, part of the Sherwood Sandstone Group and which is classed as a principal aquifer.

2.8.8 The potential receptors within 500m of the site boundary are provided on Drawing 3982-CAU-XX-XX-DR-V-1800 and are summarised in Table 1.

Table 1: Potential Receptors identified within 500m of the site boundary

Receptor	Activity	Distance from site	Direction from site
Travellers Site	Residential	155m	SWS
Daneshill Road	Public road	250-500m	S, W, SW
Retford Ready Mix Limited	Industrial premises (concrete plant)	330m	S
Daneshill Lakes Nature Reserve	Nature Conservation	400m	W
Retford Dismantlers	Industrial vehicles dismantling	440m	W
Loundfield Farm	Residential	495m	E
Mattersey Hill Marsh SSSI	Nature Conservation	500m	NW
Residential properties off Daneshill Road	Residential	500m	SW
Daneshill Sailing Club	Recreational	520m	W
Scrap Yard	Industrial	860m	NW

2.8.9 The closest SSSI is Groby's Flash. It is understood that these flashes are the result of subsidence caused by natural or anthropogenic halite dissolution at depth and it is further understood that water within these flashes ranges from fresh to saline due to the present of saline springs in some pools. There is no evidence of any such springs in the immediate vicinity of the site. To the east of the site, two small, enclosed pools are located east of the railway line.

3. SOURCE TERM CHARACTERISATION

3.1.1 The source term characterisation details provided in the 2004 ESID for the landfill remain valid, no activities relating to the permit were carried out on the proposed STF area. During the May 2004 ESID report, Cells 11 and 12 (proposed STF) were proposed for landfill operations, however this did not commence. The site was historically agricultural land prior to it being developed as a Royal Ordnance Munitions factory until its closure in the 1970's. The site was acquired by Nottinghamshire County Council (NCC) and the factory was demolished.

3.1.2 The STF will treat hazardous soils prior to enabling their use as restoration materials for the landfill. Contaminants within the waste soils are organic and will predominantly comprise (but not be limited to) the following:

- a range of petroleum hydrocarbons (e.g. petrol, heating fuel, diesel, used oils crude oil)
- polycyclic aromatic hydrocarbons (PAH's)
- creosote
- phenols and
- chlorinated solvents and other volatile organic compounds
- Visible bound asbestos debris suitable for removal by hand picking

3.2 Pollution History

3.2.1 From a review of previous reports and operational records, it is concluded that there have been no historical incidents which may have given rise to any significant land pollution. There are no CAR reports or improvement conditions which have indicated a contamination pollution event within the vicinity of the site.

3.3 Historic land-uses

3.3.1 Historical activities on site were summarised in the 2004 ESID site condition report (Appendix 2) for the wider Daneshill Landfill Site from review of historical ordnance survey mapping.

3.3.2 Prior to any waste activities, the site was previously operated as an Royal Ordnance Factory (ROF) munitions factory, where the site was eventually decommissioned and ownership transferred in the 1970's and 1980s. The Ranskill factory was a United Kingdom Ministry of

Supply, World War II explosive ROF which was built to manufacture cordite, producing 300tons of cordite per week. Codite production ceased in 1945, but the site was retained by the ministry on a "care and maintenance" basis for a further 30 years. A Research Department Explosive (RDX) plant was installed in the 1950s, which is an explosive widely used in military and industrial application. The production plant at ROF Ranskill was eventually broken up from the 1975 with useful spares from the RDF plant sent across to the ROF Bridgewater before the site was handler over to become the Defence Estates for disposal

3.3.3 The Nottingham County Council website did not indicate any references to contaminated land at the Daneshill ROF at Ranskill, there are no available records to identify any demolition and subsequent restoration/remedial works undertaken. The site was confirmed by Basset District Council 'not designated as contaminated'.

3.3.4 The historic land uses have been summarised below:

Date	Description	Source
Within the footprint of the Daneshill Landfill Site		
1921	Land use agricultural with drain on wester perimeter of site	OS County Series, 1:2,500 scale and 1:10,560
1939	Royal Ordnance Factory Ranskill created by Ministry of Works to produced explosive chargers and propellants for World War II on location of proposed Soil Treatment Facility.	Ranskill.org.uk
1948	Railway network, tracks and buildings encroaching on wider site. Area still predominantly agricultural.	OS County Series, 1:10,560 scale
1956	Marshy ground in northern corner of site	OS Plan (1:10,560)
1964	No change since previous mapping	OS Plan (1:2,500)
1969	North and western corners of site mapped as marsh and woodlands	OS Plan (1:10:560)
1970	Evidence of ROF munitions factory with a network of several buildings barracks and factory outbuildings.	1970 mapping from ranskill.org.uk
1991	Change in land use in the north eastern part of the wider landfill site development from agricultural to refuse dump	OS Plan (1:10,000)
Land use of surrounding area outside of Daneshill Landfill Site footprint		
1964	Danes Hill including woodland, buildings, Cottages and a Smithy lie on the sites southern perimeter. South of Danes Hill a pump is present. The Great Northern Railway runs along the west perimeter of the site.	OS County Series, (1:2,500) and (1:10,560)
1948	Predominantly agricultural land. The development of the area north west of the site along the railway line, Globe Fork Works and other buildings. Tanks and development of the area east of the site.	OS County Series, (10,560)

	A sheepwash is present south of the site. A gravel pit is located north of the site and Mattersey Hill Moises Plantations.	
1956	The gravel pit has expanded to the north west of the site. Agricultural land changed to woodland. Loundfield farm borders the eastern edge of the site.	OS Plan (1:10,560)
1964	No change	OS Plan (1:2,500)
1969	Lakes present to the west of the site and marshland between the site and the railway line. Sand and gravel quarry is an active works to the north. In the north east is the Mattersey and sand quarry along with the Antcliff Plantation.	OS Plan(1:10,560)
1991	South west of the site is Danes Hill lake (Nature Reserve) and Bird Sanctuary. The Mattersey quarry north of the site is now disused. Timber yard located to the north west of the site. Danes Hill buildings south of the site are no longer present.	OS Plan(1:10,000)

3.4 Evidence of existing or historic contamination

3.4.1 The 2004 ESID report carried out a reconnaissance of the wider Daneshill Landfill area, in particular to the non-landfill areas and facilities that have potential to create pollution findings are summarised below:

Storage tanks - No evidence of cracks or spillages evident e.g. staining or breaks in tank walls. Stored on impermeable surfacing on Cell 10b, not within the proposed area for STF.

Hardstanding and bunded areas – Hardstanding areas laid to fall towards an interceptor, no evidence of surface cracks or any other damage. No polluting substances handled outside of hardstanding areas.

Surface Water features – No evidence of discolouration, surface films, turbidity, or odour which would suggest possible contamination.

Surface water, drainage and foul drainage – Drainage around vehicle refuelling areas discharges via interceptors. Surface water discharges via soakaway/interceptor.

3.4.2 Findings from the WRG 2004 ESID report did not observe any visual evidence of significant pollution to the site.

3.4.3 In addition, a site visit was carried out in February 2019 by a Caulmert Environmental Consultant. The existing site as well as the immediate surroundings were inspected.

3.4.4 A Site Inspection Record is provided in Appendix 1 which includes photographic evidence of the current condition of the site of the proposed operations.

3.5 Baseline soil and groundwater reference data

3.5.1 The proposed STF area was previously used as a munitions factory, since its decommissioning, no landfilling or waste activities were carried out. At the time of the May 2004 ESID, the site was proposed for landfill operations, however these activities did not commence. The area was provided with impermeable surfacing without a sealed drainage system. Due to the many years of wear & tear since the munitions, the site surfacing shows many areas of cracks and breakages, therefore, the integrity of the concrete surfacing cannot be fully established. Based on the site inspection, the platform of the site will be redeveloped by use of subsurface drainage, a GCL layer and impermeable surfacing for the proposed STF activity.

3.5.2 A review of the 2004 ESID report identified that there have been no past pollution incidents or spillages within the wider Daneshill Site. Given the nature of historic activities, it is considered that there is little likelihood that land pollution occurred in the non-landfilling areas, therefore further intrusive monitoring of the site is not required.

4. PERMITTED ACTIVITY

Permitted activities

4.1.1 Daneshill Landfill Site is currently permitted under EPR/NP3538MF and operated by FCC Recycling (UK) Ltd. Other permitted activities included the treatment of soils under Standard Rules permit SR2010No12 'Treatment of waste to produce soil, soil substitutes and aggregate' which allows the operator to store and treat wastes (excluding hazardous' not exceeding 75,000 tonnes per year. In addition, the storage and recycling of fridge freezers were carried out.

4.1.2 The permit variation is to include a Soil Treatment Facility on the former aggregates recycling pad within the landfill site boundary and to handle 29,999 tonnes per annum of hazardous soils and 20,001 tonnes of non-hazardous soils over a 10-year period. The treated soils will be primarily used in the restoration of the landfill site. The treatment areas consist of 2 treatment pads measuring at 3450m2 and 3500m2 for biotreatment/physical treatment and another 1 x 48800m2 treatment pad solely for screening/processing.

4.1.3 The activities that will take place include the biological waste treatment of hazardous soils with the temporary storage of hazardous waste whilst formal acceptance analysis is conducted. Non-hazardous soils will be screened to remove oversize inclusions prior to reuse after validation testing is complete. Visible bound asbestos will be segregated by screener and a handpicking line. Soils to be accepted are outlined in the supporting document.

4.1.4 The STF will incorporate a biofilter as part of the treatment process to treat air that has been extracted from hydrocarbon impacted soils. In addition, a water treatment system is

shown that allows for temporary water storage and treatment prior to any disposal off-site or reuse in the biotreatment works.

Plan showing activity layout

4.1.5 The proposed boundary and activity layout and drainage detail is shown on drawing ref: 3982-CAU-XX-XX-DR-V-1805 'Proposed Site Layout Plan'.

Environmental risk assessment

4.1.6 An environmental risk assessment has been carried out to support the permit application; this is presented separately within the '*Amenity and Accident Risk Assessment*' (document reference 3982-CAU-XX-XX-RP-V-0303). This report is based on Environment Agency guidance and assesses the potential risks from odour, noise, fugitive emissions and accidents.

4.1.7 The risk assessment identifies risk mitigation measures such as infrastructure, equipment or operational practices that are required to manage the risks from the site. Identified mitigation measures are incorporated as part of the management measures for the Site. The identified activities that will be conducted at the site which may lead to land pollution along with the identified preventative measures that are needed to be in place to protect the land are presented within 'Fugitive emissions' and 'Accidents' tables of the above report.

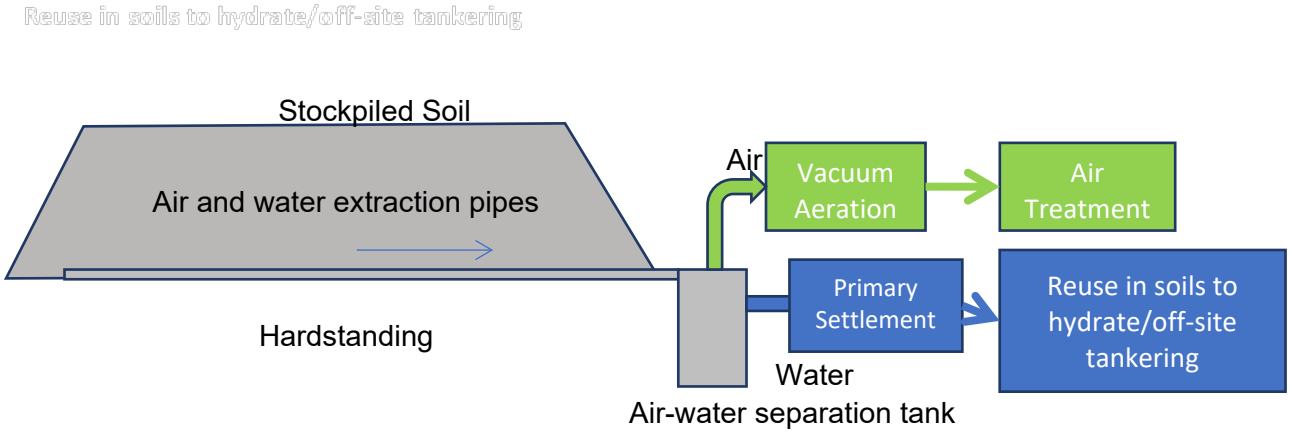
4.2 Proposed Operations

4.2.1 The treatment of 29,999 of hazardous soils and 20,0001 tonnes of non-hazardous soils per annum is proposed at Daneshill Soil Treatment Facility. The usual maximum treatment time for soils is 6 months in general with the majority being treated in periods of between 8-16 weeks. Treatment will consist of bioremediation with a screening and hand picking line for the removal of oversize inclusions and asbestos fractions.

Bioremediation of Soils

4.2.2 The proposed bioremediation process will utilise industry standard biopile technology and will operate through means of use of biopiles and moisture control, addition of suitable amendments to the soil, forced air extraction to encourage micro-organism growth and breakdown of hydrocarbons into by products such as carbon dioxide and water vapour. The process is detailed in Figure 1 below.

Figure 1: Bioremediation process proposed at Daneshill Soils Treatment Facility



4.2.3 Prior to any requirement for biotreatment, soils containing any hydrocarbons will be inspected for any visible bound asbestos. If present, soils will undergo pre-acceptance testing to confirm that the asbestos fibre content is lower than 0.1% for chrysotile asbestos and 0.01% for all other forms of asbestos. Upon satisfactory receipt of pre-acceptance results, the stockpiles will undergo screening and handpicking to remove the visible asbestos fraction It will then will be moved into the biotreatment phase will be formed into biopiles and placed on water and air extraction pipes. These extraction pipes are connected to a blower that will draw air through the soils where it is then passed through a biofilter before being discharged to air. Excess water draining through the soils will be collected and treated to remove any oils or suspended solids.

4.2.4 This step is not implemented when soils do not contain visible asbestos debris, soils will just be subject to standard reception testing to ensure that the hydrocarbons present are compliant with the initial waste description and are treatable for reuse on the Daneshill landfill.

4.2.5 Standard NPK fertiliser 25:05:05 ratio, typically added initially at 1kg/tonne of soil per application. Occasionally, an organic additive such as woodchip is added, it is anticipated that a maximum of 1,500 tonnes per annum of amendment at ~5% will be added to clayey soils to break up the cohesive nature of the soils and aid aeration.

4.2.6 The typical reception/quarantine area is shown on drawing 3982-CAU-XX-XX-DR-V-1805, however the exact layout will vary over time dependent upon inputs and treatment timescales. Demarcation of the areas will be managed via suitable signage and/or barriers.

4.2.7 These activities all take place within separately designated impermeable areas within the proposed permit boundary as shown on drawing ref: 3982-CAU-XX-XX-DR-V-1805 'Proposed Layout Plan'. Drainage systems at the site will lead to sealed sumps and holding tanks which will be treated for reuse in the biopile or tankered off site to an appropriate disposal site. No surface water runoff will be released to the environment.

Asbestos containing soils

4.2.8 The approach is to accept hazardous asbestos impacted soils which can be treated and recovered to soils of a non-hazardous classification. Asbestos containing soils will undergo a number of pre-acceptance conditions, the overall soil treatment approach is detailed in Figure 2 below.

Figure 2: Overall Soil Treatment process at Daneshill Landfill Site

4.2.9 It is not proposed to accept soils that would result in airborne asbestos emissions above the method of detection limit for air sampling, no disposal of hazardous materials within the landfill is proposed.

4.2.10 Following acceptance and valid pre-acceptance testing results to confirm chemical validity, non-hazardous soils will be placed into their respective treatment batches and undergo physical treatment. Non-hazardous soils will be screened to remove oversize inclusions prior to reuse to ensure they are physically suitable.

Drawings

LEGEND

- AREA OF PROPOSED ACTIVITY
- 1000m OFFSET BOUNDARY
- MAJOR ROAD
- MINOR ROAD
- RAIL
- SURFACE WATER
- PUBLIC AREAS
- AGRICULTURAL
- COMMERCIAL
- INDUSTRIAL
- RESIDENTIAL
- EDUCATION
- SSSI

REV	MODIFICATIONS	BY	RE	AP	DATE
P02	RECEPTOR BOUNDARY INCREASED	EJD	KB	AS	25.11.20
P01	ISSUED FOR INFORMATION	EJD	KB	AS	10.12.19

PURPOSE OF ISSUE: FOR INFORMATION
STATUS: S2

CLIENT: FCC Environment

PROJECT:
DANESHILL
SOILS TREATMENT
FACILITY

TITLE:
1000m SENSITIVE
RECEPTOR
PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
KB	EJD	KB	KB

DATE	SCALE @ A1	JOB REF:	REVISION
04.11.2019	1:2500	3982	P02

DRAWING NUMBER
3982-CAU-XX-XX-DR-1800

Caulmert
engineering environmental planning

WWW.CAULMERT.COM

©COPYRIGHT CAULMERT LIMITED - NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM CAULMERT LIMITED

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

NOTE

AREA OF PROPOSED ACTIVITY

©COPYRIGHT CAULMERT LIMITED - NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM CAULMERT LIMITED

REV	MODIFICATIONS	BY	RE	AP	DATE
P2	ISSUED FOR INFORMATION	EJD	KB	AS	10.12.19
P1	ISSUED	KB	KB	KB	14.11.19

PURPOSE OF ISSUE: FOR INFORMATION

STATUS: S2

CLIENT: FCC Environment

PROJECT:
DANESHILL
SOILS TREATMENT
FACILITY

TITLE:
SITE
LOCATION
PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
KB	KB	KB	KB

DATE	SCALE @ A1	JOB REF:	REVISION
14.11.2019	1:10000	3982	P2

DRAWING NUMBER: 3982-CAU-XX-XX-DR-1801

Caulmert
engineering environmental planning

WWW.CAULMERT.COM

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

NOTE

1. DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

LEGEND

PERMIT BOUNDARY

AREA OF PROPOSED ACTIVITY

REV					
P1	ISSUED FOR INFORMATION	EJD	KB	AS	03.02.20
REV	MODIFICATIONS	BY	RE	AP	DATE

PURPOSE OF ISSUE: FOR INFORMATION

STATUS: S2

CLIENT: FCC Environment

PROJECT:

DANESHILL
SOILS TREATMENT
FACILITY

TITLE:

SITE BOUNDARY PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
KB	EJD	KB	KB

DATE	SCALE @ A3	JOB REF:	REVISION
17.12.2019	1:5000	3982	P1

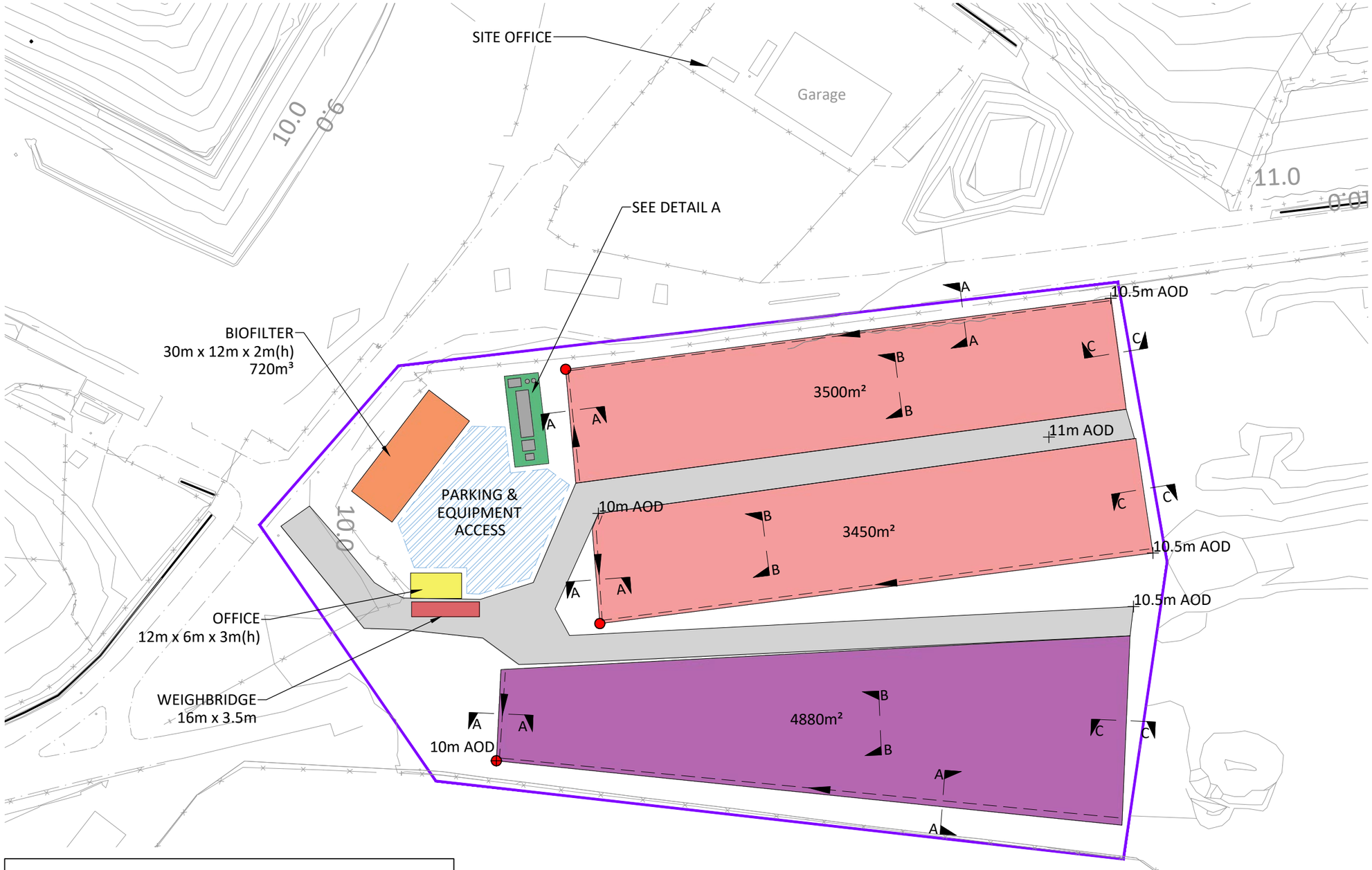
DRAWING NUMBER: 3982-CAU-XX-XX-DR-V-1804

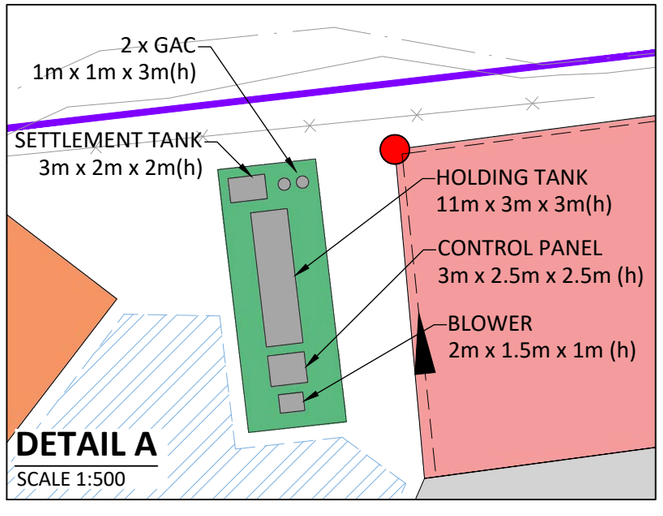
Caulmert
engineering environmental planning

WWW.CAULMERT.COM

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

©COPYRIGHT CAULMERT LIMITED - NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM CAULMERT LIMITED





DETAIL A
SCALE 1:500

SITE LAYOUT
SCALE 1:1000

NOTES

1. DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

3. DESIGN BASED ON PROVECTUS DRAWING - DANESHILL 1

4. SECTIONS SHOWN ON DRAWING 3982-CAU-XX-XX-DR-C-1806

LEGEND

- AREA OF PROPOSED ACTIVITY
- LEACHATE & DRAINAGE FLOW DIRECTION
- SECTION LINES
- BIOTREATMENT SCREENING AND PROCESSING AREA
- SCREENING / PROCESSING
- ACCESS ROAD
- WATER COLLECTION & PUMPING CHAMBER

REV					
P2	LEGEND UPDATED	EJD	KB	AS	24.03.20
P1	ISSUED FOR INFORMATION	EJD	AS	AS	06.02.20
REV	MODIFICATIONS	BY	RE	AP	DATE

PURPOSE OF ISSUE: FOR INFORMATION
STATUS: S2

CLIENT: FCC Environment

PROJECT:
DANESHILL
SOILS TREATMENT
FACILITY

TITLE:
PROPOSED
LAYOUT
PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
JC	EJD	JC	JC
DATE	**SCALE @ A3**	**JOB REF:**	**REVISION**
04.02.2020	AS SHOWN	3982	P2

DRAWING NUMBER
3982-CAU-XX-XX-DR-1805

Caulmert
engineering environmental planning

WWW.CAULMERT.COM

©COPYRIGHT CAULMERT LIMITED - NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM CAULMERT LIMITED

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG Company Registered No: 06716319

APPENDIX 1

Site Inspection Record

Daneshill Proposed Soil Treatment Facility
Photo Record Report
October 2019
Caulmert Ltd

1.1.1 The site inspection took place in October 2019 by a Caulmert Limited employee. The inspection took the form of a walk-over over the area proposed for the soil treatment operation.

1.1.2 The purpose of the visit was to assess the presence of pollution linkages that could result in contamination from the current land activities. Estates Surveyor, Emily Hanlon from FCC Environment Ltd accompanied the site visit.

1.1.3 A summary of the observations are presented below:

- The condition and permeability of the existing concrete surfacing could not be determined due to the quantity of soils covering concrete surface. However, there was evidence of cracking/breakage across the surface. Evidence from the photographs detailed below shows a mixture of soils and stones across the majority of the surface.

- The site was previously used as a Royal Ordnance ammunitions factory, evidence of a small rail/tram line still exists (as shown in the site photos) as well as foundations from previous structures. The site area was reported to have more recently been used as storage for WEEE, inert soils processing, composting of green waste.

- Due to the uncertainties of the integrity of the existing site surface, it is proposed to strip off the soils and excavate and crush the current concrete surface and laydown impermeable treatment pads with integrated drainage.

Site Inspection Photographs

Figure 1 area of proposed STF operations existing concrete conditions

Figure 2 area of concrete pad looking to the north west

Figure 3 closer inspection of concrete pad with disused rail line

Figure 4 Existing site surface at proposed STF area

Appendix 2:
ESID Report (SLR, 2004)

SECTION A

ENVIRONMENTAL SETTING AND INSTALLATION DESIGN

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 REPORT CONTEXT 1
1.2 INSTALLATION DETAILS 1
2.0 SOURCE TERM CHARACTERISATION 4
2.1 THE DEVELOPMENT OF THE INSTALLATION 4
2.1.1 Historical Development 4
2.1.2 Proposed Development 5
2.2 INSTALLATION ENGINEERING 9
2.2.1 Groundwater Management System 9
2.2.2 Basal Lining System 9
2.2.3 Side Slope Lining System 11
2.2.4 Capping System 11
2.2.5 Restoration and Aftercare 12
2.3 LEACHATE MANAGEMENT AND MONITORING 12
2.3.1 Leachate Generation 12
2.3.2 Leachate Management and Monitoring 12
2.4 LANDFILL GAS MANAGEMENT AND MONITORING 15
2.4.1 Landfill Gas Generation 15
2.4.2 Landfill Gas Management 16
2.4.3 Landfill Gas Monitoring 16
2.5 POST CLOSURE CONTROLS 17
3.0 PATHWAY AND RECEPTOR TERM CHARACTERISATION 19
3.1 CLIMATE 19
3.2 GEOLOGY 20
3.2.1 Solid Geology and Structure 20
3.2.2 Drift Geology 21
3.3 MAN-MADE SUBSURFACE PATHWAYS 22
3.4 HYDROLOGY 22
3.4.1 Off-site Hydrology 22
3.4.2 Surface Water Management System 23
3.5 HYDROGEOLOGY 24
3.5.1 Aquifer Characteristics 24
3.5.2 Groundwater Flow 26
3.5.3 Groundwater Quality 26
3.6 OFF-SITE LANDFILL GAS MONITORING 26
3.7 RECEPTORS AND COMPLIANCE POINTS 27
3.7.1 Hydrogeological Risk Assessment 27
3.7.2 Landfill Gas Risk Assessment 28
3.7.3 Risk Assessment for Nuisance and Health Issues 28
4.0 SITE REPORT 29
4.1 INTRODUCTION 29
4.1.1 Site Location 29
4.1.2 Details of Installation 29

4.2 OBJECTIVES 29
4.3 SITE ENVIRONMENTAL SETTING AND POLLUTION HISTORY 30
4.4 RECONNAISSANCE 30
4.5 SCOPE 31
4.6 IDENTIFICATION OF POTENTIALLY POLLUTING SUBSTANCES 32
4.7 IDENTIFICATION OF PREVENTATIVE MEASURES 32
4.8 ASSESSMENT OF POLLUTION PREVENTION MEASURES AND LIKELIHOOD OF LAND POLLUTION 32
4.9 CONCEPTUAL SITE MODEL 33

TABLES

Table ESID 1: Potential Environmental Receptors within the Vicinity of Daneshill Landfill..2
Table ESID 2a: Historic Map Land Use within the Installation Boundary 4
Table ESID 2b: Historic Map Land Use Surrounding the Installation Boundary 4
Table ESID 3: Summary of Existing Phase Design....6
Table ESID 4: List II Substances Detected in Leachate 8
Table ESID 5: Leachate Volumes Tankered and Recirculated During 2002 & 2003 13
Table ESID 6: Leachate Level Monitoring Statistics 14
Table ESID 7: The Conceptualisation of Management Measures and Technical Controls throughout the Landfill Life Cycle 18
Table ESID 8: Environment Agency Surface Water Quality Classifications....22
Table ESID 9: Licensed Surface Water Abstractions within 3km Radius of Daneshill Landfill....23
Table ESID 10: Discharge Consents within 1km Radius of Daneshill Landfill 23
Table ESID 11: Aquifer Characteristics 24
Table ESID 12: Licensed Groundwater Abstractions within 3km Radius of Daneshill Landfill 25
Table ESID 13: Summary of Boreholes Recording Methane Gas Above 1% V/V....27
Table ESID 14: Site Reconnaissance....31
Table ESID 15: Areas Not Subject to Permanent Deposition of Waste 31
Table ESID 16: Assessment of Likelihood of Land Pollution….33

DRAWINGS

Dwg No	**ESID1**	**Scale**	50,000	**Title**	Location
Detail		Site location in relation to surrounding features			
Dwg No	**ESID2**	**Scale**	2,500	**Title**	Environmental Site Setting
Detail		Installation boundary			
		Residential areas			
		Schools			
		Recreational areas			
		Waterways			
		Water bodies			
		Agricultural areas			
		Urban sites			
		Flood risk map overlay			
		Roads, railways			
Dwg No	**ESID3**	**Scale**	50,000	**Title**	Cultural and Natural Heritage
Detail		Natural heritage SSSIs, Cultural heritage Listed buildings Scheduled ancient monuments			
Dwg No	**ESID4**	**Scale**	2,000	**Title**	Site Layout and Waste Deposition
Detail		Cell layout			
		Filled areas			
		Pre-settlement contours			
		Infrastructure (tanks, hard surfacing, quarantine areas)			
		Security infrastructure			
Dwg No	**ESID5**	**Scale**	2500	**Title**	Restoration
Detail		Post settlement contours			
		Topography 500m outside site			
		Landscape planting proposals			
		Aftercare proposals			
Dwg No	**ESID6**	**Scale**	As shown	**Title**	Installation
Detail		Summary of engineering details for the installation of the lining system and capping system inclusive of schematic cross sections of as-builts and proposals			
Dwg No	**ESID7**	**Scale**	2500	**Title**	Leachate Management
Detail		Leachate sumps, abstraction wells, risers etc (sections may be necessary)			
		Leachate treatment plant			
		Monitoring point location/ construction detail (sections may be necessary)			
Dwg No	**ESID8**	**Scale**	2,000	**Title**	Landfill Gas Management
Detail		Gas wells (location and construction)			
		In waste monitoring points			
		Perimeter/external monitoring points			
		Flare(s) location			
		Engine location			
		Aerial emission monitoring points			

Dwg No	**ESID9**	**Scale**	50,000	**Title**	Regional Geology
Detail		Regional geology (taken from BGS Geological Map)			
		Any appropriate regional cross sections			
Dwg No	**ESID10 A/ 10B**	**Scale**	25,000	**Title**	Regional Hydrogeology and Hydrology
Detail		Aquifer classification			
		SPZs			
		Licensed and private abstractions from ground and surface water			
		Springs			
		Regional Groundwater contours			
		Groundwater vulnerability			
		Off-site groundwater monitoring points			
Dwg No	**ESID11**	**Scale**	2,000	**Title**	Local Hydrogeology and Hydrology
Detail		Groundwater monitoring points (NB logs in conceptual site model/ hydro risk assessment)			
		Groundwater contours (for each ground water body)			
		Local springs			
		Surface water management features			
		Surface water monitoring points			
Dwg No	**ESID12**	**Scale**	As shown	**Title**	Hydrogeological Cross Sections
Detail		Geology			
		Groundwater levels			
		Groundwater flow to discharge points			
		Inter-relationship between; site (base and sides), leachate levels, groundwater levels and relevant surface water features			
Dwg No	**ESID13**	**Scale**	2500	**Title**	Source, Pathways, Receptors
Detail		Landfill cells			
		Leachate management plant			
		Landfill gas flares, engines			
		Met station location			
		Receptors			
		Surface water Groundwater Amenity			
		Pathways			
		Air- include wind rose Surface water Groundwater Drains- pipes etc Migration through surrounding strata			

APPENDICES

Appendix ESID1 List I Results for Leachate and Groundwater Samples
Appendix ESID2 Leachate Quality – Results of Routine Monitoring
Appendix ESID3 Selected Leachate Chemographs
Appendix ESID4 Leachate Management Risk Assessment
Appendix ESID5 Leachate Hydrographs
Appendix ESID6 Estimates of Landfill Gas Generation
Appendix ESID7 Available Borehole Logs
Appendix ESID8 Surface Water Management Risk Assessment
Appendix ESID9 Surface Water Quality – Results of Routine Monitoring
Appendix ESID10 Selected Surface Water Chemographs
Appendix ESID11 Groundwater Elevation Data
Appendix ESID12 Groundwater Quality Data Summary
Appendix ESID13 Off-site Landfill Gas Monitoring – Results of Routine Monitoring

1.0 INTRODUCTION

1.1 Report Context

SLR Consulting Ltd (SLR) has been appointed by Waste Recycling Group (WRG) to prepare a PPC Permit Application in support of the further development of the Daneshill Landfill facility, located to the north-west of Retford, Nottinghamshire (Drawing No. ESID1).

Daneshill Landfill is regulated by Waste Management Licence No. 1/92/112/68/NE and waste disposal operations commenced in 1984. To-date waste disposal operations at Daneshill Landfill have taken place within Phases 1 & 2, and Cells 1 to 7, 8A, 8B & 9B; Cells 9A, 10A, 10B, 11 & 12 have not yet been constructed (Drawing No. ESID2). Phases 1 & 2 were completed and restored by 1993. Cells 1, 2, 3, 4 & 5 were completed by 1997, with Cells 6 and 7 constructed in 1996 & 1997 respectively. Cell 8A was constructed in 1999 with Cell 8B built in 2000; cell 9B was constructed in 2002. Phases 1 & 2 and Cells 1 to 7 have been capped and restored, with Cells 8A, 8B & 9B currently being infilled. It should be noted that Phases 1 & 2 have been developed remotely from the rest of the site, the newer areas in the west of the site being identified by being called cells, and not phases.

The installation for which a PPC Permit Application at Daneshill Landfill has been made includes the leachate and landfill gas management plant and all landfill phases and includes the area currently occupied by the Civic Amenity (CA) Site.

This report sets out the details of the site's conceptual model of environmental setting and installation design and it should be read in conjunction with the supporting risk assessments.

1.2 Installation Details

Daneshill Landfill (Centred NGR SK 675 867) is located approximately 2km east of Lound village, and 6km north-west of Retford (Drawing No. ESID1). Tipping within all the previous phases was by co-disposal and the site accepts both hazardous and non-hazardous waste; however; it is proposed that the site will operate as a non-hazardous facility following issue of the PPC Permit.

The PPC Application boundary is presented within Drawing No. ESID2 and includes the whole of the site, i.e. the largely restored Phases 1 & 2, as well as Cells 1 to 7, 8A, 8B, 9A, 9B, 10A, 10B, 11 and 12 and the gas management plant, CA site and the site compound and site access. All phases are included within the PPC installation as there is no separation between the restored areas and those being actively tipped. The boundary of the entire landfill site is securely fenced and access to the landfill is only possible via a private entrance road, which is gated, and locked during non-operational hours.

Daneshill Landfill lies at an elevation of approximately 10mAOD and is surrounded by a surface water drainage ditch around the areas already restored. The surrounding area is sensibly level with minor undulations. Levels vary between a high of up to 16m AOD (some 2km west of the site), falling to less than 10m AOD to the north and east of the site, though local high points are present. The site is bordered to the north and east by agricultural land and mixed woodland, whilst the site is bounded to the west and south-west by a nature

reserve and the Daneshill Lakes. The closest buildings to the site are Daneshill cottages which lie approximately 75m to the south-west of the site, whilst Loundfield Farm is located 200m east of the site.

Surface water from the site is currently collected and channelled to a surface water lagoon in the south-west of the site, which allows for settling and filtering of the water prior to discharge from the site to the local network of drains.

A summary of the potential environmental receptors that are located within the vicinity of the Daneshill Landfill is presented within Table ESID1 and Drawings ESID 2, ESID 3 and ESID 13. Further identification of the potential hazards and risks to these receptors is provided within the accompanying risk assessments.

TABLE ESID 1: POTENTIAL ENVIRONMENTAL RECEPTORS WITHIN THE VICINITY OF DANESHILL LANDFILL

Receptor Name	Type of Receptor	Minimum Distance from Boundary	Direction from Site Boundary	Receptor Reference (Drawing No.ESID13)
Farmland	Farmland	Adjacent	North and East	3.1
Drain	Surface Water	Adjacent	North-East	3.2
Track	Road	250m	East	3.3
Loundfield Farm	Residential	200m	East	3.4
Depot	Commercial/ Industrial	300m	South-East	3.5
Works	Commercial/ Industrial	250m	South	3.6
Traveller's Site	Residential	160m	South	3.7
Daneshill Road	Public Highway	Adjacent	South	3.8
Daneshill Lakes Nature Reserve	Associated Flora and Fauna	30m	South-West & West	3.9
Daneshill Piggery	Agricultural	300m	West	3.10
Daneshill Cottages	Residential	60m	West	3.11
Footpath	Footpath	160m	West	3.12
Drain	Surface Water	Adjacent	West	3.13
Track/ Road	Road	Adjacent	North-West	3.14
Scrap Yard	Commercial/ Industrial	200m	North-West	3.15
Antcliff Plantation	Woodland	20m	North-East	3.16
Nature Reserve (SSSI)	Associated Flora and Fauna	Adjacent	West	3.17
Civic Amenity Site	Commercial	Within site	Within site	3.18
Finningley Airport	Airport	11.5km	North	3.19
Fishing Lakes	Residential and Recreational	400m	North-west	3.20

Table ESID1 includes the closest residential properties only and it should be noted that additional residential areas are present at distances beyond 500m from the site.

Scheduled Monuments within a 5km radius of the site are shown on Drawing ESID3.

Four Sites of Special Scientific Interest (SSSI) have been identified within a 5km radius of the site (Drawing ESID3):

Scrooby Top Quarry (SK 652892) is a working quarry that provides accessible exposures of the Triassic Nottingham Castle Formation. The sequence at Scrooby Top provides an important contribution to our overall understanding of ancient river systems as well as an insight into the palaeogeography of this region during the Triassic period of geological time.

Mattersey Hill Marsh (SK 672874) comprises one of the best examples of mixed marsh in Nottinghamshire. A mosaic of neutral marsh and related plant communities developed on the site of former gravel workings. The site includes sphagnum bog communities within one of the most extensive and species-rich areas for wetland mosses and liverworts in the county. Additional interest is provided by the occurrence of willow carr and by the abundance of aquatic insects.

Chesterfield Canal (SK 722821 – SK 762944) is a 20km stretch of canal between Retford and Misterton supporting a nationally uncommon aquatic plant community characteristic of the brackish, eutrophic water.

Sutton & Lound Gravel Pits (SK 710863 & SK 690835) include extensive open water and marginal habitats which support an exceptionally rich assemblage of breeding, wintering and passage wetland birds.

2.0 SOURCE TERM CHARACTERISATION

2.1 The Development of the Installation

2.1.1 Historical Development

Historic ordnance survey maps have been provided by the Bodleian Library, University of Oxford. These detail the historic uses of the site and the surrounding area. Tables ESID2A and ESID 2B details the historic uses at the Daneshill Landfill site derived from this data.

TABLE ESID 2A: HISTORIC MAP LAND USE WITHIN THE INSTALLATION BOUNDARY

DATE	DESCRIPTION	SOURCE (SCALE)
1921	Land use is agricultural. Drain on the western perimeter of the site.	OS County Series, (1:2,500) and (1:10,560)
1948	The rail network has encroached onto the site adding railway tracks and buildings. Much of the area is still agricultural.	OS County Series, (1:10,560)
1956	Marshy ground in the north corner of the site.	OS Plan (1:10,560)
1964	No change	OS Plan (1:2,500)
1969	North and west corner of the site is marsh and woodland.	OS Plan (1:10,560)
1991	Land use change in the north east corner of the site from agricultural use to refuse dump.	OS Plan (1:10,000)

TABLE ESID 2B: HISTORIC MAP LAND USE SURROUNDING THE INSTALLATION BOUNDARY

DATE	DESCRIPTION	SOURCE (SCALE)
1921	Danes Hill including woodland, buildings, Cottages and a Smithy lie on the sites southern perimeter. South of Danes Hill a pump is present. The Great Northern Railway runs along the west perimeter of the site.	OS County Series, (1:2,500) and (1:10,560)
1948	Predominantly agricultural land. The development of the area north west of the site along the railway line, Globe Fork Works and other buildings. Tanks and development of the area east of the site. A sheepwash is present south of the site. A gravel pit is located north of the site and Mattersey Hill Moises Plantations.	OS County Series, (10,560)
1956	The gravel pit has expanded to the north west of the site. Agricultural land changed to woodland. Loundfield farm borders the eastern edge of the site.	OS Plan (1:10,560)
1964	No change	OS Plan (1:2,500)
1969	Lakes present to the west of the site and marshland between the site and the railway line. Sand and gravel quarry is an active works to the north. In the north east is the Mattersey and sand quarry along with the Antcliff Plantation.	OS Plan(1:10,560)
1991	South west of the site is Danes Hill lake (Nature Reserve) and Bird Sanctuary. The Mattersey quarry north of the site is now disused.	OS Plan(1:10,000)

	Timber yard located to the north west of the site. Danes Hill buildings south of the site are no longer present.	

The site was historically agricultural land prior to being developed as a Royal Ordnance factory. The Royal Ordnance factory was subsequently closed in the 1970s. Nottinghamshire County Council (NCC) subsequently acquired the site and the factory was demolished.

Planning permission for waste disposal at the Daneshill Landfill site was granted to NCC in 1981, and Phases 1 and 2 were subsequently developed from 1984 onwards. The site was operated by Nottinghamshire County Council between 1984 and 1993 when the site was transferred to Waste Notts, a Local Authority Waste Disposal Company wholly owned by NCC. In June 1995, a new planning permission was granted to extend the area for landfilling. The site was subsequently bought by Yorkshire Environmental, who merged with WRG in 1999. A minor revision to the planning permission was granted in 2001.

Phases 1 and 2 were constructed with a basal liner of at least 500mm of compacted colliery spoil which is considered to form the artificial geological barrier beneath these phases. Given the predominantly land-raise nature of the site no sidewall liner was required.

Cells 1 to 7, 8A, 8B and 9B were all constructed with a similar basal engineered containment system. A 1m thick engineered clay (colliery spoil in cells 1, 2 and 3) liner was constructed, underlying a 2mm thick high density polyethylene (HDPE) geomembrane, the geomembrane being protected from the overlying gravel leachate collection system by a geotextile protector.

Table ESID3, presented overleaf, summarises the nature and characteristics of each of the phases developed at Daneshill Landfill.

2.1.2 Proposed Development

The site is currently licensed to receive household, commercial, demolition, ash and industrial wastes together with difficult waste types and sewerage sludge. The total maximum annual waste input was increased to 149,999 tonnes in 1995. It is understood that typical future waste inputs will be around 150,000 tonnes per year. Approximately 1.9 Mm^3 of waste has been deposited to date, with an estimated remaining void space of 2.2Mm^3.

It is proposed that the site will continue to accept a similar range of wastes until issue of the PPC Permit, after which the site will then accept non-hazardous wastes only.

TABLE ESID 3: SUMMARY OF EXISTING PHASE DESIGN

Phase/ Cell No.	Phases 1 & 2	Cells 1 to 7, 8A, 8B & 9B	Proposed Cells 9A, 10A, 10B, 11 & 12
Status	Phase 1 & 2 have been capped and restored for a number of years	Cells 1 to 7 and 8A have been capped and restored Cells 8B & 9B are currently being infilled with waste	Phases 9A proposed to be constructed in 2004, subsequent cells proposed in the future.
Basal Elevation Range/mAOD	8.5 to 10.5m AOD	8.5 to 10.5m AOD	8.5 to 10.5m AOD
Estimated Current Depth of Waste	Approximately 10m	Approximately 18m	Not yet constructed
Basal and Sidewall Liner	500mm thick compacted colliery spoil liner with 2m high compacted colliery spoil intercell and perimeter bunds.	1m thick low permeability clay (colliery spoil in cells 1 to 3) liner overlain by a 2mm thick HDPE geomembrane liner. Site has been developed as a land raise and so the edges of the landfill are represented by 2m high bunds, engineered identically to the base.	1m thick low permeability clay liner overlain by a 2mm thick HDPE geomembrane liner, with 2m high intercell and perimeter bunds constructed as per the basal liner.
Leachate Drainage System	No collection system, three combined monitoring/ extraction points in each phase.	Geotextile protector overlain by a 150mm thick gravel (sand in cells 3 and 4) drainage layer and collection pipework	Geotextile protector overlain by a 150mm thick gravel drainage layer and collection pipework
Capping System	1m thick colliery spoil cap and 900mm thick restoration soils.	Cells 1 to 3 have a 1m thick clay cap, all other cells have 300mm thick stabilisation layer, 1mm thick VFPE geomembrane, geotextile protector and between 1.2m and 1.5m of restoration soils. Cells 7, 8A and 8B have been capped with only 500mm of soils temporarily placed whilst Cell 9B is currently being infilled.	300mm thick stabilisation layer, 1mm thick VFPE geomembrane, geotextile protector and between 1.2m and 1.5m of restoration soils
Additional Engineering Details			
CQA	Phases developed without CQA.	Cells 1 to 3 developed without CQA, all other cells developed with CQA.	Cells developed with CQA.

The site layout is presented as Drawing ESID 4. Phases 1 & 2 have been landfilled and restored for a number of years, along with Cells 1, 2, 3, 4 & 5. Cells 6, 7, 8A & 8B were capped and partially restored in 2003. Cell 9B was constructed in 2003 and is currently operational, Cell 9A is planned to be constructed in 2005, with the remaining cells to be constructed in future years.

Drawing ESID 5 presents the proposed final landform and after-use. It is proposed that the site will be restored to anumber of uses including grassland and woodland.

WRG routinely monitors leachate quality at Daneshill Landfill at a number of leachate monitoring points. The locations of the monitoring points are indicated on Drawing ESID7 and the leachate quality data is presented in the following manner:

- Appendix ESID1 contains a summary of leachate quality List I monitoring data:
- Appendix ESID2 contains a summary of routine leachate quality List II monitoring data:
- Appendix ESID3 includes time-series plots of ammoniacal-N and chloride concentrations

Review of the available monitoring data indicates the following:

- With regards to List I analytical results, substances that have been found at concentrations above appropriate Minimum Reporting Values[1] (MRVs) are:

    - Cadmium maximum: 0.9µg/l (LMH08);
    - Mecoprop maximum:109µg/l (LMH11);
    - 1,4 Dichlorobenzene maximum: 2.1µg/l (LMH08)
    - Naphthalene maximum: 18.7µg/l (LMH01)
    - 2-Methylnapthalene maximum: 2.2µg/l (LMH08)
    - Acenaphthalene maximum: 2.1µg/l (LMH01)
    - Fluorene maximum: 1.2µg/l (LMH01)
    - MTBE maximum: 10.3µg/l (LMH08)
    - Ethylbenzene maximum: 10.3µg/l (LMH11)
    - m,p-xylene maximum: 26.1µg/l (LMH11)
    - o-xylene maximum: 15.5µg/l (LMH08)
    - Toluene maximum: 8.9µg/l (LMH11)
    - 1,2,4-trimethylbenzene maximum: 13.0µg/l (LMH11)
    - p-isopropyltoluene maximum: 28.3µg/l (LMH11)

With regards to List II and general substances, Table ESID 4 shows the maximum recorded concentration in leachate compared to the current drinking water standard (DWS) for that

[1] [1] Environment Agency, 2003. *Hydrogeological Risk Assessments for Landfills and the Derivation of Control and Trigger Levels.* Environment Agency, Bristol.

substance. A risk factor is also included which is calculated by dividing the maximum observed concentration by the drinking water standard. This gives an indication of the potential for a contaminant to cause pollution by leaking from the landfill.

TABLE ESID 4: LIST II SUBSTANCES DETECTED IN LEACHATE

Determinand (units)	Maximum Recorded Value	DWS	Risk Factor
Phenol (ug/l)	3130	0.5	6260
Ammoniacal Nitrogen (N:mg/l)	1880	0.39	4820
Iron (Diss) (mg/l)	90.45	0.2	452
Manganese (Diss) (mg/l)	18	0.05	360
Nickel (Diss) (mg/l)	0.65	0.02	32
Phenol(monohydric) (mg/l)	7.8	0.5	15
Total Sulphur (Diss) (SO4:mg/l)	3660	250	14
Sodium (Diss) (mg/l)	2190	200	10
Chloride (mg/l)	2430	250	9
Total Sulphur (SO4:mg/l)	1570	250	6
Chromium (Diss) (mg/l)	0.3	0.05	6
Lead (Diss) (mg/l)	0.04	0.025	2
Zinc (Diss) (mg/l)	1.1	5	0.22
Copper (Diss) (mg/l)	0.36	2	0.18

The leachate quality defaults that are presented within the LandSim and LandSim2 Manuals are primarily derived from the Department of the Environment's study[2], which considered the composition of leachate generated within all of the different types of landfill sites that have taken, or are taking, primarily municipal wastes. Comparison of the Daneshill Landfill leachate quality with the LandSim defaults indicates that:

- The general composition of the Daneshill Landfill leachate is typical of landfills that have received primarily municipal wastes; and

- The composition of the leachate is broadly comparable to the LandSim defaults.

Notwithstanding the potential impact of the Landfill Directive upon the waste types that may be deposited at Daneshill in the future, it is considered prudent to assume that the future quality of the leachate would be similar in character to that already found within the existing landfill site.

The nature of the leachate present within Daneshill Landfill confirms that:

- The site represents a potential hazard to ground and surface water resources in that it contains List I and List II Substances;

[2] Department of the Environment (1995*): A Review of the Composition of Leachates from Domestic Wastes in Landfill Sites*. Report No. CWM/072/95.

- The development falls, therefore, within the scope of the Groundwater Directive; and

- Future landfill development will need to include engineering measures to collect leachate in accordance with Schedule, paragraph 2 (i) (c) of the Landfill (England & Wales) Regulations, 2002.

2.2 Installation Engineering

2.2.1 Groundwater Management System

The base of the existing landfill cells and phases lie close to the piezometric surface of groundwater contained within permeable horizons within the Terrace Gravel, and the hydraulically connected Sherwood Sandstones.

Construction of previous phases has revealed the local groundwater table to lie close to existing ground level, and so the engineering has been designed such that formation levels lie just above the groundwater table, and as water levels are consistent then no underliner drainage system is required.

2.2.2 Basal Lining System

The landfill will operate under the classification of a non-hazardous landfill, as defined by the Landfill Regulations. In order to comply with the Regulations, the minimum requirements of the basal lining system are a geological barrier at least equivalent to that resulting from a 1m thick geological barrier of maximum permeability of $1x10^{-9}$ m/s and an artificial sealing liner. Where the geological barrier does not provide sufficient environmental protection naturally it can be completed artificially with a barrier that must be at least 500mm thick. The design of the basal lining system has been undertaken on a risk basis, with departures from the minimum requirements set out in the Regulations justified by the risk assessment.

Details of the engineering design of Phases 1 and 2 and Cells 1 to 7, 8A, 8B & 9B are described in Table ESID3. Cells 9A, 10A, 10B, 11 and 12 remain to be constructed at Daneshill. The remaining cells to be constructed will all have a minimum basal level (top of liner) of 9.5mAOD and will be constructed so as to achieve a fall towards the sump area.

No natural geological barrier exists at Daneshill Landfill, though there are occasional bands or lenses of clay and silt within the Terrace Gravels, these do not form a continuous barrier. Phases 1 and 2 were constructed with at least 500mm of compacted colliery spoil as a basal lining system, and whilst the works were supervised by Waste Notts staff and some confirmatory testing was undertaken, no records survive[3]. Cells 1 to 7, 8A, 8B & 9B have all been constructed with a 1m thick imported clay (colliery spoil in cells 1 to 3) liner placed and compacted to achieve a maximum permeability of 1×10^{-9} ms^{-1}, underlying a 2mm thick high density polyethylene (HDPE) geomembrane. This design will continue to be adopted for the

[3] Discussions with NCC staff in March 2004.

remaining cells to be constructed. Individual phases of the landfill will be separated from each other by 2m high intercell bunds. The intercell bunds will be constructed from the same materials and to the same specification as the basal liner, with the HDPE geomembrane extending over the top of the bund. The composite liner will be placed over the whole of the base and up the sideslope bunds. The HDPE geomembrane will tie in with the existing system in Phases 1 & 2 as detailed on Drawing ESID6.

A geotextile protector will be installed above the HDPE geomembrane to prevent damage to the geomembrane from the leachate drainage blanket. The geotextile specification will be based upon the results of a cylinder test, undertaken using the actual leachate drainage stone and proposed geosynthetic materials. The test procedure will be in accordance with the Environment Agency's guidance on protectors for geomembranes.

Upon completion of the construction of the basal lining system, and associated leachate drainage and extraction system, a Geophysical Leak Location Survey will be undertaken to check the integrity of the HDPE geomembrane liner; should the survey identify any defects in the geomembrane liner, then remedial works will be undertaken to repair those defects.

Cells 1 to 7, 8A, 8B and 9B have been designed such that any leachate generated can be contained within the individual phases and drained to leachate sumps from where it can be abstracted as and when required. Phases 1 and 2 contain leachate monitoring and extraction points, though no basal collection system was included.

The leachate collection system in the remaining cells will comprise a 150mm thick granular drainage blanket of clean suitably sized non-calcareous granular material, laid over the geotextile protector, which will drain leachate to the collection sumps. The risk assessment has indicated that at this thickness the primary requirement for the granular material, forming the leachate drainage blanket, is an average permeability of not less than 1×10^{-3} m/s; accordingly, this deviation from the prescriptive Landfill Regulations requirements has been validated by risk assessment as reported in Appendix ESID4.

The leachate drainage blanket will incorporate a herringbone system of leachate pipework. This shall comprise a 200mm diameter perforated spine drain with 200mm diameter feeder drains. All leachate pipework shall be laid upon 50mm of 10mm (nominal size) granular material, and shall have twice the pipe diameter of cover. All pipework will have threaded or welded fittings. Primary pipework will be installed so as to fall at a gradient directly towards the leachate extraction point; secondary pipework will be installed so as to fall at a gradient towards the primary drain. Secondary drains will be installed at maximum 50 metre intervals along the length of the primary drain. Details of the leachate collection system are presented in Drawing No. ESID7.

The leachate extraction point for the remaining cells will comprise a vertical extraction riser of 450mm internal diameter. Construction details are shown on Drawing No. ESID7. The well is designed to resist and accommodate the predicted settlement of the waste mass. Two leachate monitoring wells of 450mm nominal diameter will be installed to the base of the remaining cells, in accordance with Drawing No. ESID7.

The installation of all elements of the basal lining system to the remaining cells will be subject to construction quality assurance (CQA). The construction quality assurance process ensures and documents, that the works are carried out in accordance with the specification. Prior to each stage of construction, a CQA Plan will be submitted to the Environment Agency. This plan will present the specification for the works, and detail the CQA activities and testing to be undertaken for each element of the works. Upon completion of the works a validation report shall be submitted to the Environment Agency, demonstrating that the construction works and CQA activities have been carried out in accordance with the CQA Plan.

2.2.3 Side Slope Lining System

The minimum requirements for the side slope lining system in a non-hazardous landfill, as prescribed by the Landfill Regulations, is at least equivalent to that resulting from a 1m thick geological barrier with a maximum permeability of $1x10^{-9}$m/s.

Daneshill Landfill has been developed as a land raise, and no side slope lining system exists at the site. The only element of the lining system that could be interpreted as a side slope lining system are the perimeter bunds, and these consist of a minimum of 2m of compacted low permeability clay, overlain by a geomembrane, so meeting the requirements of the Landfill Regulations.

The installation of all future elements of the sidewall lining system will be subject to construction quality assurance, detailed in Section 2.2.2, above.

2.2.4 Capping System

To date, Phases 1 and 2 have been capped and restored for a number of years. It is understood that these areas were capped with 1m of colliery spoil and approximately 900mm of restoration soils. Cells 1, 2, 3, 4, and 5 have also been capped and restored for a number of years. Cells 1, 2 and 3 were capped with 1m of clay/ colliery spoil, whilst cells 4 and 5 were capped with a 300mm thick colliery spoil stabilisation layer and a 1mm thick lapped VFPE geomembrane, overlain by a geotextile protector. Cells 6, 7, 8A and 8B have been capped and partially restored during 2003 although some restoration works are currently incomplete over these areas. Cells 6, 7 and 8A were capped in the same manner as cells 4 & 5, but the geomembrane was welded rather than lapped. Cells 1 to 6 are all covered with between 1.2m and 1.5m of restoration soils, whilst cells 7, 8A & 8B have been capped and partially restored with approximately 500mm of soils.

It is proposed that future phases will be capped using a welded geomembrane overlying a 300mm thick clay or colliery spoil stabilization layer. A geotextile protector and between 1.2m and 1.5m of restoration soils will overlie the geomembrane.

Details of the proposed capping system are presented on Drawing No ESID6.

The installation of all elements of the capping system has been subject to construction quality assurance (CQA), with the exception of Phases 1 and 2.

The installation of all future elements of the capping system will be subject to construction quality assurance, detailed in Section 2.2.2, above.

2.2.5 Restoration and Aftercare

Waste infilling, capping and restoration will take place in order to achieve the restoration profile approved by the Planning Authority (Drawing No. ESID5). The final restored profile will take account of the likely settlement of the deposited wastes.

As indicated in Drawing ESID5, the upper parts of the landfill area will be restored to woodland, woodland edge planting, heathland and agricultural grassland in the east of the site. An area of biomass planting is proposed over the northern part of the site. Slope angles will be designed in accordance with the approved restoration proposals.

2.3 Leachate Management and Monitoring

2.3.1 Leachate Generation

The potential future volumes of leachate that will be generated by Daneshill Landfill have been estimated using water balance methods and the results are presented within Appendix ESID4. These estimations indicate that:

Leachate generation rates rise steeply prior to 2017, mirroring the increase in the area of open waste deposition.

Future leachate generation rates peak at 69,845m^3/year in 2017

Leachate generation rates reach a steady state rate of 43,592m^3/year in 2021 following site closure.

2.3.2 Leachate Management and Monitoring

The objectives of the leachate management system will be to utilise recirculation in the early years of development of each phase, in order to accelerate stabilisation of the waste mass, whilst accepting that management of the volume of leachate will be necessary to ensure that the maximum permitted leachate levels are not exceeded

All phases and cells at Daneshill Landfill have been designed in order to contain and manage leachate by abstraction from the leachate sumps located within each of the containment phases. The leachate collection and removal system within the various phases and cells incorporated a geotextile protector or separator, a 150mm thick granular drainage blanket (absent in Phase 1 & 2) and vertical riser extraction system.

In cells 1 to 7, 8A, 8B & 9B the leachate collection system comprises a herringbone network of perforated HDPE pipework with gravel surround of clean suitably sized non-calcareous granular material. The drainage pipework of each phase consists of push fit perforated 150mm or 200mm diameter feeder drains connected to push fit perforated 250mm or 300mm diameter spine drains. The spine drains are connected to vertical HDPE leachate extraction risers of 450mm diameter, protected by concrete rings. Leachate is extracted from each phase by float and trigger pumps (set to maintain leachate below an appropriate compliance level).

It is anticipated that the remaining cells 9A, 10A & 10B to be developed will comprise a similar leachate collection and extraction system to the operational and restored cells and phases, though the maximum pipework diameter is likely to be 200mm.

Leachate is primarily re-circulated on site, though some has also been extracted and tankered off site. During the period from March 2002 to February 2004, 18,840m^3 of leachate was extracted. Leachate is currently extracted from all leachate extraction points to a holding tank with a capacity of 25m^3 and is then re-circulated through the waste mass on a daily basis via recirculation points in Cells 5, 6, 7 & 8A. Approximately 80m^3 per week is currently being re-circulated. Table ESID5 below details the leachate volumes being removed and re-circulated from March 2002 to February 2004.

TABLE ESID 5: LEACHATE VOLUMES TANKERED AND RECIRCULATED DURING 2002 & 2003

Date	Volume Re-circulated (m^3)	Volume Tankered (m^3)
March 2002	1352.92	45.4
April 2002	926.16	45.4
May 2002	1103.22	45.4
June 2002	885.3	45.4
July 2002	1071.44	22.7
August 2002	817.2	45.4
September 2002	544.8	22.7
October 2002	612.9	22.7
November 2002	531.18	45.4
December 2002	603.82	68.1
January 2003	653.76	68.1
February 2003	985.18	68.1
2002-2003 Total	**10088**	**545**
March 2003	535.72	45.4
April 2003	0	858
May 2003	0	790.5
June 2003	0	920
July 2003	215	897
August 2003	561.4	140
September 2003	638.9	160
October 2003	500	180
November 2003	386.474	160
December 2003	274.111	160
January 2004	193.764	140
February 2004	311.2	140

2003-2004 Total	**3617**	**4591**
Total	**13705**	**5136**

The re-circulation of leachate will facilitate quicker and more even degradation of the waste and reduce the time to completion. In the future it is anticipated that leachate will continue to be re-circulated with leachate that needs to be removed from the system to maintain compliance with leachate heads being tankered away to a suitably licensed facility.

Leachate elevations are currently monitored within Phases 1 and 2, and Cells 1 to 7, 8A, 8B & 9B. Time-series plots of leachate levels are included within Appendix ESID5 and a summary of the monitoring data is presented as Table ESID6. The monitoring locations are included on Drawing ESID7.

TABLE ESID 6: LEACHATE LEVEL MONITORING STATISTICS

	Leachate Depth (m)			
Monitoring Point	**Number of readings**	**Minimum**	**Mean**	**Maximum**
LMH01	92	0	0.71	2.54
LMH02	101	0	0.78	2.59
LMH03	101	0	0.67	1.54
LMH04	93	0	0.82	1.07
LMH05	86	0	0.82	1.51
LMH06	88	0	0.56	1.83
LMH07	113	0	0.70	1.3
LMH08	170	0	0.58	1.36
LMH09	89	0	0.75	0.96
LMH10	95	0	0.79	1.05
LMH11	177	0	1.03	1.75
LMH11a	179	0	0.96	2.83
LMH13	27	0.32	1.57	3.05
LMH14	89	0.12	0.71	2.38
LMH15	183	0	0.96	1.75
LMH16	183	0	1.22	2.13
LMH17	153	0.03	0.68	2.09
LMH18	33	0	0.41	0.89
LMP01*	1	2.62	2.62	2.62
LMP02*	31	3.44	3.57	3.7
LMP03	161	0.08	0.60	1.49
LMP04*	27	0.55	2.76	7.74
LMP05	163	0.49	1.15	1.69
LMP06*	9	0.12	3.14	6.64
LMP07*	22	0.9	3.33	4.06
LMP08	1	0.78	0.78	0.78
LMP09	31	0.04	0.04	0.04
LMP10	19	0	0.08	0.12

Note: Monitoring points marked with an asterisk include readings whilst the point was blocked, i.e. these maximum readings are not representative of the actual leachate heads present on site.

With regards to existing leachate levels it is noted that:

The current Waste Management Licence (1/92/112/68/NE) specifies a compliance level of 1m above the base of cells.

Leachate heads at Daneshill Landfill vary between 0m to 3.05m (heads greater than 3.05m are only recorded within blocked monitoring points) and examination of the leachate hydrograph included within Appendix ESID 5 indicates that these high levels are rare and that maximum leachate heads are generally maintained below 2m, with mean leachate heads generally maintained below 1m.

The ability of the leachate abstraction system to maintain heads beneath the proposed compliance level for the future cells has been established by a leachate management risk assessment that is presented within Appendix ESID4.

2.4 Landfill Gas Management and Monitoring

2.4.1 Landfill Gas Generation

As part of the landfill gas risk assessment process, total bulk landfill gas production was simulated by GasSim and is presented within Appendix ESID 6. This simulation indicates the following:

- For all phases the peak predicted gas generation occurs in 2010 with a peak flow of 1840m^3 hr^{-1} (50th percentile);

The above estimations therefore confirm that landfill gas flaring and/or utilisation is required at the site, in order to comply with the requirements of the Landfill Regulations 2002[4].

The composition of landfill gas varies according to the type of waste and the time that has elapsed since deposition within the site. However, typically in a contained site taking biodegradable wastes, landfill gas usually consists of approximately 64% methane, 34% carbon dioxide, 2% nitrogen, <1% oxygen and 1% trace elements such as organic gases and vapours[5].

WRG routinely monitors landfill gas concentrations within a number of gas extraction wells installed within the landfill footprint (Drawing No. ESID8). Monitoring data indicates that

[4] The estimated value exceeds the simplistic benchmark value of 50 to 100 m^3/hr, which has been proposed by the Environment Agency as an indication as to whether flaring or utilisation is viable under the terms of the Landfill Regulations, 2002. The benchmark gas flow rate for gas utilisation is 600 m^3/hour. These Regulations state that that landfill gas must be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and, to the extent possible, used. In addition, landfill gas that cannot be used to produce energy must be flared.

[5] Environment Agency, November 2002, Draft Guidance on the Management of Landfill Gas

landfill gas concentrations at Daneshill typically comprise 53 to 61% methane and 32 to 37% carbon dioxide.

2.4.2 Landfill Gas Management

An active landfill gas management system is operational at Daneshill Landfill site and is summarised on Drawing No. ESID8. The gas extraction system comprises a network of vertical gas extraction wells connected to HDPE/ MDPE pipework. The pipe runs incorporate pumped condensate sumps where required to ensure that collection efficiency is maintained at optimum levels. The system is designed such that additional gas extraction wells can be added if required.

Landfill gas at Daneshill Landfill is currently managed via a single 980 kW landfill gas engine and a single high temperature flare, which is rated at 850m^3/hour. Additional flaring capacity will be installed in the near future, as increased gas production occurs. The need for additional or larger gas engines shall be reviewed over time, and adopted should gas generation support it.

Any combination of the engine and flare may operate concurrently. If the engine shuts down, or the engine is unable to cope with an increase in gas flow, gas would be diverted to the flare for combustion. If both the engine and the flare were to shut down for any reason, a telemetry link automatically informs a designated member of staff.

The proposed gas treatment system is capable of treating the predicted peak landfill gas generation. Actual gas generation at the site is continuously monitored and this data will be used to determine if and when additional gas engines or flares may be required.

2.4.3 Landfill Gas Monitoring

More details of the proposed landfill gas monitoring regime are presented within the Landfill Gas Risk Assessment[6]. However, in summary, it is proposed that landfill gas monitoring would comprise the following (Drawing No. ESID 8):

- The installed extraction wells would be used for landfill gas monitoring within the main body of the fill. This would be carried out on a monthly basis in order to assess methane generation and the quality of the gas, so as to evaluate landfill gas management requirements. The gas extraction wells are monitored for methane, carbon dioxide, oxygen, and differential pressure.

- The emissions from the flares and the generator sets will also be monitored for appropriate parameters in accordance with the Environment Agency's guidance on monitoring emissions from landfill gas flares and landfill gas engines, when this guidance is issued in final form.

[6] SLR Consulting Limited, May 2004, Daneshill Landfill, Landfill Gas Risk Assessment, Ref: 4C-197-219 /LFGRA

- Landfill gas is currently monitored on a weekly basis within 49 perimeter boreholes[7]. The external gas wells are monitored for methane, carbon dioxide and oxygen. Barometric pressure is also recorded. A summary of the external landfill gas monitoring data is included within Section 3.6 of this report.

2.5 Post Closure Controls

The management measures that are critical to the operation of the proposed development include: leachate and landfill gas management, the containment system and the landfill cap. The conceptualisation of how these systems will operate throughout the life cycle of the proposed development is presented within Table ESID7. In summary:

- Leachate and landfill gas management would be ongoing throughout the operational and post-closure phases in the life of the landfill. These systems would not operate during the site completion/post completion stages, although monitoring would be ongoing during site completion.

- Some degradation of the management systems is expected, which would reduce their efficacy. The extent of the degradation would increase with time and it has been assumed that all management systems (apart from the geological barrier/attenuation layer) become non-functional during the post-site completion phase of the site.

With regards to the conditions when Permit Completion will be attained, these would be satisfied when the site no longer has the potential to cause damage to or deterioration of the environment and risk to human health i.e. it no longer poses a potential risk to the environment or human health. More specifically:

- With regards to ***potential impact on ground and surface water***, this means that the site needs to comply with the requirements of the Groundwater Regulations, 1998, following the cessation of active leachate management.

- ***Landfill gas*** completion criteria would be related to when the site no longer poses a potential risk to either humans or the environment following the cessation of active landfill gas management.

[7] Available borehole logs for all borehole monitoring locations are included within Appendix ESID 7.

TABLE ESID 7: THE CONCEPTUALISATION OF MANAGEMENT MEASURES AND TECHNICAL CONTROLS THROUGHOUT THE LANDFILL LIFE CYCLE

Landfill Phases	Leachate Management	Landfill Gas Management	Containment System		Landfill Cap	
			Geomembrane	Engineered Geological Barrier	Clay	Geomembrane
Operational	Ongoing management of leachate heads to ensure compliance with specified limit.	Ongoing management of landfill gas.	Operates as designed	Operates as designed	Not applicable	Not applicable
Post Closure and Aftercare Period	Ongoing management of leachate heads to ensure compliance with specified limit. Some degradation (i.e. clogging) of the drainage system.	Ongoing management of landfill gas. Some degradation (i.e. well clogging) of the abstraction system.	Operates with some degradation	Operates as designed	Operates as designed	Operates as designed
Site Completion	Passive management (monitoring only). Complete degradation of the drainage system.	Passive management (monitoring only). Some degradation (i.e. well clogging) of the abstraction system.	Non-functional	Operates as designed	Operates as designed	Assumed to be non-functional
Post-site completion	None	None	Non-functional	Operates as designed	Operates as designed	Assumed to be non-functional

3.0 PATHWAY AND RECEPTOR TERM CHARACTERISATION

3.1 Climate

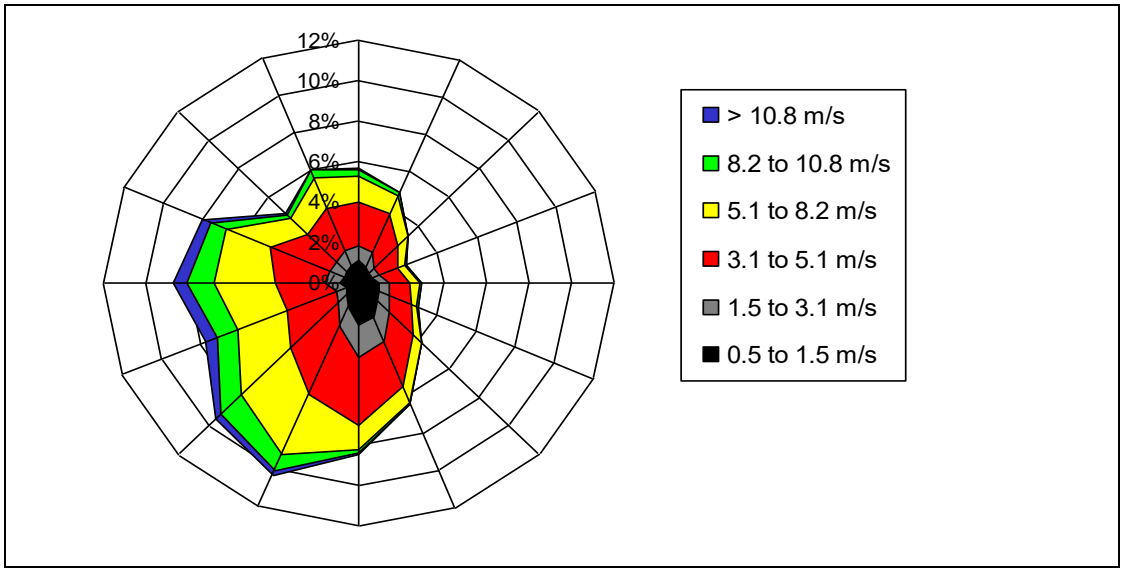
The site lies in MAFF Agroclimate Area No. 16[8] which reports long term minimum, average and maximum average annual rainfall values of 540, 622 and 800mm respectively. MAFF also report an average annual potential evapotranspiration value of 510mm.

It is considered that much of the incident rainfall on the Terrace Deposits and Sherwood Sandstone will provide groundwater recharge.

The Environment Agency maintain a rainfall station at Wiseton, located approximately 6km northeast of the site and monitoring records for 1998 to 2002 indicate average monthly and annual rainfalls as set out below.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
39.4	35.2	36.4	60.6	35.36	47.6	62.04	56	60.5	83.2	59.8	54.3	630.4

With regards to local wind speed and direction, data has been obtained from the observing station at Finningley, for the period 1990 to 1994 inclusive. The wind speed and direction data recorded at this observing station are appropriate for characterising the wind climate at Daneshill Landfill. Wind speed and direction data for the observing station are presented as a wind rose below.



[8] Ministry of Agriculture, Fisheries and Food, 1975. *Technical Bulletin 34 Climate and Drainage* HMSO, London.

The predominant wind direction is from the west-north-west and west-south-west, winds from between these two directions occurring for 59.9% of the time. The south-west direction alone accounts for 14.8% of the wind, the single largest sector. Winds from the north-north-west also occur relatively frequently at 7.6% of the time. Wind directions from the north-east and south-east sectors occur relatively infrequently. Calm conditions (i.e. wind speeds of less than 2.1m/s) occur for approximately 2.4% of the time.

3.2 Geology

The following published information sources, which detail the geology of the site and the surrounding area, have been consulted as part of this study:

- British Geological Survey (1:50,000 Scale), Geological Sheet 101, East Retford, Solid and Drift Edition, 19.
- Institute of Geological Sciences: Hydrogeological Map of the Northern East Midlands.
- Information obtained from site investigations and technical reports[9].

Borehole logs are included in Appendix ESID 7.

3.2.1 Solid Geology and Structure

The regional geological setting of the Daneshill site is presented as Drawing ESID 9, which shows that the site is underlain by drift deposits (See Section 3.2.2) overlying the Nottingham Castle Formation of the Sherwood Sandstone Group. The Nottingham Castle Formation is noted at surface in the south-eastern part of the site, i.e. superficial deposits are absent in this area. A British Geological Survey Industrial Mineral Assessment Unit borehole drilled in 1976 on the north-east corner of the site, revealed 0.6m of terrace sand and gravel overlying the Sherwood Sandstone. Deposits of Permian and Carboniferous age are known to occur at depth below the Sherwood Sandstone.

Daneshill Landfill is developed predominantly above the First Terrace Sands and Gravels. Below the First Terrace Sands and Gravels, and outcropping in the south-east of the site, are the Nottingham Castle Formation (formerly the Pebble Beds) of the Sherwood Sandstone Group. The Sherwood Sandstone (formerly known as the Bunter Sandstone unit) is underlain by the Permian units and the Carboniferous Coal Measures. The geology of these units is summarised below.

[9] Including: SLR Consulting, July 2003, Daneshill Working Plan, Ref: 4C-197-049;
Waste Recycling Group Limited: Daneshill Environmental Monitoring Plan;
All available borehole and trial pit logs.

Nottingham Castle Formation

The Sherwood Sandstone consists of approximately 140m of Nottingham Castle Formation and 20m of Lenton Sandstone Formation in the vicinity of the site. The Nottingham Castle Formation is predominantly a medium to coarse-grained, poorly cemented sandstone, with numerous pebbles and thin layers, lenses and small irregular bands of red and grey-green mudstone and siltstone. The Lenton Sandstone Formation is generally red-brown, yellow or pink in colour with the top few metres being notably pale. In places occasional small pebbles, of the types found in the overlying strata, are present within the Lenton Sandstone Formation which is generally fine grained, marly, and has a deeper red colour than the overlying Pebble Beds.

Permian Strata

The Permian strata include the Roxby Formation (Upper Permian Marl), Brotherton Formation (Upper Magnesian Limestone), Edlington Formation (Middle Permian Marl and Sand), Cadby Formation (Lower Magnesian Limestone), Lower Permian Marl and Basal Permian Breccia. These units comprise approximately 120m of mudstones, sandstones, dolomitic limestones and breccia.

Carboniferous Coal Measures

The Carboniferous Coal Measures unconformably underlie the Permo-Triassic strata and range in thickness from 900m to 1300m.

Previous works at Daneshill have included consultation of the Coal Authorities mine abandonment records at Bretby. These records failed to reveal any mine workings beneath the site, although a report by Wardell Armstrong covering the site suggests that the Deep Soft coal may have been worked in the vicinity of the site.

Future coal mining cannot be discounted, as extensive reserves exist beneath the site.

3.2.2 Drift Geology

The site is underlain in the south and east by First Terrace sand and gravels associated with the River Idle which flows to the east of the site. The sands and gravels are exploited in excavations to the east of Lound, many of which have subsequently infilled with water. It is understood that these deposits have also been worked from the western part of the Daneshill site and have exposed the underlying Sherwood Sandstone.

Boreholes, included as Appendix ESID7, revealed alluvial sand and gravel overlying weathered sandstone.

First Terrace Sands and Gravels

The First Terrace deposits consist of sands and gravels associated with the River Idle which flows to the east of the site. The deposits are of variable and inconsistent thickness, being locally absent in the south-east of the site.

Regionally the Permo-Triassic geological strata dip gently to the east, with successively older deposits outcropping in a westerly direction. The Carboniferous strata are folded and dip gently to the east and west. A fault is apparent to the south-east of the site, as indicated by the regional hydrogeological map and shown on Drawing No. ESID10A.

Borehole drilling logs from Daneshill Landfill confirm that the site is situated predominantly within the First Terrace Deposits.

3.3 Man-made Subsurface Pathways

Residential and industrial properties have been identified within the general area of Daneshill Landfill. Consequently, it is anticipated that there will be underground utilities located within close proximity of the landfill. These utilities could be associated with gas, water, electricity or telephone services.

3.4 Hydrology

3.4.1 Off-site Hydrology

The site is located in an area of flat lying land and rests upon highly permeable sand and gravel and Sherwood Sandstone deposits. Therefore, surface water flow will be limited in both quantity and velocity.

A network of agricultural drains (including Main Drain) and small streams flow to the west and north of the site. The Environment Agency indicates that the western half of Daneshill landfill lies within the 1 in 100 year floodplain of these drains, with an estimated flood depth of 0-1m.

TABLE ESID 8: ENVIRONMENT AGENCY SURFACE WATER QUALITY CLASSIFICATIONS

Monitoring Station	Watercourse	Stretch	Chemical Water Quality Grade (2000)	Biological Water Quality Grade (2000)
1	Ranskill Brook	A638 road Bridge Barnby Moor at Ranskill	B	B

The chemical water quality grade is based on the BOD, ammonia and dissolved oxygen content of the water. A rating of B – 'good' indicates that the water is suitable for all abstractions, salmonid fisheries, cyprinid fisheries and ecosystems at or close to natural.

The River Quality Objective for this stretch of water is grade 2 and the stretch is compliant with this objective.

The water quality reflects the various land uses within the catchment of each watercourse.

Indicative maps, presented within the Environment Agency website indicate that the site partially lies within a 100-year river flood plain.

TABLE ESID 9: LICENSED SURFACE WATER ABSTRACTIONS WITHIN 3KM RADIUS OF DANESHILL LANDFILL

Ref.	Licence No.	Licence Holder	Location	Source	NGR	Use	Annual Limit (m3)
1	03/28/74/0073	Tiln Farms Ltd	Babworth Hall, Retford	River Idle	SK691839	Spray irrigation	230,000
1	03/28/77/0030	HW Smith and Sons	Mattersey Grange, Mttersley	Ranskill Drain	SK669887	Spray irrigation	36,368

TABLE ESID 10: DISCHARGE CONSENTS WITHIN 1KM RADIUS OF DANESHILL LANDFILL

Ref	Location	NGR	Discharge Type
1	The Old Royal Ordnance Factory	SK676863	Not given
2	Daneshill Landfill	SK671866	Site drainage trade effluent from Daneshill Landfill

Note: Locations shown on Drawing No. ESID10

3.4.2 Surface Water Management System

The local hydrological features are presented on Drawing Nos. ESID10A& 10B. Drainage ditches located along the northern, southern and western boundaries of the site control the hydrological regime in the vicinity of the site. The ditches collect run-off from the site and feed water westwards towards Daneshill Lakes, flowing via drains northwards and eventually into the River Idle.

A surface water management plan has been prepared for the site[10] which details measures to maintain the quality of the discharged water and to restrict flows from the site to the greenfield rate of runoff. Further details of the surface water management system are

[10] Egniol Ltd, 2002. *Daneshill Landfill Site Surface Water Management: Proposals for discharge to water course* Unpublished report for WRG, and references therein.

presented within Appendix ESID 8. A plan of the proposed final surface water management system is also presented within this Appendix.

WRG has routinely monitored surface water quality at six locations at Daneshill Landfill, as indicated on Drawing ESID11.

A summary of the surface water quality monitoring data is presented within Appendix ESID 9 whilst Appendix ESID 10 includes time-series plots of ammoniacal-N and chloride concentrations. Review of the monitoring data indicates the following:

- Ammoniacal-N concentrations vary significantly and concentrations have exceeded the UK Drinking Water Standard (DWS) of 0.39mg/l on at least one occasion at all locations except SW02 and SW05, with a maximum recorded concentration of 5.9mg/l at SW1 in July 2002 (this is understood to have been a testing error, and the next highest recorded level is 0.63mg/l in SW06). Ammoniacal-N concentrations are currently less than 1mg/l;

- Chloride concentrations have also have varied significantly at all monitoring locations. Concentrations have not exceeded the UK Drinking Water Standard (DWS) of 250mg/l at any locations, with a maximum recorded concentration of 98mg/l at SW1 in July 2002.

3.5 Hydrogeology

3.5.1 Aquifer Characteristics

A summary of the aquifer characteristics of the main formations found in the vicinity of the site is shown in Table ESID 10. Environment Agency Aquifer Classifications[11] are also detailed.

TABLE ESID 11: AQUIFER CHARACTERISTICS

Formation	Aquifer Characteristics
River Terrace Deposits	Typically of variable permeability. Intergranular flow mechanisms will dominate. Unit can locally support small groundwater abstractions ***EA Classification: Minor Aquifer***
Sherwood Sandstone Group	Permeabilities, both intergranular and fissure, are high the later often enhanced by coal workings. Groundwater yields are high and in the Severn Trent region the aquifer contributes around 42% of the potable water supplies in the area. ***EA Classification: Major Aquifer***

In the area of Daneshill landfill, the superficial sand and gravel deposits will be in hydraulic continuity with the underlying sandstone, and will therefore also be considered a Major Aquifer. The Environment Agency classifies the soils in the vicinity of the site as H1, soils of

[11] National Rivers Authority (now the Environment Agency), 1995. *A Guide to Groundwater Vulnerability Mapping in England and Wales.*

high leaching potential. These are soils that readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.

The hydrogeological map of the area[12] reports that groundwater yields of 40 l/s from the Sherwood Sandstone group are common and the natural groundwater movement has been modified in many areas due to the influence of large groundwater abstractions. Annual fluctuations in groundwater level within the unconfined Sandstone are reported to be in the order of just 2m, due to the aquifer's high specific yield.

TABLE ESID 12: LICENSED GROUNDWATER ABSTRACTIONS WITHIN 3KM RADIUS OF DANESHILL LANDFILL

Ref.	Licence No.	Licence Holder	Location	Source	NGR	Use	Annual Limit (m^3)
1	03/28/74/0006	Tarmac Central Ltd	Bellmoor Quarry, Retford	Groundwater – borehole	SK688835	Mineral washing	365157
2	03/28/74/0007	Tarmac Central ltd	Lound Quarry, Retford	Groundwater – catchpit	SK697855	Mineral washing	301672
3	03/28/74/0037	North Notts Gravel Ltd	Wild Goose Cottage	Groundwater – Borehole	SK703874	Gen. farming and domestic	1987
4	03/28/74/0055	SevernTrent water Ltd	Barby Moor	Groundwater – borehole	SK670842	Public Supply	3652000
5	03/28/74/0060	Powell Farms	Yew Tree Farm, Lound, Retford	Groundwater – borehole	SK691878	Spray irrigation	62737
6	03/28/74/0064	Tarmac Central Ltd	Lound Quarry, Retford	Groundwater – borehole	SK671857	Mineral washing	1212600
7	03/28/77/0020	Tarmac Central Ltd	Ellis Plantation, Mattersey	Groundwater - borehole	SK684878	Mineral Washing	32731
8	03/28/77/0028	Grange Farm	Grange Farm, Banby Moor	Groundwater – borehole	SK661848	Spray irrigation	146610
9	03/28/77/0031	HW Smith & Sons Ltd	Mattersey Grange, Mattesey	Groundwater – off stream pond	SK672888	Spray irrigation	9092
10	03/28/77/0036/1	Grange Farm	Grange Farm, Barnby	Groundwater – borehole	SK659856	Spray irrigation	146610

[12] Hydrogeological Map of the Northern East Midlands, Institute of Geological Sciences, 1981.

			Moor				

Note: Locations shown on Drawing No. ESID10B

3.5.2 Groundwater Flow

Groundwater elevation monitoring data is shown in Appendix ESID 11 along with groundwater hydrographs for boreholes at the site and the locations of the boreholes are shown on Drawings ESID8 & ESID11. Groundwater contours are shown on Drawing ESID 11 and indicate that groundwater flow is in a generally northerly direction.

3.5.3 Groundwater Quality

Groundwater quality has been routinely monitored over an extended period and this data is presented in Appendix ESID 12 along with chemographs of selected substances. The data presented in Appendix ESID 12 indicate that groundwater quality is generally good with few exceedences of drinking water standards. Elevated concentrations of ammoniacal nitrogen have been observed in the majority of boreholes in July (later confirmed as a laboratory error) and December 2002; the transient nature of these peaks, together with the presence of these elevated concentrations in upstream and downstream boreholes, suggests a non-landfill source. Elevated chloride concentrations are observed in Boreholes GW6 and GW12 during 2002 but these have since declined to below the drinking water standard.

List I analysis was undertaken in March 2004 on samples from borehole GW6 and GW13. The results are included in Appendix ESID 1 and do not indicate the presence of any list I substances in groundwater.

3.6 Off-site Landfill Gas Monitoring

Landfill gas has been regularly monitored at Daneshill Landfill and this information has been presented in this report in the following manner:

- Appendix ESID 13: presents a summary of all of the data that has been collected since January 2001: and

- Drawing No. ESID8: shows the gas monitoring locations.

Table ESID13, presented below, sets out the monitoring locations that have recorded methane concentrations above 1% v/v.

TABLE ESID 13: SUMMARY OF BOREHOLES RECORDING METHANE GAS ABOVE 1% V/V

Site Boundary	Monitoring Location	Mean Concentration (%v/v)	Maximum Concentration (%v/v)
SW of Phase 1	BHG11	0.1	1.9
SW of Phase 1	BHG12	4.5	28.9
S of Phase 1	BHG13	0.8	13.3
S of Phase 1	BHG14	0	3.1
S of Phase 1	BHG15	0.2	4.4
SE of Phase 1	BHG16	0.3	4.9
SE of Phase 1	BHG17	0.1	3.6
E of Phase 1	BHG18	0	4.2
N of Phase 2	BHG24	0.1	11.3
N of Phase 2	BHG25	0.3	20.3
NW of Phase 2	BHG27	0	1.1
NW of Cell 7	BHG33	3.0	69.4
NW of Cell 7	BHG34	0.9	41.1

The available monitoring data indicate the following:

- Methane concentrations around the vast majority of the site's perimeter are generally low, with average methane concentrations in excess of 1% v/v being recorded at only 2 of 49 locations around the perimeter of the site. The most frequent breaches of the 1% threshold have been recorded around the older Phase 1 and 2 areas, and could be a reflection of the lack of a geomembrane lining system over these areas.

- If a carbon dioxide assessment level of 1.5% is assumed, then all locations exceed this level at their maximum values. However, in the absence of pre-tipping monitoring data, it is not possible to draw definitive conclusions on its origin.

The existing monitoring therefore indicates that there has been some lateral sub-surface migration of landfill gas, particularly around the western and southern boundaries of Phase 1.

3.7 Receptors and Compliance Points

3.7.1 Hydrogeological Risk Assessment

For the purposes of the hydrogeological risk assessment, the primary receptors have been taken to be the compliance points as requested by the Groundwater Regulations 1998. These are as follows:

- For **List I Substances**, the potential receptor has been assumed to be the groundwater directly beneath the landfill site within the River Terrace Deposits or Sherwood Sandstone (prior to any dilution occurring); while

- For **List II Substances**, the potential receptor has been assumed to be groundwater within the River Terrace Deposits or Sherwood Sandstone at the downstream boundary of the site.

In both cases it is assumed that the target groundwater will be in a permeable horizon within the Terrace Gravels, *i.e.* immediately below the clay liner.

3.7.2 Landfill Gas Risk Assessment

For the purposes of the landfill gas risk assessment, the compliance points have been taken as the following:

- The off-site gas monitoring boreholes as presented within Drawing ESID8;

- The off-site receptors that have been indicated as being at potential risk from the development (see Landfill Gas Risk Assessment for more details).

3.7.3 Risk Assessment for Nuisance and Health Issues

For the purposes of the risk assessment for nuisance and health issues, the potential receptors that need to be considered are presented within Drawings ESID3 and ESID13 and have been set out within Table ESID1. However, with regards to the potential compliance points, it is proposed that the landfill site boundary would be used.

4.0 SITE REPORT

4.1 Introduction

The requirement to submit a Site Report as part of a landfill PPC Application does not apply to areas of the landfill installation which form the stationary technical unit for the landfill activity, and accordingly this Site Report only covers those areas of the landfill installation which do not consist of permanent deposits of waste.

This Site Report has been developed in accordance with Environment Agency 'Guidance on the Protection of Land under the PPC Regime: Application Site Report and Site Protection and Monitoring Programme' (IPPC H7). As recommended in the guidance the Site Report has been developed using a phased approach, and comprises the following Sections.

- Introduction;
- Objectives;
- Site environmental setting and pollution history;
- Reconnaissance
- Scope;
- Identification of potentially polluting substances;
- Identification of preventative measures;
- Assessment of pollution prevention measures and likelihood of land pollution; and
- Conceptual site model

4.1.1 Site Location

The location of the site, a description of the features around the installation, together with a brief description of land use, geographical and topographical features of note are provided in Section 1.2, and Drawings ESID 1, 2, and 3 of this ESID report.

4.1.2 Details of Installation

A description of the operations to be conducted under the permit including future operational layouts and processes are provided in Section 2.0, and Drawings ESID 4, 5, 6, 7 and 8 of this ESID report.

4.2 Objectives

The objectives of this report are:

To satisfy the requirements of the PPC Regulations at the time of permitting by:

- Identifying the environmental setting and land pollution history of the site;

- Identifying activities that will be conducted at the installation that may lead to land pollution;
- Identifying and assessing the preventative measures that are in place to protect the land; and

Assessing whether there is

- Little likelihood that land pollution or leaks to land will occur during the future life of the installation

Or there is

- A reasonable possibility that there is potential for current or future land pollution of the land from the installation.

4.3 Site Environmental Setting and Pollution History

Details on the Site's Environmental Setting and Pollution History are provided within Section 1.0, 2.0 and Section 3.0 of this ESID report.

Details on Environment Agency Consents, Licences, Authorisations, Permits and Designations for the site and surrounding area are included within the ESID in Sections 1.2 and 3.4.1 as are Geological, Hydrological and Hydrogeological data in Sections 3.2, 3.4 and 3.5 respectively.

From an examination of operational records, and interviews with site personnel, it is concluded that there have been no incidents which may have given rise to significant land pollution. According to Environment Agency records, there has been no record of land pollution incidents in the vicinity of the site.

Site operational layout plans including the nature of relevant underground services and pipelines are illustrated in Drawing ESID4. The location of all bulk storage tanks is shown on Drawing ESID4.

Details of site investigations which have been undertaken at the site are provided in Section 3.2 of this ESID report.

4.4 Reconnaissance

A reconnaissance of the Daneshill Landfill installation has been carried out in relation to the non-landfill areas. This has focussed on those facilities that have the potential to create pollution and the condition of these facilities is documented in Table ESID 10.

TABLE ESID 14: SITE RECONNAISSANCE

Area	Comment
Storage tanks	No evidence of loss of integrity or spillage such as staining. No cracking of tank walls evident.
Hardstanding and bunds	Hardstanding areas laid to a fall towards interceptor. No evidence of cracking or other damage.
Vegetation	No visual evidence of stress to vegetation on the site and surrounding areas.
Surface water features	No evidence of discolouration, surface films, turbidity, or odour which would suggest possible contamination.
Nature of the storage and handling of materials	No polluting substances handled outside areas of hardstanding. Drainage around vehicle fuelling areas discharges via interceptors. All tanks in vehicle manoeuvring areas suitably protected.
Surface water and foul drainage	Surface water discharges via soakaway/interceptor.
Other Observations	No visual evidence of significant pollution.

4.5 Scope

Those areas of the Daneshill Landfill installation which will not be subject to immediate deposit of waste are detailed in Table ESID 15 below and illustrated on Drawings ESID 2 and ESID 13; it should be noted that, whilst these areas will be lined and landfilled in due course, it was decided to assess the risk and mitigating measures in the meantime for completeness sake.

TABLE ESID 15: AREAS NOT SUBJECT TO IMMEDIATE DEPOSITION OF WASTE

Area	Zone Reference (see Dwg ESID 13)	Potentially polluting substances stored	Quantities of Potentially Polluting Substances Stored	Containment Systems
Access road	1	None	n/a	
Wheel cleaner	2	Water with suspended solids	5 m^3	Concrete tank
Waste reception area and weighbridge	3	Waste	Up to 5 x 20 m^3 loads	HGV body and kerbed and sealed pavement with drain to interceptor
Quarantine area	4	Waste	20 m^3 load	HGV body and kerbed and sealed pavement with drain to tank for off-site treatment
Fuel storage area	5	Fuel Oil	10,000 litres	Double skinned steel tank
Plant maintenance area	6	Lube oils	15 x 25 litre drums	Steel drum placed on drip tray
Landfill gas	7	Condensate		

management areas		Oils & greases		
Leachate storage area	8	Untreated and treated leachate	1 x 50 m^3 treated leachate tanks	Concrete tanks

4.6 Identification of Potentially Polluting Substances

Those areas of the site where potentially polluting substances are used, produced or stored are identified in Table ESID 15 above. This table also provides details of the potentially polluting substances, together with the quantities involved and method of containment.

An assessment has been made of the pollution potential of individual substances based on their properties, toxicity, and the volume stored, used or manufactured.

4.7 Identification of Preventative Measures

The physical pollution prevention measures that are in place for all the potential emission points are identified in Table ESID 15 above.

The pollution prevention measures can be divided into two categories. Firstly the physical infrastructure outlined in Table ESID 15 and secondly the management procedures that are in place to ensure appropriate inspection and maintenance is undertaken. These additional management procedures are outlined in Table ESID 16 below.

The principal means of pollution prevention is the careful handling and storage of potentially polluting substances and in the majority of cases this is determined by the level of containment of a particular substance. Three levels of containment are considered in the table; primary, secondary and tertiary.

Details of the management procedures that are implemented at the installation are detailed in the installation's Site Management System, and include the following aspects

- Documented procedures for operation and maintenance
- Emergency procedures and action plans
- Training and training records covering all relevant activities

4.8 Assessment of Pollution Prevention Measures and Likelihood of Land Pollution

The pollution prevention measures in place at the installation and identified in Table ESID 15 have been reviewed in order to determine whether they are adequate and sufficient to ensure that there is little likelihood of land pollution occurring.

TABLE ESID 16: ASSESSMENT OF LIKELIHOOD OF LAND POLLUTION

Area	Zone Reference (see Dwg ESID 13)	Potentially polluting substances stored	Pollution Control Measures Additional to Containment	Assessment of Pollution Potential
Wheel cleaner	2	Water with suspended solids	Visual monitoring of water levels	Very limited
Waste reception area and weighbridge	3	Waste	Visual monitoring of load condition. Inspection of containment surfaces.	Very limited
Quarantine area	4	Waste	Inspection of containment surfaces.	Limited
Fuel storage area	5	Fuel Oil	Annual tank testing. Visual inspection of bund.	Moderate
Plant maintenance area	6	Lube oils	Visual inspection	Very limited
Landfill gas management areas	7	Condensate	Visual inspection and maintenance	Limited
Leachate storage area	8	Untreated leachate	Visual inspection.	Moderate

In determining whether there is the likelihood of land pollution occurring as a result of the activities undertaken in those areas of the installation which are not subject to permanent disposal of waste by landfill, the following factors are considered relevant:

- There have been no past pollution incidents or spillages;
- Pollution prevention measures exist for each relevant activity;
- The pollution prevention measures are considered adequate;
- Adequate integrity monitoring is undertaken; and
- An adequate management system is in place

It can therefore be concluded that there is little likelihood that land pollution or leaks to land will occur during the future life of the installation as a result of activities carried out in those parts of the installation which are not subject to landfilling.

4.9 Conceptual Site Model

The information presented within Sections 1.0, 2.0 and 3.0 of this ESID report establishes the landfill source, pathway and receptor term characterisation for the installation, and defines the baseline site conditions, in terms of the geology, surface water and groundwater conditions and their sensitivity.

This section of the ESID report is considered to have provided the necessary information on the potential source term characterisation for the non landfill areas of the installation, and should be read in conjunction with the remaining sections of the ESID report.

Caulmert
engineering environmental planning

Registered Office: Intec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672666
Fax: 01248 672601
Email: contact@caulmert.com
Web: www.caulmert.com