



**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Infinis Energy Services Ltd.

Llanddulas Landfill Site

Decommissioning of Gas Wells
Construction Quality Assurance Plan

May 2015



5303

Infinis Energy Services Ltd.

Llanddulas Landfill Site

Decommissioning of Gas Wells

Construction Quality Assurance Plan

May 2015

Prepared for
Infinis Energy Services Ltd.

Prepared by
Egniol Environmental Ltd.
Tre Felin
Bangor
Gwynedd
LL57 4LH

Document Review

Version No.	Date of Review	Prepared By	Reviewed By	Approved By
1.0	04.12.2014	Richard Furniss	Dylan Williams	Dylan Williams
2.0	10.03.2015	Richard Furniss	Russell Pearson	Richard Furniss
3.0	01.04.2015	Russell Pearson	Steven Lowe	Russell Pearson
4.0	01.05.2015	Russell Pearson	Richard Furniss	Richard Furniss
5.0	06.05.2015	Russell Pearson	Richard Furniss	Richard Furniss

Contents

Definition of Terms

Parties and Responsibilities

1.0 INTRODUCTION

- 1.1 Description of the Works
- 1.2 Supervision
- 1.3 Surveying
- 1.4 Validation Report

2.0 WELL DECOMMISSIONING

- 2.1 Preparation of Working Area
- 2.2 Decommissioning Works
- 2.3 Geomembrane Repair Works
- 2.4 Protection and Restoration Layer Reinstatement
- 2.5 Restoration Soils

APPENDICES

Appendix 1 – Capping Construction Information:

- Llanddulas Landfill Site, Phase 3 Capping Works CQA Plan (*Llanddulas Landfill Site, Phase 3 Capping Design Report and CQA Plan, Report: FCC 112-NW-2011-29*)
- Llanddulas Landfill Site, Phase 3A Capping Construction works, CQA Report, December 2012.

Appendix 2 – INF-Llanddulas – 190713_AW – Llanddulas Landfill Site, Gas Infrastructure Plan (December 2014)

Appendix 3 – Proposed Site Record Forms

- Daily Record
- Geomembrane Patch Repair Record
- Geomembrane Destructive Sample Record
- Geomembrane Trial Weld Record

DEFINITION OF TERMS

'Directed'	means an oral or written confirmation that an action by the Contractor under the Specification is to be carried out
'CQA'	Construction Quality Assurance
'NRW'	Natural Resources Wales/Cyfoeth Naturiol Cymru
'Verify'	confirm orally or in writing that an action has been performed in accordance with the CQA Plan
'Record'	writing/drawing in an approved format as evidence of work carried out
'Works'	the permanent works as shown on the contract drawings
'Agree'	agree details orally or in writing before an action is carried out

PARTIES AND RESPONSIBILITIES

There are five parties involved in the development works outlined in this document, and these are:

The Permit Holder – FCC Environment Ltd.

This is the person or company for whom the Works are constructed.

The Main Contractor – Infinis Energy Services Ltd.

This is the person or company appointed by the Permit Holder to execute the construction of the Works. He will be responsible for all matters relating to the site including temporary works, working areas and site safety. The Main Contractor will appoint an Agent who will be responsible for the site and will receive instructions from the Permit Holder and liaise with the CQA Inspector in so far as this is required under the CQA Plan.

The Sub Contractors –

Decommissioning Works – TBC

This is the persons or companies appointed by the Main Contractor to carry out the execution of the Works. He will be responsible for the restoration layer excavation, well decommissioning, geosynthetic repairs and subsequent restoration layer reinstatement works. All geosynthetic installation operatives shall hold the relevant accepted welding training accreditation. Copies of this certification shall be made available by Contractors on request.

The Designer – Infinis Energy Services Ltd.

This is the person or Company appointed by the Permit Holder to undertake the design of the works.

The CQA Inspector – Egniol Environmental Ltd.

This is the independent person or company appointed by the Main Contractor to confirm the work carried out by the Main Contractor is in accordance with the CQA Plan. He will be responsible for keeping site records of the Works, verifying the methods of construction used. He shall liaise closely with NRW, the Permit Holder and the Main Contractor and take a proactive approach to matters that may affect the construction and performance of the Works. The CQA Inspector may delegate his duties and responsibilities to representatives on site. The CQA Inspector or any delegated representative shall be approved by NRW prior to their supervising of any works.

1.0 INTRODUCTION

1.1 Description of the Works

This CQA Plan appertains to works to decommission 12 no. landfill gas extraction wells at Llanddulas Landfill Site. The proposed works include the following activities:

- Removal/excavation of existing restoration layers to the level of the geosynthetic capping system;
- Removal of a suitable area of the geosynthetic capping system and exposure of the wells to be decommissioned;
- Decommissioning of existing Gas Wells;
- Repairs to the existing geosynthetic capping system as required;
- Reinstatement of the overlying restoration layers to the original ground profile.

Llanddulas Landfill Site is an active site owned by the Permit Holders, FCC Environment Ltd. A de-odouriser unit will be present on site and used during the works.

1.2 Supervision

The Sub Contractor is required to have full-time supervision on site whilst any activities are being undertaken. A third party experienced Construction Quality Assurance (CQA) personnel will also be present on site for all works to verify the Works are constructed in accordance with this CQA Plan.

The CQA Inspector will compile a daily log of site activities. The log will be kept on site in a notebook and on record sheets during the Contract and will be incorporated into the Validation Report upon completion of the Works. This log will include:-

- i Weather conditions
- ii Site Hours (Time on/off site)
- iii Works carried out on site

1.3 Surveying

The locations and details of each well to be decommissioned are shown in Table 1 overleaf, with all 12no. wells being located within the 2013 Capping Works areas.

Table 1 – Wells proposed to be decommissioned.

Well Reference	Location
C132	Cell 3
C134	Cell 3
C135	Cell 3
RD187	Cell 3A
RD188	Cell 3A
D239	Cell 3A
D240	Cell 3A
D241	Cell 3A
D244	Cell 3A
D245	Cell 3A
D248	Cell 3A
D252	Cell 3A

1.4 Validation Report

Upon completion of the Works a Validation Report will be forwarded to NRW, The Permit Holder and the Main Contractor. The Report will verify methods implemented during construction together with any additional site-specific data.

After the project, as-built drawings detailing the location and ground levels at each newly installed gas well will be forwarded to the CQA Consultant. These drawings will be included within the Validation Report for the Works.

2.0 WELL DECOMMISSIONING

2.1 Preparation of Working Area

The proposed works area shall be trimmed or filled to provide a firm base for the plant to be used where required.

The initial stage of the works shall involve the excavation of the restoration layers around each well. The depth of the restoration layer is anticipated to be 1.0m, but may well vary across the site, as such the excavation works shall be carried in a careful manner to minimise damage to the geosynthetic capping system.

It is anticipated that underlying the restoration soils is either a geotextile protection layer or geocomposite protection/drainage layer, dependent upon the area of site where each well is located. The protection layer shall be carefully cut and removed from around the well to a sufficient diameter.

The excavated restoration material shall be stockpiled close to the works area to allow it to be reinstated to previous ground levels following completion of the works.

2.2 Decommissioning Works

Following excavation of the overlying layers to the level of the geomembrane cap, any existing geomembrane pipeboot around each well shall be carefully removed by way of cutting around the entire diameter of pipeboot at the point where this is welded to the geomembrane cap.

Once the pipeboot has been removed, the gas well pipework shall be carefully extracted from its existing location using an excavator. This shall be performed in such a manner as to minimise the risk of damage to the geomembrane cap.

Upon the completion of removing the pipework from the borehole, the borehole shall be backfilled to the 2.0m below the level of the geomembrane cap using inert fill. The CQA Inspector shall monitor the backfilling procedure at each location to ensure that bridging has not occurred; as part of this process, rods shall be placed into the borehole during backfilling to agitate the material to reduce the risk of bridging. The final 2.0m being filled with hydrated bentonite mixed prior to being installed to the borehole. Installation of the bentonite slurry shall be carried out to ensure that there is minimal risk of subsidence of the bentonite plug following completion of the works.

2.3 Geomembrane Repair Works

2.3.1 General Description

Works shall be carried out to repair the geomembrane capping system following the extraction of the well casing pipework. This shall involve the installation of an extrusion welded geomembrane patch above the decommissioned well, using the methods detailed in below. All geomembrane works are to be carried out in accordance with the FCC Environment CQA Plan for the Phase 3 Capping Works at Llanddulas Landfill Site (reference: *Llanddulas Landfill Site, Phase 3 Capping Design Report and CQA Plan, Report: FCC 112-NW-2011-29*), enclosed in Appendix 1 for reference.

2.3.2 Additional Details

Trial seams shall be carried out prior to any welding being undertaken, in accordance with Section 6.9.1 of the Capping CQA Plan (enclosed in Appendix 1). All trial seams and field destructive testing of them shall be undertaken in the presence of the CQA Inspector. He shall verify that trial seaming is performed at the appropriate intervals and that passing results are achieved prior to any field seaming being undertaken by the Contractor. The CQA Inspector will maintain a record of all trial seam data, which shall be included in the CQA Validation Report.

Samples shall also be recovered by the Contractor (as per Section 6.10.2 of the Capping CQA Plan) to allow for destructive seam testing to be carried out; the CQA Inspector shall forward these samples to a UKAS accredited testing facility.

The Contractor shall recover samples from the geomembrane for conformance testing in accordance with the parameters given in Table 3 of the Capping CQA Plan. Samples will be 1.0m long and the full width of the roll. More than one sample may be recovered from any particular roll. The Contractor shall pass the samples to the CQA Inspector who shall then forward them to a UKAS accredited testing facility.

2.4 Protection Layer Reinstatement

2.4.1 General Information

Upon completion of the geomembrane repair works at each location, the geosynthetic protection layer shall be reinstated, followed by placement of the stockpiled restoration soils to the previous ground levels.

In areas where a protection geotextile was installed during previous works, a protection geotextile shall be installed as soon as practicable above the geomembrane. Where a drainage/protection geocomposite was installed, a geocomposite shall be installed as soon as practicable above the geomembrane.

The materials to be used to reinstate the protection layer above the geomembrane cap shall conform to the requirements of the relevant sections of the Capping CQA Plan (Table 5 for Geotextile and Table 6 for Geocomposite).

Installation shall be carried out in accordance with the relevant sections of the Capping CQA Plan. All materials shall maintain a minimum overlap of 300mm in all directions with the existing protection layers.

The Contractor shall not deploy any upper protection geotextile at any location over the underlying surface until the CQA Inspector has approved it at that location.

Where required, the Contractor shall recover samples from the protection layer material for conformance testing in accordance with the parameters given in Table 5 (for geotextile) or Table 6 (for geocomposite) of the Capping CQA Plan. Samples will be 1.0m long and the full width of the roll. More than one sample may be recovered from any particular roll. The Contractor shall pass the samples to the CQA Inspector who shall then forward them to a UKAS accredited testing facility.

2.5 Restoration Soils

2.5.1 General Description

Following the placement of a suitable protection layer above the geomembrane cap, the previously excavated restoration soils layer shall be reinstated above the protection layer to previous ground levels in accordance with the Contractors agreed method statement.

Prior to this, the material shall be visually assessed by the CQA Inspector to ensure it does not contain any materials deemed to be unsuitable or that could damage the underlying layers. Any oversize material (>125mm) will be removed.

APPENDIX 1



LLANDDULAS LANDFILL SITE

PHASE 3 CAPPING
DESIGN REPORT AND CQA PLAN

REPORT: FCC 112-NW-2011-29

Status	Date	Prepared by		Reviewed by	Approved by
Version 1.1	May 2012	Andrew Kirk		Dr Gary Fowmes	Mark Lancaster
		Engineering Manager	CAD	Senior Geotechnical Engineer	Regional Engineering Manager

FCC Environment
Doncaster Office
6 Sidings court
White Rose Way
Doncaster
DN4 5NU

Tel: 01302 303030
Fax: 01302 303040

TABLE OF CONTENTS

SECTION	PAGE
1. GENERAL REQUIREMENTS	1
2. CONSTRUCTION REQUIREMENTS	4
3. SCOPE OF CONSTRUCTION WORKS	10
4. CQA SUPERVISION	12
5. EARTHWORKS REQUIREMENTS	14
6. GEOMEMBRANE LINING	18
7. PROTECTOR GEOTEXTILE	32
8. DRAINAGE GEOCOMPOSITE	37
9. RESTORATION SOILS	42
10. CQA VALIDATION REPORT	45
11. REFERENCES	46

LIST OF TABLES

Table 1	Regulating Layer Testing Requirements
Table 2	Geomembrane Specification
Table 3	Geomembrane Conformance Testing
Table 4	Geomembrane Installation Testing
Table 5	Geotextile Specification and Conformance Testing
Table 6	Drainage Geocomposite Specification and Conformance Testing

LIST OF APPENDICES

Appendix 1	Design Risk Assessments
Appendix 2	Principal Quantities
Appendix 3	Geomembrane Weld Failure Codes
Appendix 4	CQA Proforma Sheets

LIST OF DRAWINGS

112D_NW_2011_29_01	Phase 3 Proposed Extents of Capping Works and Construction Details
--------------------	--

1 GENERAL REQUIREMENTS

1.1 Introduction

FCC Environment (FCC) are seeking to Permanently Cap the southern and western flanks to Phase 3 at Llanddulas landfill site, Llanddulas, North Wales in order to control gas and leachate migration. Llanddulas Landfill site is located between Abergale and Colwyn Bay at National Grid Reference SH 901 777. The site currently operates under an Environmental Permit (EP) REF: BU0800IZ (Reference 1). The site address is:

Llanddulas
Abergele Road
Llanddulas
Conwy
LL22 8HP

FCC has prepared a detailed Design Report for the Temporary Capping construction. This document presents the Engineering Specification for the construction works to be undertaken and has been prepared in accordance with the EP Permit.

This document details both the requirements for the installation of the lining system undertaken by the Contractor and the quality control procedures to demonstrate that the works have been undertaken in accordance with the Specification.

1.2 Project Team

The project team will comprise:

Waste Management Operator/Employer – FCC Environment
Designer – FCC Environment
Main Contractor – Ascot Environmental Ltd
CQA – Egniol Environmental Limited
CDM Coordinator – URS/Scott Wilson Ltd

1.3 Definitions

For the sake of clarification the following definitions are given:

Construction Quality Assurance (CQA) – A planned and systematic pattern of all means and actions designed to provide confidence that items or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

Construction Quality Assurance refers to means and actions employed by the CQA Inspector, to assure conformity of the lining system preparation, production, and installation to this CQA plan, the

Contract Drawings and Specifications. FCC shall appoint a CQA Consultant prior to commencing each phase of Construction.

Construction Quality Control (CQC) – Those actions which provide a means to measure and regulate the characteristics of an item or service to contractual requirements.

Construction Quality Control refers to those actions taken by Manufacturers, Contractors, or the Employer to ensure that the materials and the workmanship meet the requirements of the Drawings and Specifications.

Employer – means the person or persons, firm or company or other body who own and have responsibility for the facility. For the works undertaken at the site, the Employer is FCC. The FCC has entered/will enter into a contract with a Contractor for the execution of the works detailed in the specifications and Contract Drawings. FCC may be represented on site by personal representatives or other parties.

Contractor – means the person or persons, firm, company or other body to whom the Contract has been/will be awarded by FCC, and includes the Contractor's personal representatives or other parties, e.g. Sub-contractors, Manufacturer. The Contractor will undertake the execution of the Works under the terms of the Contract.

Specification – means that part of the Contract entered into between FCC and the Contractor which sets out FCC's detailed requirements as to how the works should be constructed, tested, measured and quality assured.

1.4 Facilities

1.4.1 Contractor's Compound

The location and layout of the Contractor's compound shall be agreed with FCC prior to commencement of any works on site. The Contractor shall submit his proposals to FCC for mess facilities, plant standing, and maintenance areas. The Contractor shall site his plant standing, maintenance and refuelling areas so that no pollution will occur. 110% secondary containment bunding shall be used for fuel/oil storage tanks where appropriate. The Contractor shall also take into account the storage and mess requirements of his sub-contractors, if appropriate.

No lodgings or caravans will be allowed on site.

The Contractor shall ensure that adequate provision is made within the compound area for parking of all the plant, equipment and any private vehicles owned by operatives/subcontractors and visitors. Parking will not be permitted in any other areas of the landfill site.

The Contractor shall be responsible for the security of the works, all the Contractor's offices, plant, materials, services and machinery.

1.4.2 Contractor's Offices and Welfare Facilities

The Contractor shall be responsible for the provision and maintenance of welfare facilities for himself and any sub-contractors. These facilities shall be as prescribed in the Working Rule agreement published by the Civil Engineering Construction Conciliation Board for Great Britain. The sanitary accommodation and disposal arrangements shall comply with the requirements of the local Environmental Health Authority. The Contractor's personnel shall not be permitted access to FCC's mess, shower and toilet facilities.

1.4.3 Fuel and Oil Installations

The Contractor's fuel and oil installations within the site shall only be provided at locations approved by FCC, such approval not to be unreasonably withheld or delayed.

All fuel and oil installations provided by the Contractor within his compound shall be contained within an impermeable bund capable of containing 110% of the tank capacity in the event of a spillage; 'self-bunded' items will be permitted, subject to the Contractor being able to substantiate their efficacy.

The Contractor shall designate an area within his compound for carrying out plant maintenance and repairs. The Contractor shall ensure that all routine maintenance and repairs take place within this area. Any fuel or oil spillages will be remediated in a safe and controlled manner by the Contractor and at his expense.

1.4.4 Facilities for the CQA Inspector (If required)

Where required, the Contractor shall provide, service and maintain one high-security steel ISO container, or as otherwise provided for, for the sole use of the CQA Inspector within the agreed location of his compound, subject to the approval of the CQA Inspector, which shall not be unreasonably delayed or withheld. The Contractor shall ensure that the container is provided with power supply, sufficient electricity power sockets, electric lighting and space heating, such that it will be ready for use by the CQA Inspector on the first day that CQA work is required. The Contractor shall be responsible for the maintenance of these facilities throughout the duration of the works.

All keys for the CQA Inspector's facilities shall be handed to the CQA Inspector.

1.5 Landfill Gas and Leachate Management Systems

FCC has installed landfill gas and leachate management systems across the Site, including areas within and adjacent to the works. FCC shall inform the Contractor which systems are to remain undisturbed during the period of the works, and which can be, or have been, decommissioned.

Should the Contractor subsequently damage or disturb any operational system, he shall immediately inform FCC. Only if required by FCC, the Contractor shall carry out such reasonable remedial measures as are deemed necessary by FCC to reinstate any damaged or disturbed system to the same condition as immediately prior to commencement of the works, otherwise FCC shall provide for the remediation to be completed within a timescale to be agreed with the Contractor.

1.6 Environmental Permit (EP)

The area of the works is encompassed by the existing EP for the current landfill operations. The Contractor shall not directly or indirectly compromise FCC's ability to carry out its operations in accordance with the Permit, a copy of which shall be provided by FCC on request.

2 CONSTRUCTION REQUIREMENTS

2.1 Regulations and Site Safety

The works come under the Construction (Design and Management) Regulations of 2007 and the Main Contractor will also be appointed as the Principal Contractor.

The Contractor shall comply with the safety requirements set out in the following documents:

- FCC - Health and Safety Policy;
- FCC - Site User Safety Instructions;
- FCC - General Policy Statement for Contractors Conditions of Contract and Safety Rules;
- FCC - Health & Safety Site Plan.

A copy of these documents is available for inspection at the landfill site office.

The Contractor shall adhere to the site Health and Safety Rules and the DSEAR Regulations dated 2002. The Contractors performance with respect to these rules will be reviewed at each progress meeting.

2.2 CDM Area

The extent and location of the CDM area shall be agreed with FCC prior to any works commencing on-site, and 'works' shall include the delivery of any plant, equipment, materials and/or accommodation.

The agreed area shall be demarcated on site and once demarcated, the Principal Contractor shall ensure that the requirements of the CDM Regulations 2007 are adhered to at all times within it.

2.3 Method Statements and Risk Assessments

The FCC Design Risk Assessments are enclosed in Appendix 1.

The Contractor shall submit to FCC for the approval, prior to commencement of the works, method statements and risk assessments detailing the proposals for all the works to be undertaken.

2.4 Substances Hazardous to Health

A substance hazardous to health shall only be used or generated in or about the works where specified in the Contract or with the consent of FCC

Where any substance hazardous to health is so used or generated during the works the Contractor shall provide FCC with:

- A copy of the assessment of the risks created by the use of that substance; and
- Details of the measures to be taken to prevent or adequately control the exposure of the persons working with or those who may be affected by the substance.

The information required in the above shall be provided to FCC at least 14 days prior to the use of or incorporation into the works of substances hazardous to health or where appropriate at the commencement of the works where this is less than 14 days.

The Contractor shall advise FCC of the information, instruction, training and supervision to be provided for the Contractor's personnel and any other person likely to enter the area in which the hazard exists. The Contractor is to ensure that provision is made for monitoring health.

Where the measures referred to necessitate the use of protective clothing or other safety apparatus the Contractor shall:

- Provide FCC and his staff with sufficient and suitable items of protective clothing and safety apparatus if not previously supplied;
- Arrange for the proper storage, maintenance and regular testing and replacement of the items provided to the Employer and his staff; and
- Arrange for appropriate training or instruction for FCC and his staff in the use of such items.

2.5 Noise

The Contractor shall comply with any site specific noise limits and the following specific requirements:-

- No work other than the operation of plant and equipment for the control of the groundwater shall take place outside the permitted hours except in case of emergency. FCC shall be informed of any such emergency immediately.
- All mobile plant, equipment and vehicles under the control of the Contractor, his sub-Contractors and suppliers, and in use or calling at the site, shall be fitted with appropriate silencing equipment and shall be maintained to manufacturers' standards.

2.6 Naked Flames and Smoking

Naked flames are prohibited within the working area on site at all times. Smoking will only be permitted in areas approved by FCC.

The Contractor shall obtain a permit to work from FCC for any 'hot works'. The works are to be carried out away from the landfill area and at a location agreed with FCC.

2.7 Mobile Plant

All Contractors vehicles (plant and operatives vehicles) shall be fitted with flashing amber beacons for vehicle awareness. Green flashing beacons to indicate that seat belts are in operation shall also be fitted to all construction plant. These beacons shall be located in a visually prominent position and shall be used whenever vehicles are on site. No Contractors vehicles will be allowed on site without the use of a flashing amber beacon.

All mobile plant shall be assessed for restricted rear view vision and action agreed, dependant upon the outcome of this assessment, which may result in suitable equipment being fitted in order to minimise the potential risk to within acceptable limits.

2.8 Dust Nuisance

The Contractor shall take all necessary steps to eliminate the generation of dust nuisance during the works.

Existing highways, site and access roads used by the vehicles and plant of the Contractor or of his sub-Contractors or suppliers of materials, shall be kept clean and clear of all dust and mud dropped by the vehicles in any form. All dust and mud from the works spreading onto highways, site and access roads shall be immediately cleared by the Contractor by use of mechanical plant to the approval of FCC.

Compliance with this clause shall not relieve the Contractor of any responsibility for complying with the requirements of any Highway Authority in respect of keeping roads clean.

2.9 Communication Systems

The Contractor shall obtain the approval of FCC prior to the commissioning of any communication equipment and, following approval, shall ensure that it does not interfere with any existing systems on the site.

2.10 Access

The general arrangement of the site is shown on the respective site layout drawings. The only entrances to the works for the use of the Contractor are via the main site entrance, no other site entrances are to be used unless stated in the Specification. Areas for site offices, welfare facilities and plant standing areas will be arranged with FCC.

The main access road is to be kept clear at all times, as it will be used primarily by FCC's operations traffic. The Contractor will need to make provision for providing suitable access within the site, in particular between borrow areas, stockpile areas and the Contractors compound.

The Contractor must not use the access roads used by FCC for access into active cells unless given prior permission of FCC. Alternative access roads must be used or constructed, the locations of which shall be agreed with FCC prior to work commencing.

The Contractor shall carry out jointly with FCC a condition survey of the access roads made available under the Contract prior to the commencement of any works. The Contractor shall repair and make good any damage to FCC's landfill access roads which occur as a result of the Contractor's activities.

The Contractor's vehicles must give way to landfill traffic and not impede the movement of the traffic involved in landfill operations.

The specified speed limits within the landfill site shall be observed at all times. Non compliance may result in the exclusion of any offender from the site.

Appropriate signage must be displayed to warn traffic of slow moving plant, particularly if the haul road access crosses the main access road.

All vehicles leaving the site must be free from mud and debris. The Contractor will be responsible and will pay for the removal of debris and any damages arising from mud and debris that leaves the site as a consequence of the works.

2.11 Permitted Hours of Working

Unless otherwise agreed with FCC, the permitted hours of working are:

Monday to Friday	-	07.00 -18.00
Saturday	-	07.00 -14.00

Working on Sundays and Bank Holidays will not be allowed unless approved beforehand by FCC.

2.12 Control of Surface Water

The Contractor shall carry out all necessary operations for the control of standing water, or surface water run-off, within the CDM area to enable the construction of the works, and by doing so shall prevent damage to the works, the site, or adjoining properties. Where these actions include measures to prevent the in-flow of water from the site, these works shall be approved by FCC before commencement.

Any water shall only be discharged outside the CDM area and/or off-site following the receipt of approval by FCC.

2.13 Control of Leachate

The Contractor shall carry out all necessary operations for the control of leachate, within the CDM area to enable the construction of the works, and by doing so shall prevent damage to the works, the site, or adjoining properties. Where these actions include measures to prevent the in-flow of leachate from the site, these works shall be approved by FCC before commencement.

Any leachate collected shall only be discharged outside the CDM area and/or off-site following the receipt of approval by FCC.

2.14 Disposal of Exhumed Waste

In the event that it is necessary to excavate waste in order to achieve any element or elements of this specification, the excavated waste will be disposed of in the operational area of landfill, or as otherwise directed by FCC.

2.15 Protection of Boreholes

The Contractor shall locate and adequately protect existing deep ground water and landfill gas monitoring boreholes within the works area from damage during the works. The location of the boreholes are to be confirmed with FCC.

2.16 Inclement Weather

No materials shall be placed or compacted during inclement weather conditions, if in the opinion of FCC, trafficking over compacted or uncompacted material would prove detrimental to the construction. Any such trafficking damage caused by the Contractor shall be repaired in accordance with the Contract at the Contractor's expense. Inclement weather conditions may include, rain, snow, freezing conditions or excessive heat as indicated by FCC.

Following wet weather conditions, any standing water on the surface of the construction must be removed at the Contractor's expense. If instructed by FCC, the Contractor shall remove any material rendered unsuitable by wetting at the Contractor's expense. Earthworks placement operations following inclement weather conditions shall not proceed without the prior approval of FCC.

Any frozen material shall be allowed to thaw before use. Previously compacted material that has become frozen shall be removed from the works and stockpiled until suitable for reuse.

2.17 Tolerance limits

Tolerance limits for the work shall be as follows:

- i) Positions in plan shall be within 50 mm of the true positions shown on or calculated from the drawings.

- ii) Levels shall be + 50mm of the required elevation shown on or calculated from the drawings.
- iii) Tolerance for clay liner thickness shall be 0.5 m, + 50 mm, -0 mm.

2.18 Confidentiality

The whole of the Tender Documents and all information provided by FCC for the purpose of or in connection with the Contract shall be dealt with by the Contractor as confidential to him and not be disclosed by him other than to his employees, sub-contractors or agents as appropriate for the sole purpose of the Contract.

The Contractor shall not, except with the prior consent in writing of FCC:

- i) Publish or advertise or permit to be published or advertised any photograph, drawing or written matter concerning the Contract or the works.
- ii) Use or permit the use of the name of FCC in any publication or advertisement.
- iii) Place any advertisement on any part of the works.

The Contractor shall refer all press representatives to FCC. Photographs for publication shall not be made of any part of the works without the prior written authorisation of FCC. Such authorisation if granted shall be in the form of itemised approvals for each exposure concerned.

3 SCOPE OF THE CONSTRUCTION WORKS

3.1 General Description

The design concepts for the capping construction were developed to accord with the Permit for the site.

The position of the proposed development in relation to previous cells, is shown on Drawing 112D_NW_2011_29_01 – Phase 3 Proposed Extents of Capping Works and Construction Details.

Construction of the capping area shall generally involve:

- Full Removal of temporary capping and any underlying geocomposite protection layer;
- Trimming/placement of the 300mm thick regulating layer to achieve the formation levels for the liner;
- Installation of a 1 mm thick, LLDPE, double textured, Geomembrane liner ;
- Installation of French drains and associated water extraction sump
- Installation of Drainage Geocomposite to slopes with gradients $<1(v):3(h)$ and lower section of the cap as shown on the design drawing;
- Installation of a geotextile protector to the permanent capping area to slopes with maximum slope gradients of $1(v):3(h)$;
- Installation of a 1000mm restoration soils to the permanent capping area with maximum slope gradients of $1(v):3(h)$ / soils placed to a maximum slope angle of 1:3 slopes with underlying gradients $<1(v):3(h)$ and lower section;
- Tie into existing lining system.

3.2 Principal Quantities

The principal quantities for the works are given in Appendix 2.

3.3 Survey Information

The Contractor shall undertake an initial survey on a 10m grid spacing, or a 5m grid spacing on slopes and at breaks of slopes, of the site, this shall be compared to existing surveys, and once approved by FCC, the Contractor's survey will form the 'original ground level survey' (OGL) from which the measurement of the works will be undertaken. Further surveys will be required as follows;

- i) Formation levels/top of waste;
- ii) Location of existing lining systems for tie in;
- iii) Regulating layer surface
- iv) LLDPE geomembrane panel layout;
- v) Geotextile protector panel layout;
- vi) Drainage Geocomposite panel layout;
- vii) Top of placed soils.

3.4 Daily Journal

The Contractor will be required to keep a detailed daily journal recording the information detailed below. The Contractor will give FCC reasonable access to the daily journal which will, if necessary, be made available to FCC, The EA or any other Authority during and after completion of the Works if required. The Contractor will forward copies of the daily journals on a weekly basis to the FCC.

This information shall be recorded in an acceptable form of daily journal which shall include the following:

- date of shift;
- names of personnel in attendance during the shift;
- Start and finish times of Contractor and CQA Inspector;
- weather conditions, including ambient temperature;
- type of plant used; plant breakdowns and hours;
- approximate totals of earthworks carried out including identification of source and destination;
- removal of foreign matter and oversize material;
- depth of regulating layer and restoration layer;
- approximate totals for amount of materials deployed, seamed, tested and repaired including width of each panel installed;
- summary of field and laboratory testing carried out;
- sample type and material taken for particular testing;
- delays;
- additional works, reasons and reference;
- deliveries;
- details of meetings and other correspondence;
- details of remedial works; and any other relevant information.

4 CQA SUPERVISION

4.1 General

The CQA Project Team will comprise the following:

The CQA Manager - Will be office based and responsible for the following:

- Administration of the CQA program;
- Attendance at selected progress or liaison meetings and is the key contact with regulatory officers;
- Production of the CQA Validation Report.

The CQA Inspector – The representative of the CQA Manager located full time at the site during works requiring CQA supervision and responsible for the following:

- The on-site representative of the CQA Manager;
- To be fully familiar with all CQA requirements for the project;
- Attendance at all CQA-related meetings (e.g. Pre-construction and Progress);
- Preparation, or overseeing the ongoing preparation of the as-built drawings;
- Assigning locations for testing and sampling;
- Keeping daily reports and records;
- Reporting to the CQA Manager any relevant observations;
- Overseeing the collection and shipping of all samples for laboratory testing;
- Reviewing the results of laboratory testing and making appropriate recommendations;
- Reporting any unresolved deviations from this CQA Plan to the CQA Manager;
- Provision of all records and relevant data to the CQA Manager for the preparation of the final validation report, which will be submitted to The EA for approval upon completion of the works; and
- Noting and bringing to the attention of the Contractor any on-site activities that could result in damage to the liner system.

Staff undertaking the roles of the CQA Manager and the CQA Inspector should have relevant experience in landfill construction and earthworks control or be supervised by experienced staff until relevant experience is obtained.

4.2 Daily Meetings

Meetings will be held daily between the CQA Inspector and the Contractor's representative. The purpose of which is to:

- Review the work activities and locations for that day;
- Note the Contractor's installation personnel and plant for the day/shift;
- Review the previous days progress;

- Review the work schedule;
- Discuss any interfacing with other contractors and/or site operations; and
- Discuss/highlight any problems and identify solutions.

4.3 Site Visits

It is anticipated that from time to time that The EA will visit the site to review the works. During these visits the CQA Inspector shall make available all test results and daily records up to that date for inspection by The EA.

Any problem encountered during construction should be discussed with The EA upon their arrival to site prior to any subsequent site walkover. The CQA inspector shall discuss the problems encountered any discuss any proposed remediation methods.

4.4 CQA Requirements

The CQA requirements associated with each component of the works are detailed in the individual sections below.

5 EARTHWORKS REQUIREMENTS

5.1 General

This section outlines the requirements for excavation and placing the engineered fill materials to the details as shown on Drawing 112D_NW_2011_29_01.

The compaction of all engineered fill materials shall be carried out in accordance with the Highways Agency “Manual of Contract Documents for Highway Works (MCDHW) – Volume 1 Specification for Highway Works” 1998 Series 600 Earthworks, published by HMSO except as amended hereunder. The Contractor shall employ only that plant and those working methods that are suited to the materials to be handled and traversed. He shall be responsible for maintaining the nature of the suitable material so that when it is placed and compacted it remains in accordance with the Contract. Suitability shall be determined in accordance with the definitions below.

The Contractor shall submit his proposals to the CQA Inspector regarding the extent and management of the excavations, stockpiling and filling of materials before starting works. Excavations shall not proceed without the prior approval of the CQA Inspector.

The Contractor shall not remove any materials from the site unless approved by FCC.

After completion of the works, the Contractor is required to re-grade any stockpiles and surrounding areas where deemed necessary. This shall be carried out to the satisfaction of the CQA Inspector..

5.2 Definitions

The following definitions shall apply to the specifications wherever reference is made to the defined engineered fill material.

- “Suitable material” shall comprise all that is acceptable in accordance with the Contract for use in the works and deemed by the CQA Inspector to be suitable;
- “Unsuitable material” shall mean material other than suitable materials and shall include:
 - Peat, material from swamps marshes and bogs;
 - Logs stumps and perishable material;
 - Material in a frozen condition;
 - Material susceptible to spontaneous combustion; and
 - Any commercial or domestic waste.
- “rock” shall be deemed to mean hard material which, in the opinion of the Project Manager, necessitates for its loosening or removal the use of special machinery designed for rock cutting, but shall exclude any material that can be removed by normal excavating machinery and which, in any case, has a volume not exceeding 1 cubic metre or 0.25 cubic metres where the net width of the excavation is less than 2 metres.

5.3 Waste Surface Preparation

Upon completion of landfilling the surface of the waste will have been temporarily covered with a layer of soils. Prior to installing the capping system the surface of the waste shall be re-graded to remove any undulations and unsuitable waste materials, which, in the opinion of the CQA Inspector, may affect the performance of the cap.

As part of the preparation, some waste may be exposed. The Contractor shall ensure that during the re-grading works, at anyone time, the area exposed shall not exceed 1,000m², in order to minimise the emission of landfill gas, control odours and nuisance from litter, vermin, birds and insects.

If at the end of the day it is not possible to install the geomembrane over the working area, the Contractor shall place a minimum of 300mm of the waste regulating layer over the exposed waste.

The surface of the waste may require minor re-grading works to remove any undulations, which may allow water to pond. The re-graded surface of the waste shall be compacted to minimise future differential settlement.

If unusual or hazardous waste is encountered during the re-grading process, the Contractor shall not excavate these materials until they have been categorised and handling precautions confirmed with FCC.

All large articles of waste encountered during the re-grading process, such as crates, barrels, or other materials that may degrade and collapse at some time in the future, shall be crushed, broken up and flattened, and buried and subsequently covered to a depth of not less than 1m below the surface of the waste.

In the event of perched leachate being encountered locally saturating the waste surface, saturated material shall be excavated and replaced with granular drainage material. The granular material shall comprise inert crushed rock or gravel. The leachate will be allowed to flow via a granular filled trench, down the waste slope to a more permeable waste to facilitate the drainage of the leachate within the waste mass. All excavated waste material which cannot be locally re-graded shall be disposed of in the active area of the landfill.

Upon completion of the re-grading works the Contractor shall seek approval from the CQA Inspector as to the adequacy of the prepared surface to receive the waste regulating layer.

The Contractor shall undertake a topographical survey of the area to be capped in order to establish any requirement for re-grading of slopes.

5.4 Waste Regulating Layer

A minimum 300mm thick layer of clayey or other suitable material with a maximum clod size of 125 mm will form the waste regulation layer above the waste and shall be installed over the final waste level to provide an even surface upon which to place the capping system.

The CQA Inspector should be satisfied that the resulting layer is firm and unyielding. Where recycled material is used the CQA Inspector should be satisfied of the homogeneity of the material, to avoid differential compression which may induce stresses in the capping layer.

In order to ascertain the suitability of the composite layer as a regulating material. The CQA Inspector may request the contractor to produce a compaction trial, which may be subject to destructive examination at the CQA Inspector's request. Should the nature of the soils or recycled material significantly change throughout the works, the CQA inspector may request further trials to be carried out.

The surface of the waste regulating layer to receive the geomembrane cap shall be smooth and free from debris, roots, angular or sharp rocks and any other deleterious materials that may cause damage to the capping system. Any such deleterious material shall be removed from the surface and any resulting depression repaired to the CQA Inspectors satisfaction.

The surface shall be rolled and compacted such that in any event it provides a firm unyielding formation sufficient to permit the movement of vehicles and welding equipment over the surface without causing rutting or other deleterious effects. The surface shall have no sudden sharp or abrupt changes in grade, and shall be free from areas excessively softened by high water content. A continuous fall shall be maintained towards the low lying area of the restoration surface, with no areas of ponding or backfalls on the surface.

If an adequate regulating layer surface cannot be achieved, the contractor may include a lower protection geotextile, to the same specification as the upper protection geotextile, as described in the relevant section of this document.

5.5 Regulating Layer Testing Requirements

The maximum particle size for material within the regulating layer in direct contact with the Geomembrane shall be 10mm. Larger particles are permitted within the regulating layer, however should stones larger than 10mm diameter be visible within the surface of the regulating layer these shall be picked, and the surface depression in-filled with suitable material.

Testing shall be carried out on the regulating layer in accordance with Table 1.

Table 1. Regulating Layer Testing Requirements

Parameter	Test Method (BS 1377:1990:)	Acceptance Criteria	Testing Frequency
Cohesive Fill:			
In-situ Shear Strength (Hand Shear Vane)	Part 9 Test 4.4	>50 kPa	1 per 25m Grid

5.6 CQA Requirements

The CQA Inspector shall:

- Assess the methods statement submitted by the Contractor for the installation of the preparatory earthworks;
- Ensure that all material within the working area deemed unsuitable in accordance with the specification is removed to an area agreed with FCC's Site Manager;
- Ensure an assessment of the regulating layer is carried out and record the results of the assessment.
- Ensure that soils and vegetation protecting the intercell bunds are removed without damaging the underlying lining materials;
- Ensure that only suitable soils are used where required as engineered fill;
- Monitor the placement and compaction of the engineered fill, ensuring that the works are carried out in accordance with the Specification;
- Ensure that all areas of non-compliance are remediated in accordance with the specifications;
- Take photographs during the construction;
- Ensure that surveys are undertaken in accordance with the specifications to confirm that the requisite levels and layer thicknesses have been achieved.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

6. GEOMEMBRANE LINING

6.1 General

The approved surface of the regulating layer shall be covered with a welded, double textured, 1 mm thick Linear Low Density Polyethylene (LLDPE) geomembrane. The geomembrane shall be supplied in accordance with the following specification and installed in accordance with Drawing 112D_NW_2011_29_01.

The Contractor shall be required to undertake the following:

- Supply and install a welded, textured, 1 mm thick, LLDPE geomembrane on the approved surface of the regulating layer; and
- Provide all material quality control certificates and other information described below.

6.2 Contractor's Experience

The liner installation Contractor or Sub-Contractor shall have considerable experience of installing geomembrane of the type specified for the works. The Contractor shall submit a summary of the experience of the proposed liner installation Contractor with the specified materials including an estimate of the total area installed by him in the United Kingdom over the past 3 years.

6.3 Geomembrane Material

The geomembrane will consist of double textured 1.0 mm thick LLDPE produced from new resins and containing no fillers, plasticisers or additives of any kind with the exception of carbon black. The surface shall be un laminated and free from blemishes, abrasions or other surface imperfections.

The geomembrane will conform to the parameters established as given in Table 2 below.

Table 2: Geomembrane Specification

Parameter		Test Method	Requirement
1	Thickness*	ASTM D5994	1.0 mm (nom -5%) 1.0 mm (-10%, 8 out of 10) 1.0 mm (-15% lowest value)
2	Density	ASTM D1505A/D 792	0.939 g/ml (Max)
3	Carbon Black Content	ASTM D1603	2% to 3%
4	Carbon Black Dispersion	ASTM D5596	9 of 10 views in categories 1 and 2 (min) 1 view in category 3 (max.)
5	Tensile Properties: Break Strength Elongation at Break	ASTM D6693 Type IV	 >11 N/mm (min. ave) >250% (min. ave)
6	Puncture Resistance	ASTM D4833	200 N (min. ave.)
7	Tear Resistance	ASTM D1004	100 N (min. ave.)
8	Oxidation Induction Time (OIT) Standard OIT or High Pressure OIT	ASTM D3895 ASTM D5885	100 minutes (min. ave.) 400 minutes (min. ave.)
9	Oven Aging at 85°C Standard OIT - % retained after 90 days or High Pressure OIT - % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	35% (min. ave.) 60% (min. ave.)
10	UV Resistance (high pressure OIT, % retained after 1600 hours)	GRI GM11 ASTM D5885	35% (min. ave.)

* Note that this test is not appropriate for testing textured surfaces. The test should be carried out on smooth edges of textured sheet or on smooth sheets made from the same formulation as used for the textured sheet.

6.4 Delivery, Handling and Storage

The geomembrane will be delivered to site in rolls equipped with canvas slings and loaded in such a way as to facilitate the unloading and handling of each roll without damaging it.

Each roll will be clearly labelled with the manufacturers' name, the product name and type, the batch and roll number, and the roll length, width, weight, and date of manufacture.

A crane or other suitable lifting equipment will be used to off-load the rolls to the storage area. Rolls will only be lifted by the supplied the canvas sling or core bars.

The storage area for the geomembrane will be agreed with FCC and prepared to the satisfaction of the contractor prior to delivery of the material to site. The storage area will be large enough to accommodate the rolls of geomembrane flat to the ground. It will be flat, clean, dry, and free from rocks or other obstacles and it will be located out of the way of the way of moving plant. The rolls of geomembrane will not be stacked more than 3 high with nothing stacked above the geomembrane.

The Contractor shall provide adequate and acceptable measures for protecting the material at all stages of the work, from all sources of potential damage such as sharp objects, boulders, cobbles etc, including weather conditions, until completion of the contract.

6.5 Manufacturer's Quality Control

The Contractor will supply a quality control certificate for each roll of material delivered to site and each batch of resin used in production of the geomembrane. The certificates will be supplied prior to delivery of the material to site and will contain quality control data in accordance with the test methods and requirements given in Table 2 above.

The certificates will include;

- i) The manufacturers name;
- ii) Product name and type;
- iii) Date of manufacture;
- iv) Batch number and roll number and;
- v) Values for those parameters listed in Table 2 (excluding UV resistance).

Should the date of manufacture exceed 1 year prior to delivery to site, then the Contractor shall seek the following information from the manufacturer/supplier:

- vi) Storage location;
- vii) Storage conditions;

6.6 Conformance Testing

As soon as practicable after the delivery of the geomembrane rolls to site, the Contractor shall select, cut and label samples 1 m long across the entire width of the selected rolls for retention and/or conformance testing as directed by the CQA Inspector. One set of samples per 5,000 m², or part thereof, one per resin batch or one per 5 rolls delivered to site, whichever is greater. Samples for conformance shall not be taken from the first linear metre of the roll.

The Contractor shall submit the samples for conformance testing to an independent laboratory having UKAS accreditation for each test being carried out. A copy of the results of the testing are to be forwarded to the CQA Inspector.

If testing shows that the geomembrane does not meet any one of the minimum requirements of Table 3 then this may be cause for rejection of the material from that roll.

Table 3: Geomembrane Conformance Testing

Parameter	Test Method	Test Frequency	Requirement
			Textured
Conformance Sampling and Testing			
Thickness (min.ave) Thickness (8 out of 10) Thickness (lowest value)	ASTM D5994	5,000 m ²	1.0 mm -5% 1.0 mm -10% 1.0 mm -15%
Density (min.)	ASTM D1505A/D 792	5,000 m ²	0.939 g/ml (Max)
Carbon Black Content (min)	ASTM D1603	5,000 m ²	2-3%
Carbon Black Dispersion	ASTM D5596	5,000 m ²	9 of 10 in cat 1 or 2 1 of 10 in cat 3
Tensile Strength At Break (min.ave) Elongation at Break (min.ave)	ASTM D6693	5,000 m ²	11 N/mm ² 250%
Tear resistance (min. ave)	ASTM D1004	5,000 m ²	100 N
Puncture Resistance (min ave)	ASTM D4833	5,000 m ²	200 N
Oxidative Induction Time (OIT) (min. ave)*	ASTM D3895/D5885	10, 000 m ²	100/400

*The manufacturer has the option to select either one of the OIT methods listed I GM 17 to evaluate the antioxidant content of the Geomembrane.

The CQA Inspector may at his discretion accept material from elsewhere on that roll if the Contractor can demonstrate through further laboratory testing (at his expense) at a geosynthetic testing laboratory approved by the Engineer that this material does meet the acceptance criteria contained in Table 3.

6.7 Surface Preparation Prior to Geomembrane Deployment

The geomembrane will be deployed directly onto the prepared surface of the regulating layer. The surface will be clean, smooth rolled, and free from loose material, ponded water, desiccation cracks, soft spots or any other surface defects. There are to be no sharp angles in the subgrade which exceed ±10mm when checked with appropriate equipment..

The maximum size in any dimension for particles in the prepared surface will not exceed 10mm (in accordance with section 5.6), and the surface will be free from any protrusions or sharp or angular stones or other objects that could damage the geomembrane liner.

The CQA Inspector will inspect and approve the surface prior to deployment of the geomembrane. Geomembrane will not be installed at any location without the approval of the surface at that location.

Should any area fail to meet the required standard for geomembrane deployment the Contractor will remediate the area to the CQA Inspector's satisfaction. The methodology for the remediation of the failed surface will be discussed and agreed with the CQA Inspector prior to remedial works taking place.

Approval of the surface may be withdrawn if the surface should deteriorate prior to deployment of the geomembrane. Approval will then be withheld until the surface has been remediated to the CQA Inspector's satisfaction.

6.8 Deployment of Geomembrane

Prior to the commencement of installation, the Contractor will submit an accurate sketch or drawing to the satisfaction of the CQA inspector, showing the proposed rolls, panel layout, and overlaps for the geomembrane. The sketch or drawing should show the Contractor's proposed start point and proposed direction of working. Any alterations from this proposed layout will not proceed without prior consent from the CQA inspector.

The Contractor will record each panel deployed and maintain a record of the date and location of installation. Each panel will be observed for defects and a record will be kept to assure that all defects are properly repaired. All geomembrane panels will be arranged so that seams are aligned in the direction of maximum slope, wherever practicable, in accordance with accepted good practice.

The Contractor will ensure that;

- No damage is caused to the geomembrane by the tools, plant or equipment during deployment.
- Equipment used does not cause excessive heating, or leakage of hydrocarbons onto the geomembrane;
- The geomembrane will remain clean and free from any contamination.
- Personnel working on the geomembrane will not smoke, wear shoes likely to cause damage, or engage in any other activity that could damage the geomembrane.
- The method of deployment will be such as to minimise stresses or strain on the geomembrane and will not cause damage to the underlying layers.

- The geomembrane will be in intimate contact with the underlying surface without bridging over hollows or humps.
- The method of deployment will minimise wrinkles and creases in the geomembrane.
- No vehicles will track directly over the geomembrane.
- Surface water will be prevented from infiltrating beneath the deployed geomembrane.
- No geomembrane will be deployed during periods of rain, snow, or wind likely to cause damage to the geomembrane.

The geomembrane shall be secured in anchor trenches and welded to existing geomembrane where required.

6.9 Seaming Procedures

Only suitably qualified (Level 1 certification) and experienced personnel will carry out the deployment and welding of the geomembrane liner. The welding operators and installation staff should hold a current third party certificate for installation and welding of flexible lining systems to a recognised standard (e.g. the British Geomembrane Association (BGA) or Thermal Welding Institute (TWI/CSWIP) third party accreditation schemes).

The Contractor shall provide the CQA engineer with the relevant details, certifications, and experience records for the last 6 months, of his proposed personnel for all lining works.

The Contractor will only construct field seams on each working day after trial seams have been carried out on that day to the satisfaction of the CQA Inspector. The general seaming procedure will be such that:

- The welding equipment does not damage the geomembrane;
- All surfaces of the geomembrane to be seamed are clean, dry and free from dust, dirt, debris and foreign material of any kind prior to seaming;
- Where seam overlap grinding is necessary it shall not remove more than 10% of the nominal geomembrane thickness and does not extend more than 12mm on either side of any proposed extrusion seam. Grinding will not take place more than one hour prior to seaming;
- Temporary heat bonding of adjacent panels, or any pre-heating during seaming, will not cause any damage or overheating to the geomembrane. The use of adhesives shall not be permitted;
- Where a seam runs into an anchor trench the weld will extend to the back edge of the trench. Any seam defects falling within the anchor trench will be repaired in accordance with the specification;

- Seams will be aligned so as to minimise the number of wrinkles and "fishmouths". Any wrinkles/fishmouths that cannot be eliminated by pulling the sheet will be cut along their ridge, overlapped and extrusion welded. Where the overlap does not meet the requirements of the specification it will be patched in accordance with the specification.

Unless approved by the CQA Inspector, seaming shall not occur:

- During any period of rain or snow unless the CQA Inspector is satisfied that measures have been implemented to allow the seam to be made on dry geomembrane materials;
- At ambient temperatures lower than 5°C or higher than 35°C;
- during periods of high relative humidity or wind speed;
- Over frozen or saturated ground;
- Over ponded water;
- During periods of darkness unless approved by the CQA Inspector and subject to the Contractor providing adequate lighting.

If the Contractor wishes carry out welding at ambient temperatures below 5°C or above 35°C, he shall demonstrate by trial seaming that the seam is equivalent to those produced under approved conditions and that the overall quality of the geomembrane is not adversely affected.

The Contractor will clearly mark the minimum overlap on the edge of the underlying geomembrane panel prior to welding the seam.

6.9.1 Trial Seams

The Contractor will perform trial seams with each seaming machine and operator at least at the start of each shift and following any period of machine shutdown greater than 1 hour or change of operator in the presence of the CQA Inspector as shown in table 4. In addition, trial seams should also be carried out where weather conditions have changed such that there will be an effect on the welding efficiency of the machinery, and if there is any doubt about the effectiveness of the welding equipment.

The trial seams will be at least 3 m long for both extrusion seams and fusion seams. On completion of the trial seam, the Contractor shall cut a total of six 25 mm wide field tabs normal to the seam at 150 mm centres and subject the tabs to field destructive testing. Three specimens shall be tested in peel mode and three in shear mode.

If a trial seam fails field destructive testing as specified above then the entire operation will be repeated. The seaming machine and the operator will not be allowed to perform field seaming until the deficiencies are corrected and both machine and operator have achieved passing trial seams.

If any of the additional specimens fail, the welding equipment shall be inspected and a report made of any defects and the corrective action taken. Welding may continue after two further consecutive full trial seams are achieved without failure.

Should three test welds fail in any 24 hour period, two samples will be sent to an independent laboratory for testing. If the test results indicate failure the machine shall be returned for repair. If the test results indicate a pass the equipment may be used subsequent to two further consecutive full trial seams being achieved without failure. The equipment should not be used until the test results are known. If the equipment fails five times in any 48 hour period it shall be returned for repair with a record kept of the service.

The CQA Inspector will verify that trial seaming is performed at the appropriate intervals and that passing results are achieved prior to any production seaming by the apparatus/seamer. The CQA Inspector will observe the field testing of each trial seam and will maintain a log of all trial seam data.

Table 4: Geomembrane Installation Testing

Parameter	Test Method	Test Frequency	Requirement Textured
Start Up Test Weld			
Welding Equipment and Operative	Visual and peel and shear using appropriate equipment	Daily at the start of works and after 1 hr stoppages and after any significant changes in welding conditions	Test fails outside welded area
Non-Destructive Weld Testing			
Dual Track Welds (Fusion welds)	Air Pressure Test	Continuous – every weld	Inflate to 2 bar and maintain pressure over 5 minutes
Extrusion Welds	Spark Test or Vacuum Box	Continuous – every weld	No sparking witnessed
		Continuous – every weld	No bubbles witnessed
Destructive Weld Testing			
<i>On-site</i>	Peel and shear using appropriate equipment	Every weld	Failure to be outside weld
<i>Off-site</i> - Seam peel strength and bonded seam strength	ASTM D6392 GRI GM19	1 per 200m of seam	<i>Fusion Weld:</i> Shear Test >11N/mm ² Peel Test >9N/mm ² <i>Extrusion Weld:</i> Shear Test >11N/mm ² Peel Test >8N/mm ²
QA Inspection			
Visual Inspection of Geomembrane Thickness (along edge)	For tears, holes, scratches, cuts etc. Micrometer	Every roll 5 per 100m of deployed liner separated by 10-20m	No defects 1 mm (min.ave)

6.9.2 Seaming Methodology

The panels will be deployed in accordance with a method statement and proposed panel layout drawing issued by the Contractor prior to commencement of the works; the method statement and proposed layout will be submitted for approval to the CQA Inspector.

6.9.2.1 Fusion Welding

Wherever possible the seams in the geomembrane will be fusion welded with a double seam.

Fusion welded seams will be formed by working in one direction only.

6.9.2.2 Extrusion Welding

Extrusion seaming will only be used with the approval of the CQA Inspector where;

- Double seam welding is not practicable;
- Defects in the geomembrane need to be repaired;
- Patches have to be welded over the location of field seam test samples.

The width of extrusion seams will not be less than 30mm. Where it is safe to carry out spark testing of seams a thin gauge copper wire will be bonded into the fillet of the seam joint before the seam is formed.

Prior to forming an extrusion seam adjacent panels will be temporarily secured by heat bonding and the seam surfaces roughened by grinding to provide a key and to remove surface oxidation.

The extrudate material used for extrusion welding shall be identical in composition to that of the geomembrane.

The extruder will be purged prior to the commencement of any extrusion seaming or after any stoppage in seaming until all heat degraded extrudate has been removed from the barrel.

The CQA Inspector will utilise a seam numbering system that is a combination of the panel numbers being joined. For example, the seam joining panels No 1 and 2 would be seam No 1/2. The CQA Inspector will maintain a log of seaming data for each seam including the source roll for each panel, date and time, identification of the seamer and machine, ambient and machine temperatures. All seams will be observed for visual integrity and any defects will be logged to verify that they are properly repaired and tested.

6.10 Sampling and Testing

Sampling and testing shall be carried out in accordance with the requirements of Table 4.

6.10.1 Qualitative Destructive Testing

The Contractor will take a tab sample from the start and end of each completed seam. The tabs will be 25mm wide and at least 105mm long with all tabs being tested for peel failure. The seam will be deemed to have passed qualitative destructive testing if the failure occurs solely in the geomembrane and does not enter the seam. The seam will be deemed to have failed qualitative destructive testing if any of the failure enters the seam. (See Appendix 3)

If the tab sample fails field qualitative destructive testing the Contractor will carry out all of the following actions:

- The welding equipment will be taken out of service until it has passed a trial seam.
- Additional tabs will be taken at 3m intervals each side of the failed tab for qualitative destructive testing.
- Further tabs will be taken until the failed part of the seam can be identified between two successful tabs.
- The failed seam will then be reconstructed in accordance with the specification. The CQA Inspector may direct the taking of additional tab samples and qualitative destructive testing at any location along the length of a seam.

6.10.2 Quantitative Destructive Testing

The Contractor will recover samples for quantitative destructive testing from completed field seams as the seaming work progresses at a frequency of one sample from a minimum of every 200m of welding or one sample per day per machine, whichever is the greater, at locations as directed by the CQA Inspector. The Contractor shall submit the samples for conformance testing and will send a copy of the results of the testing to the CQA Inspector. This shall not relieve the Contractor from any of his obligations under the Contract.

Each sample will be at least 0.3 metres wide by 1.2 metres long with the seam centred lengthways. One 25mm wide tab will be cut from each end of the sample. The remaining sample will be cut into three parts with one additional 25mm wide tab being cut from each end of the central portion. The tabs will be tested in the field for failure in peel and shear in accordance with the specifications.

The three sample parts shall be distributed as follows:

- i) one part measuring 300mm x 300mm, to the Contractor;
- ii) one part measuring 300mm x 500mm, to the CQA Inspector, and;
- iii) one part measuring 300mm x 300mm, to FCC.

The Contractor shall forward the sample to the testing laboratory for quantitative destructive testing in accordance with ASTM D6392. In total 10 tabs will be tested from the sample, 5 in peel mode and 5 in shear mode, taken alternately throughout the sample. Copies of the results of the testing will be forwarded to the Contractor but this shall not relieve him of any of his obligations under the Contract.

The seam will be deemed to have passed quantitative destructive testing if in at least four out of the five tabs:

- i) Failure occurs solely on the parent material and does not enter the seam;
- ii) The peel and shear strength exceeds these requirements specified in Table 3; where the fifth tab fails to meet the requirements of (i) above then its peel and shear strength must exceed 80% of the requirements specified in Table 3.

If there is a failure the Contractor shall extract an additional test sample from a seam produced on the same day by the same item of seaming equipment and/or operator, at a location to be agreed with the CQA Inspector, to confirm that the failure was an isolated occurrence. If this sample fails destructive testing, all seams produced by the particular item of equipment will not be approved.

In the event of a failed destructive test the Contractor may either of the following:

- i) Replace or cap the entire seam length i.e. remove the seam and re-seam, or extrusion weld over the seam;
- ii) Extract further samples for destructive testing a minimum of 3m in both directions (if applicable) from the location of the failed test. If these samples pass destructive testing, the seam shall be reconstructed between these locations by capping in accordance with the Specification.

6.10.3 Non-Destructive Seam Testing

The Contractor shall carry out a risk assessment and submit Method Statements for his proposed method of carrying out non-destructive testing of extrusion welded seams. The preferred method is 'Vacuum box' testing, however, 'spark' testing may be used where vacuum box testing is not possible, however spark testing should not be used where there is a risk from landfill gas emission. All seams shall be non-destructively tested by the Contractor in the presence of the CQA Inspector.

The CQA Inspector will verify that the procedures outlined for non-destructive testing are adhered to by the Contractor. The CQA Inspector will record the date and time, identification of the person

performing the test, pressure values and the pass/fail conditions for all seams. The CQA Inspector will verify that all failed conditions are properly remediated and retested, and verify that all data is complete.

6.10.3.1 Air Pressure Testing

All fusion seams shall be air pressure tested. The air channel formed between the twin welds shall be sealed at both ends and an inlet valve and pressure gauge fitted to one end. The channel shall then be pressurised to a maximum pressure of 2.0 bar and a minimum pressure of 1.8 bar. Following removal of the pressure source, the pressure shall be allowed to equalise for two minutes to allow for the stabilisation of the temperature effects. The change in pressure shall then be recorded over the next five minute period. If the pressure decreases by more than 0.2 bar over the 5 minute period then the fusion seam will be deemed to have failed the test.

Upon completion of the air pressure test, the channel shall be deflated from the opposite end to which the pressure source was applied to confirm that the full length of seam had been pressurised.

If a seam fails the air pressure, or indicates a blockage in the channel, the test length shall be incrementally reduced until the failure area has been clearly identified. In the case of identifiable points of failure, the seam shall be repaired using an extrusion weld and the test repeated. If specific points of failure cannot be identified to the satisfaction of the CQA Inspector then the whole seam shall be repaired in accordance with the requirements of the specification.

6.10.3.2 Spark Testing

Where it is not possible to carry out vacuum box testing the Contractor may elect to use this method and seams shall be tested over their entire length using a high frequency continuous coil spark tester. The equipment shall be adjustable in voltage between 15kV and 30 kV and shall generally be operated at a voltage of 10kV per mm of membrane thickness. The spark tester shall be passed slowly in close proximity to the weld to test all points on the weld. Any anomalies in the seam should be identified by the presence of a spark. The location of any sparks shall be marked and the seam repaired and re-tested.

6.10.3.3 Vacuum Box Testing

Extrusion seams shall be tested over their entire length using the purpose made equipment which produces a vacuum over the tested area. A detergent/water solution shall be applied to the full test area prior to the application of the test equipment. Upon application of the vacuum, bubbling of the solution should indicate the location of a leak in the seam. The vacuum shall be applied for a period of not less than 10 seconds. The location of any leaks shall be marked in an indelible manner and then the seam repaired in accordance with the specification.

6.10.4 Defect Repair

All discontinuities in the geomembrane (whether caused by damage, or failure of geomembrane or seams, to conform with the specifications, or of sampling or testing or other factors), will be repaired by the Contractor in the following manner:

- Point defects;
 - a) The area will be prepared by grinding and an extra layer of extrudate applied.
- Large faults;
 - a) The faulted area will be cut back to remove all imperfections and will be overlain with a single piece of compatible geomembrane to give a minimum overlap of 100 mm in all directions. The area will then be prepared and seamed in accordance with this CQA Plan.
- Seam faults;
 - a) Faulted extrusion seams will be overlain with a single piece of compatible geomembrane with a minimum overlap of 100 mm in all directions to form a cap strip. The repair may then be completed as for large faults;
 - b) Faulted fusion seams will be cut back to remove the upper flap, prepared by grinding and extruded in accordance with this CQA Plan;
 - c) Junctions of three panels shall be either covered by a patch with a minimum overlap of 200 mm in all directions or an extrusion weld extending at least 200 mm from the junction point in all directions; and
 - d) Multiple joints i.e. four or more corner meeting points will be overlain with a single piece of compatible geomembrane with a minimum overlap of 300 mm in all directions.

The CQA Inspector will log each defect requiring repair with a unique code and then, using the same code, verify that each defect is properly repaired and tested. Non-destructive testing of all repairs will be observed by the CQA Inspector.

6.10.5 Testing Review

The CQA Inspector will review all destructive and non-destructive testing data, including a walkover prior to the placement of the covering layer and record that all testing has been completed to his satisfaction.

6.11 Temporary Surcharge

The Contractor shall be responsible for providing adequate temporary loading and/or anchoring measures (e.g. in the form of durable sandbags or similar weights without sharp edges and not likely to damage the geomembrane) on the geomembrane immediately after deployment to protect the geomembrane from damage by the wind or to prevent slippage during the works. These measures shall remain in place until the overlying layers are placed over the geomembrane, unless otherwise directed

by the CQA Inspector. On steep embankments, suspension of sandbags or other weights by ropes may be required.

6.12 Anchor Trenches

The geomembrane shall be secured in an anchor trench as shown on Drawing 112D_NW_2011_29_01. The geomembrane shall line the inside wall and reach to the back of the base of the anchor trench. Welding of all seams and repairs shall be completed on the full extent of the geomembrane within the trench. The trench shall be cleared of all waste arising from the works prior to filling. The trench shall be backfilled and compacted with suitable engineering fill. The anchor trench does not form part of the surface water management system and must be kept dry at all times during installation of the Geomembrane and subsequent backfilling.

6.13 Tie-in to Existing Geomembrane

The geomembrane shall be tied-in to the existing geomembrane liner of completed capping systems. The tie-ins will be, where possible Fusion welded and will be observed and recorded by the CQA Inspector to confirm that a satisfactory seal is achieved. Where Fusion welding is not reasonably practicable, extrusion welding may be used, and will be observed and recorded by the CQA Inspector to confirm that a satisfactory seal is achieved.

6.14 Protuberances

The Contractor shall ensure that all protuberances are installed as shown on Drawing 112D_NW_2011_29_01.

6.15 CQA Requirements

The CQA Inspector shall:

- Ensure that the materials are delivered, handled and stored in accordance with the manufacturers recommendations;
- Make a visual inspection of each roll as it is unloaded to identify any damage and record the relevant information for each roll;
- Assess all manufacturers' quality control certificates to confirm that the material meets the requirements of the specifications prior to installation;
- Assess and approve, with respect to the requirements set out in the specifications, the proposed panel layout for the geomembrane to be submitted by the Contractor;
- Assess the methods statement submitted by the Contractor detailing his proposed deployment and seaming techniques;
- Identify rolls from which conformance samples of the geomembrane are to be taken for laboratory conformance testing in accordance with the specifications;

- Assess the results of conformance tests to ensure compliance with the specifications. Should any materials fail to meet the specifications, the CQA Inspector shall reject the failed roll and schedule further testing in accordance with the specifications;
- Provide written certification to the Contractor that the surface on which the geomembrane is to be installed is acceptable prior to installation. *Note the CQA Inspector may withdraw the certificate should the surface deteriorate for any cause prior to installation and only reissue upon remediation works being compliant with the specifications;*
- Witness all panel deployment ensuring compliance with the specifications;
- Witness all seam constructions to ensure compliance with the specifications;
- Ensure that all defects are identified on the geomembrane and witness that they are repaired in accordance with the specifications;
- Ensure that a defect free tie-in with the existing geomembrane is constructed;
- Ensure that geomembrane and seam construction continues to the back of the anchor trenches;
- Ensure that on completion of the geomembrane installation the Contractor produces a fully referenced as-built panel layout plan including all the detail listed within the specifications.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

7 PROTECTION GEOTEXTILE

7.1 General

A Protection geotextile shall be installed above the Geomembrane to the permanent capping area.

The welded LLDPE geomembrane shall be covered with a protection geotextile / drainage geocomposite. The geotextile shall be supplied in accordance with the parameters given Table 5 and installed in accordance with Drawing 112D_NW_2011_29_01 and the procedures and CQA requirements described below. The Contractor will be required to:

- Supply and install a protection geotextile on geomembrane surface; and
- Provide all material quality control certificates and other information described below.

7.2 Geotextile Materials

The geotextile material shall be a non-woven, needle punched, geotextile, chemically resistant to the landfill environment. Conformance testing shall be carried out in line with the manufacturers' specified values for the properties set out in Table 5 below. The Contractor shall provide a schedule of results to show that the minimum requirements can be met by typical material of the type to be used, prior to installation on-site.

Table 5: Protection Geotextile Specification and Conformance Testing

Physical Properties:				
Polymer type:	Prime quality polypropylene fibre (UV stabilised) with no post consumer fibres			
Fabric construction:	Nonwoven fabric manufactured from mechanically entangled fibre			
	Approved test method	Units	Typical Mean value	Tolerance
Mass Per Unit Area	EN ISO 9864	g/m2	400	-20%
Thickness @ 2kPa:	EN ISO 9863-1	mm	2.0	-20%
Mechanical Properties:				
Static puncture strength (CBR)	EN ISO 12236	kN	4	-10%
Tensile strength (md/cmd)	EN ISO 10319	kN/m	19/24	-10%
Tensile extension (md/cmd)	EN ISO 10319	%	50/30	+/- 20%
Dynamic Perforation Resistance	EN ISO 13433	mm	8	+ 3 mm
Durability (according to annex B: EN 13253)*:				
Resistance to weathering @ 50MJ/m2 radiant exposure ¹	EN 12224	Retained Strength	80%	
Resistance to Oxidation (100 years)	EN ISO 13438	Retained Strength 56 days	50%	
Resistance to liquids	EN 14030	Retained Strength	50%	
1. 1-4 months UV exposure depending on location/season				
* Durability test data can be supplied by the manufacturer – test frequency must not exceed 3 years.				
** Manufacturer may use alternative means of assessing oxidation to achieve 100 years.				

7.3 Delivery, Handling and Storage

The material will be delivered, handled and stored in accordance with the manufacturer's recommendations and should be delivered and stored in tight wrappings in order to offer protection from ultra violet degradation. Each roll of geotextile delivered to site will be identified with:

- Manufactures name, address and telephone number;
- CE mark with accrediting bodies number;
- Product identification and polymer type;
- Geotextile batch and roll number;
- Roll length and width in metres;
- Roll weight in kilograms;and
- Polymer type.

Lifting and transportation of the geotextile materials shall be by appropriate machinery with the use of slings and core bars. The material is not to be handled with the tines of a forklift machine, the bucket of an excavator, or any similar equipment under any circumstances

The Contractor shall provide adequate and acceptable measures for protecting the material at all stages of the work, from all sources of potential damage such as sharp objects, boulders, cobbles etc, including weather conditions and will be located out of the way of the way of moving plant. The rolls of geotextile will not be stacked more than 3 high with nothing stacked above them.

Any damaged material will be excluded from the works.

7.4 Manufacturers Quality Control

Quality control certificates will be supplied to cover each roll of material delivered to site. The certificates will be supplied prior to delivery of the material to site and will contain quality control data typically according to the requirements of Table 5.

Quality Control Certificates will be provided prior to installation and for inclusion in the CQA Validation Report as follows:

- A specification for the geotextile which includes all properties contained in Table 5 measured using the appropriate test methods;
- Written certification that minimum values given in Table 5 are guaranteed by the Manufacturer; and
- Written confirmation that testing to detect needle fragments and removal of needle fragments prior to delivery of the product has taken place.

7.5 Geotextile Conformance Sampling

As soon as practicable after the delivery of the geotextile rolls to site, the Contractor shall cut and label samples 1 m long across the entire width of selected rolls for retention and/or conformance testing as directed by the CQA Inspector. Samples for conformance shall not be taken from the first linear metre of the roll.

One set of samples per 2,500 m² (minimum) shall be passed to the CQA Inspector for physical conformance testing as detailed in Table 5, and one set of samples per 6,000 m² (minimum) for mechanical conformance testing as detailed in Table 5. All testing to be carried out at an independent geosynthetic testing laboratory with UKAS accreditation for each test being carried out.

If testing shows that the geotextile does not meet any one of the minimum requirements listed in Table 5, then this may be cause for rejection of the material from that roll. Any repairs, replacement

or other works occasioned by the failure of the geotextile to meet the minimum requirements listed in Table 5 shall be carried out at the Contractor's expense.

The CQA Inspector may at his discretion accept material from elsewhere on that roll if the Contractor can demonstrate through further laboratory testing (at his expense) at a geosynthetic laboratory approved by the Engineer that this material does meet the acceptance criteria contained in Table 5.

7.6 Installation

The CQA Inspector will assign panel identification codes and maintain a record of panel/roll correspondence and the date and location of installation. Each panel will be observed for defects and a record will be kept to assure that all defects are properly repaired and tested.

Geotextile panels will be placed directly over and in intimate contact with the geomembrane. The minimum panel overlap on basal areas and across slopes shall be 300 mm and down slopes the minimum panel overlap shall be 500 mm (or in accordance with the manufacturers recommendations).

Geotextile panels shall be joined by either heat bonding or by sewing using methods to be approved in advance by the CQA Inspector.

Along the perimeter of the installation, the geotextile will be placed in the anchor trench with the geomembrane according to the detail in Drawing 112D_NW_2011_29_01.

In windy conditions and at the end of the working day, all exposed edges of the geotextile should be weighted down, the geotextile should be held down using sandbags or similar weights that will not damage the material. The CQA Inspector shall visually check for such damage.

All geotextile sheets will be visually inspected for damage and imperfections after deployment and any repairs required will be undertaken.

7.7 Repairs

Any faulted areas on the geotextile shall be overlain with a single piece of compatible geotextile. The patch shall have a minimum overlap of 500 mm in all directions.

7.8 CQA Requirements

The CQA Inspector shall:

- Agree minimum testing requirements for the geotextile protector product to be used in line with the specifications.
- Ensure that the materials are delivered, handled and stored in accordance with the manufacturers recommendations;

- Make a visual inspection of each roll as it is unloaded to identify any damage and record the relevant information for each roll;
- Assess all geotextile protector manufacturers' quality control certificates to confirm that the geotextile protector meets the requirements of the specifications prior to installation;
- Assess and approve, with respect to the requirements set out in the specifications, the proposed panel layout for the geotextile protector to be submitted by the Contractor;
- Assess the methods statement submitted by the Contractor detailing his proposed deployment and seaming techniques;
- Identify rolls from which conformance samples of the geotextile protector are to be taken for laboratory conformance testing in accordance with the specifications;
- Assess the results of conformance tests to ensure compliance with the specifications. Should any materials fail to meet the specifications, the CQA Inspector shall reject the failed roll and schedule further testing in accordance with the specifications;
- Provide written certification to the Contractor that the surface on which the geotextile protector is to be installed is acceptable prior to installation. *Note the CQA Inspector may withdraw the certificate should the surface deteriorate for any cause prior to installation and only reissue upon remediation works being compliant with the specifications;*
- Witness all panel deployment ensuring compliance with the specifications;
- Witness all seam constructions to ensure compliance with the specifications;
- Ensure that all defects are identified on the geotextile protector and witness that they are repaired in accordance with the specifications;
- Ensure that a defect free tie-in with the existing geotextile protector in adjacent cells is constructed;
- Ensure that geotextile protector and seam construction continues to the back of the anchor trenches;
- Provide written certification to the Contractor of areas approved to be covered with leachate drainage stone and ensure that approved areas are covered as soon as possible upon approval; and
- Ensure that on completion of the geotextile protector installation the Contractor produces a fully referenced as-built panel layout plan including all the detail listed within the specifications.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

8 DRAINAGE GEOCOMPOSITE

8.1 General

A Drainage Geocomposite shall be installed above the Geomembrane on capping slopes $\geq 1(v):3(h)$. Areas requiring drainage geocomposite are detailed on drawing 112D_NW_2011_29_01.

The welded LLDPE geomembrane shall be covered with a Drainage geocomposite. The geocomposite shall be supplied in accordance with the parameters given Table 6 and installed in accordance with Drawing 112D_NW_2011_29_01 and the procedures and CQA requirements described below. The Contractor will be required to:

- Supply and install a Drainage geocomposite on geomembrane surface; and
- Provide all material quality control certificates and other information described below.

8.2 Geocomposite Materials

The geocomposite material shall meet the requirements of Table 6 below and conformance testing shall be carried out in line with the manufacturers' specified values for the properties set out in Table 6 below. The Contractor shall provide a schedule of results to show that the minimum requirements can be met by typical material of the type to be used, prior to installation on-site.

Table 6: Drainage geocomposite Specification and Conformance Testing

PROPERTY	Approved Test Method	Typical Mean Value	Units	Tolerance
In Plane Water Flow (long & cross direction) @ H.G. 1.0 and 100kPa with soft foam platens to simulate soil action. Hard/Soft foam platens is acceptable.	BSEN ISO 12958	0.75	l/m/s	-10%
Max. tensile strength, md/cmd	EN ISO 10319	12/12	kN/m	-20%
Static Puncture Strength (CBR)	BS EN ISO 12236	8000	N	-10%
* Values to be achieved regardless of any manufacturer's tolerances.				

8.3 Delivery, Handling and Storage

The material will be delivered, handled and stored in accordance with the manufacturer's recommendations and should be delivered and stored in tight wrappings in order to offer protection from ultra violet degradation. Each roll of geocomposite delivered to site will be identified with:

- Manufactures name, address and telephone number;
- CE mark with accrediting bodies number;
- Product identification and polymer type;
- Geocomposite batch and roll number;
- Roll length and width in metres;
- Roll weight in kilograms; and
- Polymer type.

Lifting and transportation of the geocomposite materials shall be by appropriate machinery with the use of slings and core bars. The material is not to be handled with the tines of a forklift machine, the bucket of an excavator, or any similar equipment under any circumstances

The Contractor shall provide adequate and acceptable measures for protecting the material at all stages of the work, from all sources of potential damage such as sharp objects, boulders, cobbles etc, including weather conditions and will be located out of the way of the way of moving plant. The rolls of geocomposite will not be stacked more than 3 high with nothing stacked above them.

Any damaged material will be excluded from the works.

8.4 Manufacturers Quality Control

Quality control certificates will be supplied to cover each roll of material delivered to site. The certificates will be supplied prior to delivery of the material to site and will contain quality control data typically according to the requirements of Table 6.

Quality Control Certificates will be provided prior to installation and for inclusion in the CQA Validation Report as follows:

- A specification for the geocomposite which includes all properties contained in Table 6 measured using the appropriate test methods;
- Written certification that minimum values given in Table 6 are guaranteed by the Manufacturer; and
- Written confirmation that testing to detect needle fragments and removal of needle fragments prior to delivery of the product has taken place.

8.5 Geocomposite Conformance Sampling

As soon as practicable after the delivery of the geocomposite rolls to site, the Contractor shall cut and label samples 1 m long across the entire width of selected rolls for retention and/or conformance testing as directed by the CQA Inspector.

One set of samples per 10,000 m² (at least one per batch) shall be passed to the CQA Inspector for conformance testing. All testing to be carried out at an independent geosynthetic testing laboratory with UKAS accreditation for each test being carried out.

If testing shows that the geocomposite does not meet any one of the minimum requirements listed in Table 6, then this may be cause for rejection of the material from that roll. Any repairs, replacement or other works occasioned by the failure of the geocomposite to meet the minimum requirements listed in Table 6 shall be carried out at the Contractor's expense.

The CQA Inspector may at his discretion accept material from elsewhere on that roll if the Contractor can demonstrate through further laboratory testing (at his expense) at a geosynthetic laboratory approved by the Engineer that this material does meet the acceptance criteria contained in Table 6.

8.6 Installation

The CQA Inspector will assign panel identification codes and maintain a record of panel/roll correspondence and the date and location of installation. Each panel will be observed for defects and a record will be kept to assure that all defects are properly repaired and tested.

Geocomposite panels will be placed directly over and in intimate contact with the geomembrane. The minimum panel overlap on basal areas and across slopes shall be 300 mm and down slopes the minimum panel overlap shall be 500 mm (or in accordance with the manufacturers recommendations).

Geocomposite panels shall be joined by either heat bonding or by sewing using methods to be approved in advance by the CQA Inspector.

Along the perimeter of the installation, the geocomposite will be placed in the anchor trench with the geomembrane according to the detail in Drawing 113D_NW_2010_02_01.

In windy conditions and at the end of the working day, all exposed edges of the geocomposite should be weighted down, the geocomposite should be held down using sandbags or similar weights that will not damage the material. The CQA Inspector shall visually check for such damage.

All geocomposite sheets will be visually inspected for damage and imperfections after deployment and any repairs required will be undertaken.

8.7 Repairs

Any faulted areas on the geocomposite shall be overlain with a single piece of compatible geocomposite. The patch shall have a minimum overlap of 500 mm in all directions.

8.8 CQA Requirements

The CQA Inspector shall:

- Agree minimum testing requirements for the geocomposite product to be used in line with the specifications.
- Ensure that the materials are delivered, handled and stored in accordance with the manufacturers recommendations;
- Make a visual inspection of each roll as it is unloaded to identify any damage and record the relevant information for each roll;
- Assess all geocomposite manufacturers' quality control certificates to confirm that the geocomposite meets the requirements of the specifications prior to installation;
- Assess and approve, with respect to the requirements set out in the specifications, the proposed panel layout for the geocomposite to be submitted by the Contractor;
- Assess the methods statement submitted by the Contractor detailing his proposed deployment and seaming techniques;
- Identify rolls from which conformance samples of the geocomposite are to be taken for laboratory conformance testing in accordance with the specifications;
- Assess the results of conformance tests to ensure compliance with the specifications. Should any materials fail to meet the specifications, the CQA Inspector shall reject the failed roll and schedule further testing in accordance with the specifications;
- Provide written certification to the Contractor that the surface on which the geocomposite is to be installed is acceptable prior to installation. *Note the CQA Inspector may withdraw the certificate should the surface deteriorate for any cause prior to installation and only reissue upon remediation works being compliant with the specifications;*
- Witness all panel deployment ensuring compliance with the specifications;
- Witness all seam constructions to ensure compliance with the specifications;
- Ensure that all defects are identified on the geocomposite and witness that they are repaired in accordance with the specifications;
- Ensure that a defect free tie-in with the existing geocomposite in adjacent cells is constructed;
- Ensure that geocomposite and seam construction continues to the back of the anchor trenches;
- Provide written certification to the Contractor of areas approved to be covered with leachate drainage stone and ensure that approved areas are covered as soon as possible upon approval; and
- Ensure that on completion of the geocomposite installation the Contractor produces a fully referenced as-built panel layout plan including all the detail listed within the specifications.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

9 RESTORATION SOIL

9.1 General

After placement of the geomembrane and geotextile/drainage geocomposite the restoration soils will be placed to a total depth of 1000 mm. Thicker soils will be placed over the lower section of the southern slope to provide a buttress for the stability of this steeper slope.

The material to be used for the restoration layer shall be sourced from on site stockpiles as directed by the Employer or imported. The material shall be free from any unsuitable material, or any other deleterious materials/objects that may potentially cause damage to the capping system.

Unsuitable material shall include:

- i) Material in a frozen condition or susceptible to spontaneous combustion.
- ii) Any industrial, commercial or domestic waste.
- iii) Any excessively wet material which does not provide a firm surface sufficient to permit the movement of plant or vehicles without causing excessive rutting
- iii) Any material greater than 125mm in any dimension in the first 300mm of the restoration soils above the protector geotextile and in the remaining soils any material greater than 300mm in any dimension.

The Contractor shall excavate and handle the material from on site stockpiles in such a manner that the nature and consistency of the material is not adversely affected. Where more than one type of material is encountered the Contractor shall, wherever practicable, excavate the stockpile in such a manner that the materials can be separated. The materials will be rejected for use if it contains material that the CQA Inspector believes will potentially damage the geomembrane and or geotextile protection layer.

8.2 Placement

The restoration soils shall be placed as soon as practicable after the protector geotextile has been placed. The restoration soils shall be spread in layers to the required thickness to form a smooth even profile without undulations, hollows or depressions.

The Contractor shall undertake the placement of the restoration soils in a careful and systematic manner that does not affect the integrity, cause damage or displacement, and prevents the formation of any wrinkles and creases and/or any “folding over” in the capping system.

Under no circumstances other than for the safety of the Works shall plant be driven directly on the capping system. A minimum thickness of 300mm of material shall be placed at any location over the capping system before any of the Contractor's tracked plant is allowed to traverse over the capping area. A minimum thickness of 1000mm of material at any location shall be maintained between the capping system and wheeled haulage vehicles.

The Contractor's placement method shall ensure that no lateral stresses are induced in the underlying layers of the capping system. In general, the methods employed shall comprise the following:

- i) placing restoration soils working upslope;
- ii) tipping of fresh material on previously placed material;
- iii) casting material by 360° excavator (using a bucket without teeth);
- iv) pushing of material up and over the face of the tipped load allowing it to fall vertically onto the underlying layers, and;
- v) preloading of the underlying layers with discrete mounds of material, to prevent the generation of excessive wrinkles or folds, and infilling between mounds.

The Contractor shall control the depth of restoration soils placement by using free standing profile boards/travellers. The Contractor shall ensure that the bases of the profile boards/ traveller are flat and of such construction that they do not cause damage to the underlying geosynthetic capping system.

The Contractor shall install depth markers on a 25m grid system to allow for verification of placed soil depth.

Any damage or disturbance to the capping system during the placement of the soils shall be repaired by the Contractor in accordance with the Contract.

The restoration soils shall not be compacted except by the passage of construction plant. The final surface of the soils shall be graded to achieve the required levels and profile and shall, to the satisfaction of the Supervisor, be free from any bumps and hollows.

8.3 Protuberances

During placement of the restoration soils around any protuberance the Contractor shall batter back the soils to allow for future installation of any headworks by the Employer, unless otherwise directed by the CQA Inspector. A stockpile of restoration soils shall be left adjacent to each protuberance to allow backfilling at a later date.

The Contractor shall take all reasonable precautions against causing damage or disturbance to protuberances and any associated installations; and, at the start of the Contract the Contractor shall inspect the condition and alignment of these with the Supervisor. A similar inspection shall be carried

out following the completion of the work around each protuberance. Should the Contractor cause any damage or disturbance he shall immediately carry out remedial works in accordance with the Contract.

8.4 Temporary Cap Surcharge

The area receiving the temporary capping is to be surcharged with strips of cohesive soil/clay surcharge to prevent wind uplift of the 1mm LLDPE geomembrane. The Contractor should source this material from existing on site stockpiles.

The Contractor shall ensure that the stability and integrity of the capping liner system shall not be compromised through wind uplift during the installation of the capping liner and subsequent placement of the temporary cohesive soil/clay liner surcharge. Material sourced on site for use as surcharge should be selectively dug and free of material debris, roots, angular or sharp rocks exceeding 19mm in height and any other deleterious materials that may cause damage to the capping system.

The Contractor shall ensure that the strips of cohesive soil/clay surcharge should be placed from the bottom of the slope and progressively extended upwards, to prevent potential damage/failure in the underlying geomembrane.

A suggested system would be the placement of suitable clay/soil material in 4m strips at 10m spacing's between centres along the entire width of the temporary cap. Depending on the width of the 1mm LLDPE rolls, the surcharge strips must be placed to ensure that all 1mm LLDPE roll strips have at least one surcharge strip crossing in the middle third of the slope. These strips should not be less than 0.5m in height.

Alternate methods for temporary capping surcharge may be deployed where suitable soil material is unavailable. These include, but are not limited to loose tyres, tyres on ropes and sandbags on ropes. The placement of alternate surcharge measures must be equivalent to the surcharge load of the soil strips.

8.5 CQA Requirements

The CQA Inspector shall:

- Assess the methods statement submitted by the Contractor for the installation of the restoration soils;
- Ensure that all material within the working area deemed unsuitable in accordance with the specification is removed to an area agreed with FCC's Site Manager;
- Ensure that only suitable soils are used where required as restoration soils;
- Monitor the placement and compaction of the soil, ensuring that the works are carried out in accordance with the Specification;
- Ensure that all areas of non-compliance are remediated in accordance with the specifications;

- Ensure proposed soils thickness is installed over the capping area and provide a plan showing the location of depth markers and the soil thickness at those markers.
- Take photographs during the construction;
- Ensure that surveys are undertaken in accordance with the specifications to confirm that the requisite levels and layer thicknesses have been achieved.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

9 CQA VALIDATION REPORT

Upon completion of the lining works and/or capping works the CQA Inspector will prepare a Certification Report summarising the works undertaken and including all CQA documentation prepared. As a minimum this shall include:

- Description of the works
- Completed Summary Sheets detailing the installation of each element of the works
- Contractor's and Manufacturers' Documentation
- Test (Laboratory & Field) Reports
- As Built Drawings: Topographic (see Section 3) and Panel Layout
- Photographic Record of the Construction
- Daily Diaries
- Description of Non-conformances and the Subsequent Remediation

Pro-Forma sheets for the on site completion by the CQA inspector are included in Appendix 4.

The above report will confirm that the works have been carried out in accordance with the specifications as incorporated in this Construction Quality Assurance Plan. The report will be certified by the CQA Manager.

10 REFERNCES

1. EP Permit: LLAN BP3734XX (BU0800IZ) Date of issue: 25.07.2008.

APPENDIX 1

DESIGN RISK ASSESSMENT

Phase 3 Capping

Appendix 1

Designers Risk Assessment

The following hazards and mitigation procedures have been identified by the designer:

No.	Hazard	Risk Classification			Eliminate by Design		Reduce by Design		Mitigating Measures	Specific Actions	Remaining Risk
		Likelihood	Severity	Rating	Options Considered	Comment/ Actions	Options Considered	Comment/ Actions	Options Considered		L x S = Risk
1	Services - underground powerlines.	1	3	3	No construction involving excavation in areas with services	No known services in the area			Approval of excavation works to be undertaken to ensure no work in hazard area	Contractor to be made aware of the hazard	1 x 3 = 3 (Low)
2	Landfill gas migration to construction area	1	3	3	Not practicable	Not Practicable	Installation of gas scavenger pipe work to be installed by Infinis.	Infinis to install scavenger system, ahead of capping works.	No smoking regulations	Contractors to be aware of hazard. Site induction and Site procedures to be adopted.	1 x 3 = 3 (Low)
3	Hazards arising from failures of waste and soil slopes	1	3	3	Construction of waste slope to be at no steeper than 1(v):2.5(h) in accordance with the stability risk assessment produced as part of the permit application for the site.		Waste and side slopes at no steeper than 1(v):2.5(h)			Contractor to be aware of maximum slope angles and to ensure these are not exceeded.	1 x 3 = 3 (Low)
4	Welding Geomembrane (burns/gas explosion)	1	5	5	Not Practicable	Required by the permit/EA to weld geomembrane. Sub-contractor to demonstrate competence . No spark testing specified. Boot detail see drawing. min. Weld around gas protuberance to 2.2m.		DSEAR Zoning plan	No smoking regulations	Contractors to be aware of hazard. Site induction and Site procedures to be adopted.	1 x 3 = 3 (low)
5	Manual Handling operations	3	3	9	Avoidance - use machinery wherever possible		Design access for plant to working areas to avoid requirement for manual handling			Contractors workers to be trained in manual lifting techniques and sensible handling of loads	2 x 3 = 6 (Medium)

APPENDIX 2

PRINCIPAL QUANTITIES

FCC Environment

PROJECT ACTIVITY SCHEDULE

ACTIVITY	LANDFILL
----------	----------

SUB-ACTIVITY	Capping
--------------	---------

CONTRACTOR	
SITE NAME	Llanddulas
SITE REF	122
PROJECT REF.	Phase 3 Capping
PROJECT NAME	
PROJECT STATUS	
ENGINEERING MANAGER	Mark Lancaster
SITE START DATE	
SITE WORKS DURATION	

PROJECT DRIVER	Leachate and Gas Generation
----------------	-----------------------------

AGREED

Date:

Signature

WRG QS

Contractor

WRG PM (or Supervisor)

Description of Works	
General:-	Permanent Capping works to Phase 3
Scope of Works:-	Removal of Existing Temporary cap and remove to Landfill Regulating of existing waste surface Placement of 1mm LLDPE on whole area Installation of French drains and Surface Water Sump Placement of Protector Geotextile over Permanent Capping Area Placement of Restoration Soils over Permanent Capping Area
Extra-ordinary Works	

Assumptions
This section is purely to detail for the assumptions made, risks should be included in the appropriate Risk Section and the owner of that risk stated

	0	
1.Design	-	
2.General Items	-	
3.Strip Existing Materials	-	
4.Capping Systems	-	
5.Subsoil	-	
6.Topsoil	-	
7.Drainage	-	
8.Leachate Recirculation	-	
Project Total	£	-

**FCC Environment
LANDFILL Capping**

	L3	L4	L5	L6	Quants 1	Meas Unit 1	Quants 2	Meas Unit 2	Unit Rate	Total Cost £
1	Design									
		1 Concept				Sum		Hrs		-
		2 Detailed				Sum		Hrs		-
		3 CDM								-
		1 Pre-Construction Health & Safety Plan			1	Sum		Hrs		-
		2 Planning Supervisor Duties				Sum		Hrs		-
		3 Health & Safety File & As-built records			1	Sum		Hrs		-
									Total	-
2	General Items									
		1 Site Supervision				Sum				-
		2 Site Establishment & Temporary works				Sum				-
		3 General Attendant Plant and Equipment				Sum				-
		4 Other works				Sum				-
		5 Risk				Sum				-
									Total	-
3	Strip Existing Materials									
		1 Excavate								
		1 Soil								
		1 0 Haul				m3				-
		2 Less Than 200m Haul				m3				-
		3 More Than 200m Haul				m3				-
		2 Cap (Clay / Mineral)								
		1 0 Haul				m3				-
		2 Less Than 200m Haul				m3				-
		3 More Than 200m Haul				m3				-
		3 Cap (Synthetic & Geotextile)								
		1 0 Haul				m2				-
		2 Less Than 200m Haul				m2				-
		3 More Than 200m Haul				m2				-
		4 Stabilisation Layer			23293					
		1 0 Haul				m3				-
		2 Less Than 200m Haul				m3				-
		3 More Than 200m Haul				m3				-
									Total	-
4	Capping Systems									
		1 Excavation of Waste								
		1 Excavation of Waste								
		1 0 Haul				m3				-
		2 Less Than 100m Haul				m3				-
		3 More Than 100m Haul				m3				-
		2 Trim Surfaces				m2				-
		2 Stabilisation Layer (300mm thick)								
		1 Import				m3				-
		2 Excavate From on site / Imported.			6987.9					
		1 0 Haul				m3				-
		2 Less Than 500m Haul				m3				-
		3 More Than 500m Haul				m3				-
		3 Trim Surface, Lay & Compact			23293	m2				-
		3 Capping Layer								
		1 Clay / Mineral (1m thick)								
		1 Import				m3		Mat Type		-
		2 Excavate								
		1 0 Haul				m3				-
		2 Less Than 500m Haul				m3				-
		3 More Than 500m Haul				m3				-
		3 Trim Surface, Lay & Compact				m2				-
		4 Testing				sum				-
		5 E.O for watering clay to achieve moisture levels.				m3				-
		2 Synthetic								
		1 LLDPE			23293	m2				-
		2 Geotextile			8293	m2				-
		3 Geotextile			15000	m2		4kn		-
		4 Testing				sum				-
		5 Intrusions								
		1 Less than 300mm dia			40	no.				-
		2 300mm to 500 mm dia				no.				-
		3 500mm to 1m dia			5	no.				-
		4 Over 1m dia				no.				-
		6 Anchor Trenches			379	m				-
		7 Connect to existing			400	m				-
									Total	-

**FCC Environment
LANDFILL Capping**

	L3	L4	L5	L6	Quants 1	Meas Unit 1	Quants 2	Meas Unit 2	Unit Rate	Total Cost £
5	Subsoil (Above liner Subsurface Layer)									
						m3				-
					38907	m3				-
						m3				-
						m3				-
					23293	m2				-
									Total	-
6	Topsoil (Layer)									
						m3				-
						m3				-
						m3				-
						m3				-
						m2				-
									Total	-
7	Drainage									
					407	m		160mm ID		-
					15	m		450mm ID		-
					212	m3		20mm S/S		-
						m			Total	-
8	Leachate Recirculation									
						m				-
						no.				-
						m3				-
									Total	-
			Grand Totals							-
										-
										-

FCC Environment
LANDFILL Capping

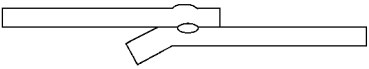
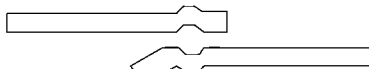
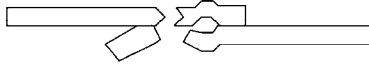
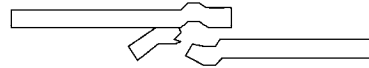
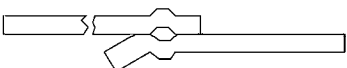
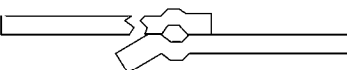
Llanddulas

General Items Build Up Sheet.	Quants 1	Meas Unit 1	Quants 2	Meas Unit 2	Quants 3	Meas Unit 3	Unit Rate	Total Cost £
1 Site Supervision								
1 Office Manager		wks		%				-
2 Sub Agent		wks		%				-
3 Section Foreman		wks		%				-
4 Site Engineer		wks		%				-
5 Site Agent		wks		%				-
6 Other Staff (incl. H&S)		wks		%				-
7 Surveyor		wks		%				-
						Total		-
2 Site Establishment								
1 Offices / Welfare and Equipment		wks						-
2 Communications (Phones / Radios etc)		wks						-
3 PPE		wks						-
4 Bunded Fuel tank		wks						-
5 Site equipment (Levels, CAT detectors etc.)		sum						-
6 Site Security		wks						-
7 Site Consumables		wks						-
8 Punctures		wks						-
9 Repairs		wks						-
10 4x4 van		wks						-
11 Van		wks						-
12								-
						Total		-
3 General Attendant Plant and Equipment.								
1 Mob & Demob		sum						-
2 Diesel fuel for genny etc.		sum						-
3 Setting out matls		sum						-
4 Sundries inc first aid		sum						-
5 Road / Site Signs		wks						-
6 Office maintenance and Cleaning		wks						-
7 Petty Cash, stationary etc		wks						-
8 Pumping to excavations		wks						-
9 Road Sweeper		hrs						-
						Total		-
4 Other works Outside the scope of Major Cost Centres								
1								-
2								-
3								-
4								-
5								-
6								-
						Total		-
5 Risk								
1								-
2								-
3								-
4								-
5								-
6								-
7								-
8								-
9								-
						Total		-
General Items Build Up Total.								£ -

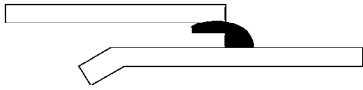
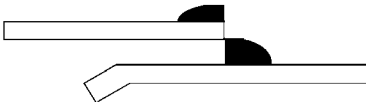
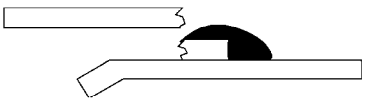
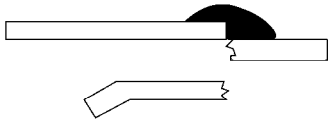
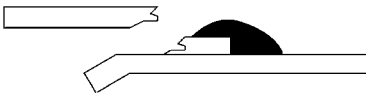
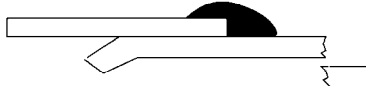
APPENDIX 3

GEOMEMBRANE WELD FAILURE CODES

FUSION WELD FAILURE CODES

UNTESTED SPECIMEN DUAL HOT WEDGE FUSION WELD		
<u>TYPES OF FAILURE</u>	PASS/FAIL CODE	DESCRIPTION
	FAIL 1	ADHESION FAILURE
	FAIL 2	FTB BREAK AT SEAM EDGE
	FAIL 3	FTB BREAK AT SECOND SEAM EDGE
	FAIL 4	FTB BREAK AT SECOND SEAM EDGE
	PASS 1	FTB BREAK IN SHEETING
	PASS 2	FTB BREAK AT SEAM EDGE

EXTRUSION WELD FAILURE CODES

UNTESTED SPECIMEN EXTRUSION WELD		
TYPES OF FAILURE	PASS/FAIL CODE	DESCRIPTION
		
	FAIL 1 (F1)	ADHESION FAILURE
	FAIL 2 (F2)	ADHESION FAILURE
	FAIL 3 (F3)	ADHESION FAILURE
	PASS 1 (P1)	FTB WELDED SEAM EDGE
	PASS 2 (P2)	FTB WELDED SEAM EDGE
	PASS 3 (P3)	FTB HEAT SEAM EDGE
	PASS 4 (P4)	FTB HEAT SEAM EDGE
	PASS 5 (P5)	FTB WELDED SEAM EDGE
	PASS 6 (P6)	FTB IN SHEETING

APPENDIX 4

CQA PROFORMA

CQA Inspector's Daily Report

Landfill Site:

Project:

Date	
Weather: Previous Night a.m p.m	
Site Hours: Contactors Arrival Time: Contractors Departure Time:	
Contractors Plant / Resources Utilised	
Contract Works Undertaken	
Testing Undertaken	
Meetings	
Health and Safety	
Visitors to Site	
Comments	

For Egniol Environmental Ltd

Landfill Site:
Project:
Material:

[illegible]

Geomembrane Seaming and Non-destructive Testing

Landfill Site:
Project:

Test Method Key

APT: Air Pressure Test

HVE: High Voltage Electricity

VB : Vacuum Box

[illegible]

Landfill Site:
Project:

[illegible]

Key for Repair Codes		
<i>APT:</i>	Air Pressure Test Hole	BT: Boot
<i>BO:</i>	Welder Burn Out	PT: Protrusion
<i>DS:</i>	Destructive Sample	
<i>FS:</i>	Failed Seam	
<i>INT:</i>	Panel Intersection	
<i>IO:</i>	Insufficient Overlap	
<i>PD:</i>	Panel Damage	
<i>WR:</i>	Wrinkle	
<i>WS:</i>	Welder Restart	



Geomembrane Destructive Testing and Sampling Record

Landfill Site:

Project:

[illegible]

Geomembrane Deployment Record

Landfill Site:

Project:

Material

[illegible]



Geomembrane Delivery and Inspection Record

Landfill Site:

Project:

Material

[illegible]

CQA Inspector's Weekly Report

Landfill Site: _____
Project: _____

Week Ending	
Weather Conditions	
Progress	
Testing Undertaken	
Problems Encountered	
Next Weeks Programme	
Health & Safety	Reported Accidents : Reported Near Misses : Welfare Facilities :
Visitors to Site	

For Egniol Environmental Ltd

Site Name :-
Works :-

Summary of Test Results

[illegible]



Geotextile Repair Record

Landfill Site:

Project:

Material

[illegible]

[illegible]

Geotextile Delivery, Inspection and Conformance Record

Landfill Site:

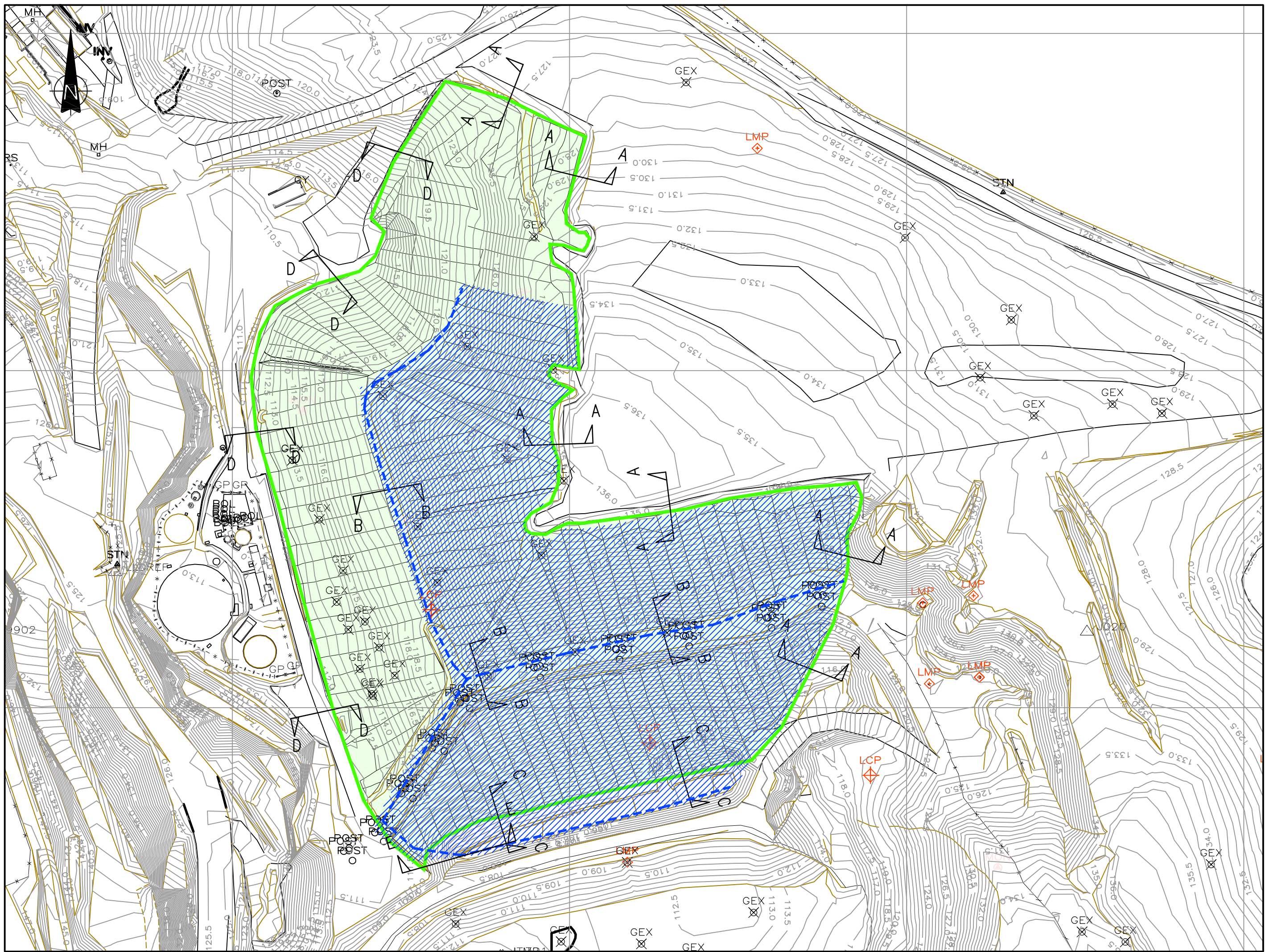
Project:

Material

[illegible]

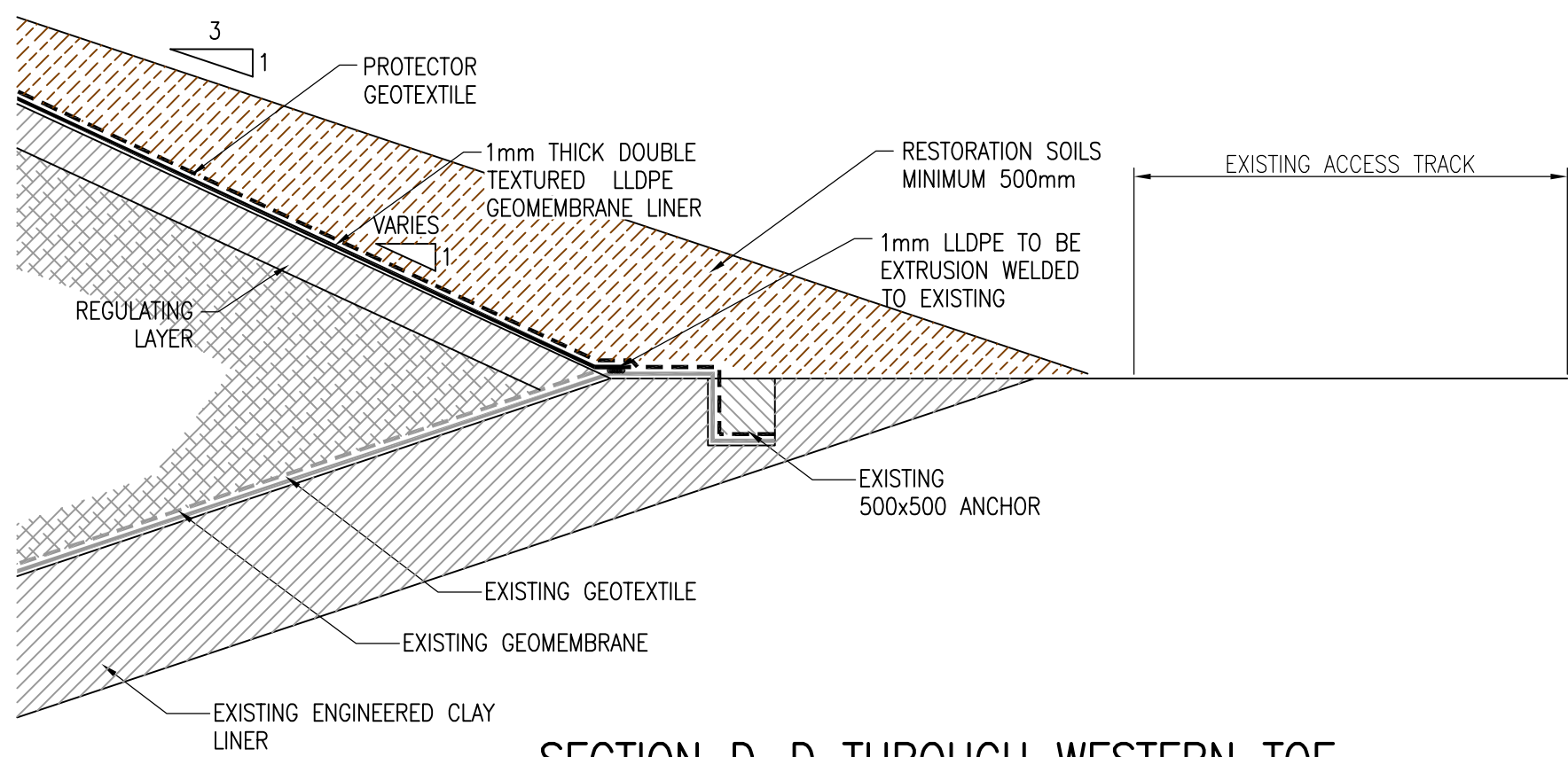
DRAWINGS

112D_NW_2011_29_01	Phase 3 Proposed Extents of Capping Works and Construction Details
--------------------	--



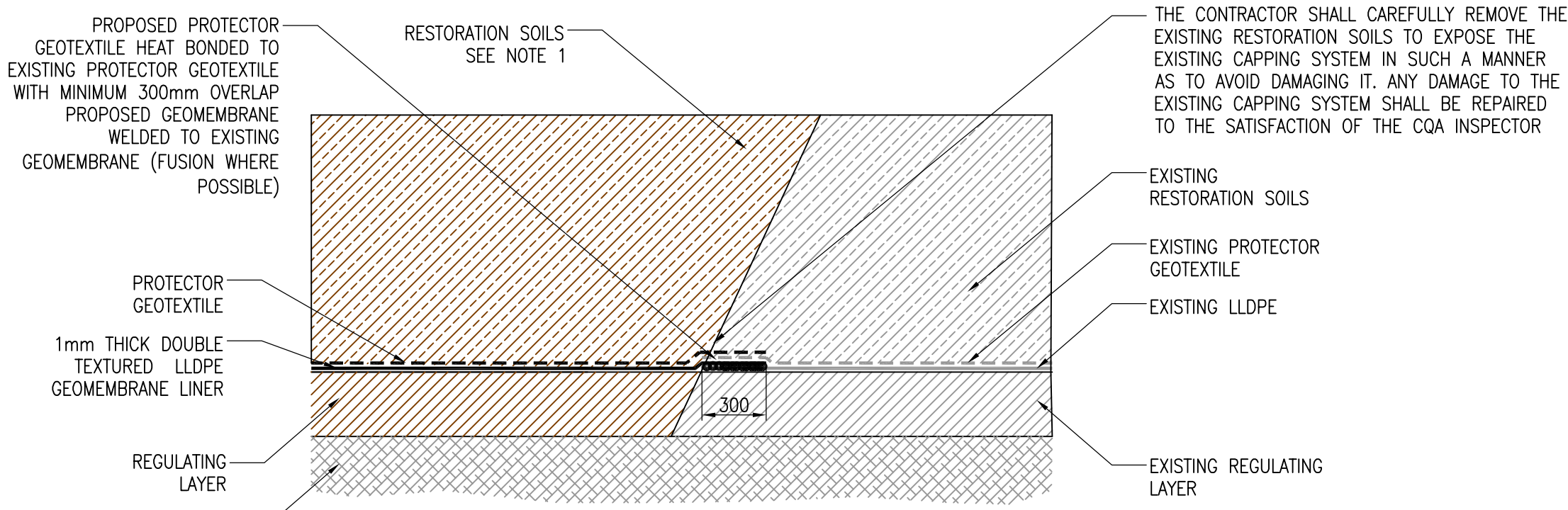
SITE LAYOUT SHOWING CAPPING AREAS AND CONSTRUCTION SECTION LOCATIONS

SCALE 1:1000



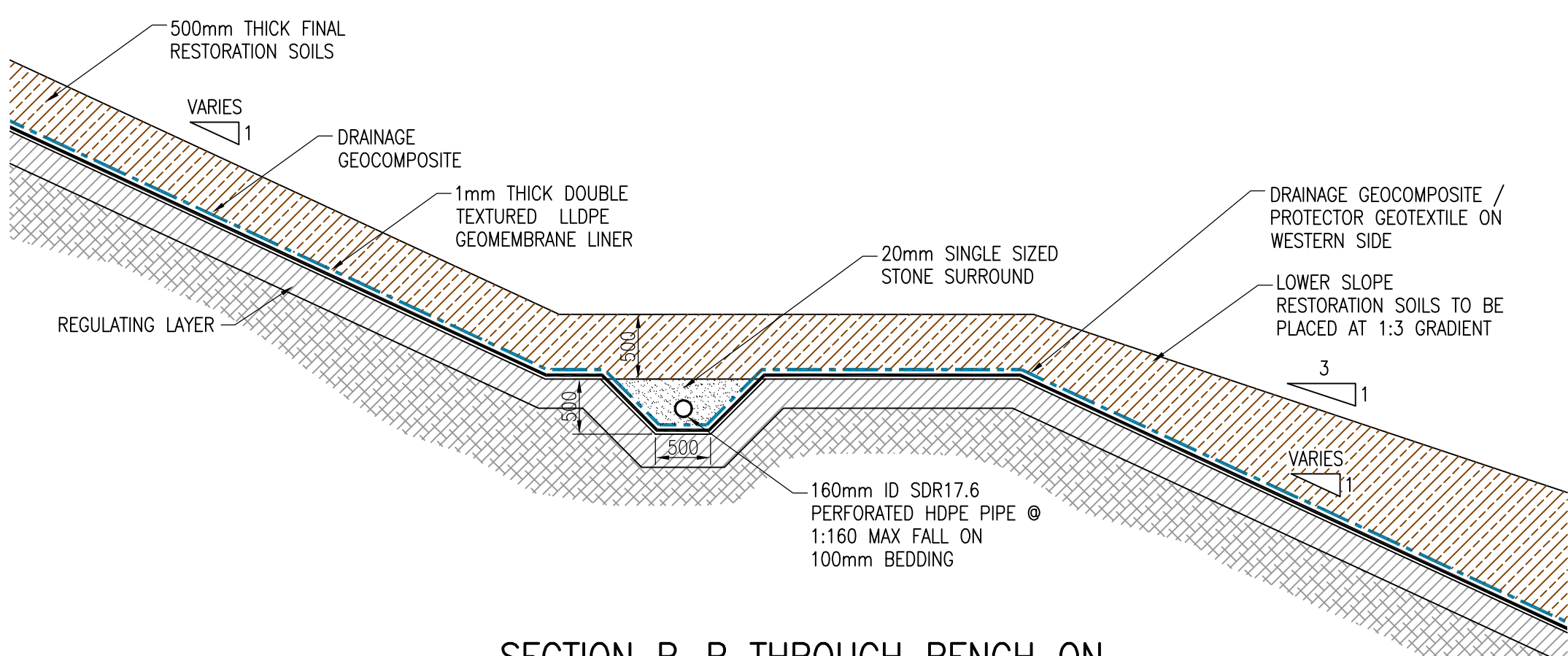
SECTION D-D THROUGH WESTERN TOE OF WASTE SLOPE PHASE 3

SCALE 1:50



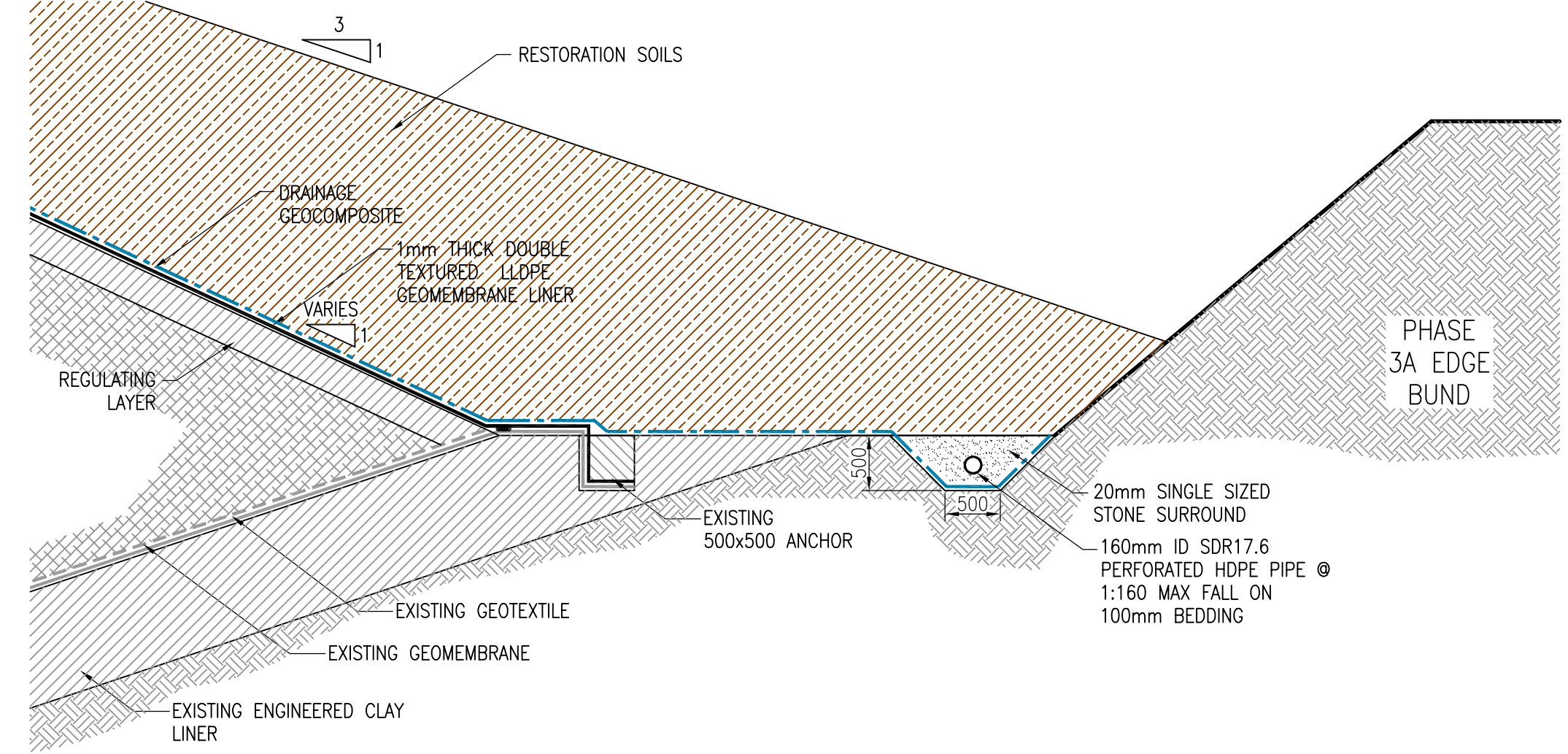
SECTION A-A TIE INTO EXISTING CAP

SCALE 1:25



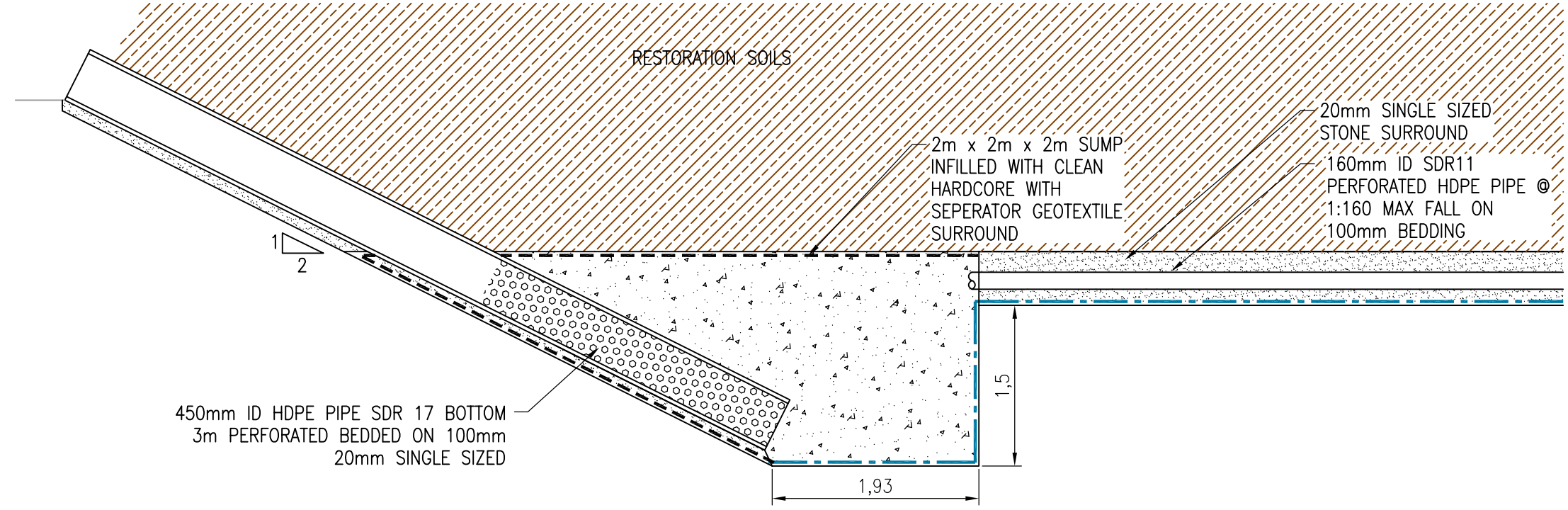
SECTION B-B THROUGH BENCH ON WASTE SLOPE PHASE 3

SCALE 1:50



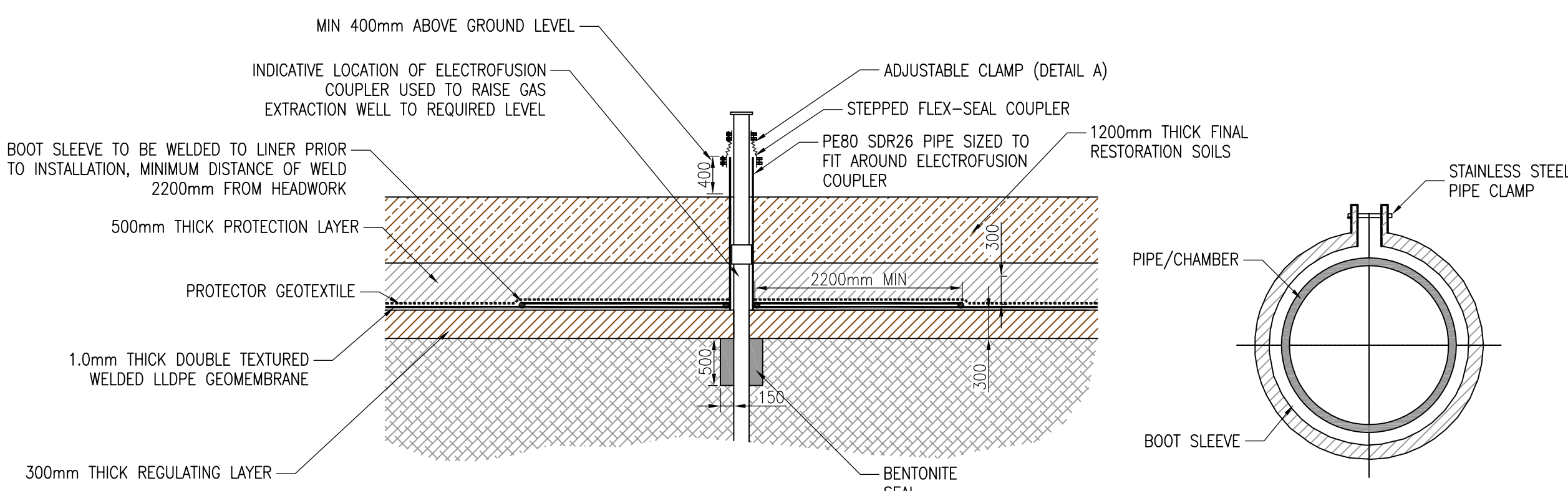
SECTION C-C THROUGH TOE OF WASTE SLOPE PHASE 3

SCALE 1:50



SECTION E-E THROUGH SURFACE WATER SUMP

SCALE 1:50



SEALING AROUND PROTUBERANCES

SCALE 1:50

DETAIL A

NOT TO SCALE

NOTES:
1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.
2. DO NOT SCALE FROM THIS DRAWING.
3. ANY ANOMALIES IDENTIFIED WITH THE DETAILS SHOWN ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF WASTE RECYCLING GROUP PRIOR TO CONSTRUCTION WORKS COMMENCING.

LEGEND

APPROXIMATE EXTENT OF PHASE 3 PERMANENT CAPPING WORKS

EXTENT OF DRAINAGE GEOCOMPOSITE

135.0 — LATEST SITE SURVEY CONTOURS

DRAFT

Revised	Date	Description	By	CHK

Reference files:
Information taken from plans:
Site Survey: 12001431
Operational Vial: XXXPXXX
Cell Footprints: XXXXXXXX
Cell Boundaries: XXXXXXXX



LLANDULAS LANDFILL SITE				
Drawing Title: PHASE 3 PROPOSED EXTENTS OF CAPPING WORKS AND CONSTRUCTION DETAILS				
Drawn By: AK	Checked By: AK	Date: 15 May 2012	Scale: As Dwg	Page No: A1
Status: DRAFT	Revised: -	Plan Number: PLAN 1	Drawing No: 112D_NW_2011_29	

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



FCC Environment Ltd.

Llanddulas Landfill Site

Phase 3A Capping Construction Works
Construction Quality Assurance Report

December 2012

Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Contents Page

Section No.

1. Introduction
2. Location and Description of Site
3. Brief Description and Timing of Works
4. Construction Quality Assurance
5. Problems Encountered
6. Conclusions

Appendices

1. Regulating Layer
 - Trial Pit Summary
 - Shear Vane Testing Summary
 - Trial Pit Location Plan
 - Shear Vane Location Plan
2. Geomembrane
 - Subgrade Release Forms
 - Delivery and Inspection Results
 - Quality Control Certificates
 - Conformance Certificates
 - Panel Deployment Record
 - Trial Weld Record
 - Seaming and Non-destructive Testing Records
 - Destructive Testing Records
 - Panel Repair Record
 - Lining Installer Certificates

Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Contents Page

Appendices

3. Geotextile Protection Layer
 - Delivery and Inspection Records
 - Quality Control Certificates
 - Conformance Certificates
 - Panel Deployment Record
 - Panel Repair Record
4. CQA Inspectors Daily Reports
5. Site Photographs
6. As Built Survey Drawings |

1.0 INTRODUCTION

- 1.1** Egniol Environmental Limited (Egniol) of Tre Felin, Bangor, Gwynedd has been appointed by FCC Environment Ltd. (FCC) as Construction Quality Assurance (CQA) Consultants for the construction of the Phase 3A Capping Works at Llanddulas Landfill Site.
- 1.2** The appointment required the professional services of Egniol for the provision of a Construction Quality Assurance (CQA) Inspector. The CQA Inspector was required to monitor the progress and report upon completion of the works, with regard to quality assurance and compliance with the approved CQA Plan for the works (FCC document: *Llanddulas Landfill Site – Phase 3A Capping Design Report and CQA Plan – Report FCC 112-NW-2011-27*).
- 1.3** In accordance with this appointment, Egniol have produced this report which covers the construction of the Phase 3A Capping Works at Llanddulas Landfill Site.

2.0 LOCATION

2.1 Site Location

Llanddulas Landfill is located within Llanddulas Quarry and is situated on the North Wales coastline between Abergele and Colwyn Bay. It lies off the A55 and A547 highways, as shown on the site location plan below.

Location plan



3.0 BRIEF DESCRIPTION AND TIMING OF THE WORKS

- 3.1** FCC Environment Ltd. appointed Jones Bros Ruthin (Civil Engineering) Co Ltd. (Jones Bros) as the principal contractor for all aspects of the works. Jones Bros appointed Dragon Lining Ltd. (Dragon) as subcontractors for the geosynthetic installation works. The works were carried out between 13th August 2012 and the 27th October 2012.
- 3.2** The sequence of events during the construction of the capping works were as follows:
- Trimming and placement of 300mm thick regulating layer to achieve the formation levels for the liner;
 - Installation of a 1mm thick LLDPE double textured geomembrane cap;
 - Installation of a geotextile protector to the permanent capping area to slopes with maximum slope gradients of 1(v):3(h);
 - Installation of a 1000mm restoration soils layer to the permanent capping area;
 - Tie into existing lining system.
- 3.3** Daily reports completed by the CQA Inspector covering all aspects of the works are located in Appendix 5 of this report with records for the geomembrane, geocomposite and geotextile contained in Appendices 2, 3 and 4 respectively. Site photographs and as-built drawings are located in Appendix 6 and Appendix 7.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.1 Waste Surface Preparation

Prior to the installation of the capping system the surface of the waste was re-graded to remove any undulations and unsuitable waste materials. The surface of the waste was compacted to minimise future differential settlement. On completion of the re-grading the CQA Inspector assessed the prepared surface prior to the placement of the regulating layer.

4.2 Waste Regulating Layer

4.2.1 Regulating Layer Placement

The regulating layer was placed at a minimum thickness of 300mm. The layer of regulating material was placed onto the re-graded waste profile and compacted and smoothed to provide an even surface on which to deploy the geomembrane capping system. The material used was sourced from on-site stockpiles and was free of any unsuitable material as defined in the CQA Plan and Specification.

The surface of the regulating layer was profiled to provide a smooth, firm surface free of any shrinkage cracks, hollows, mounds or protrusions or areas likely to gather standing water. The surface was also free of any sudden sharp or abrupt changes in gradient.

4.2.2 Regulating Layer Testing

Approval for the lining works to commence was not given until the CQA Inspector had assessed the existing regulating layer. Hand shear vane tests and trial pits were carried out to ascertain the suitability and thickness of the material and are included within Appendix 1 of this report.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.3 LLDPE GEOMEMBRANE CAP

4.3.1 Design Specification Details

The geomembrane material used for the capping system was a 1mm thick Linear Low Density Polyethylene (LLDPE) geomembrane textured on both sides. This met the requirements of the approved CQA Plan/Design Specification.

The geomembrane conformed to the criteria specified in Table 1 of the CQA Plan and Specification.

4.3.2 Source of LLDPE Geomembrane

The LLDPE Geomembrane used was a 1mm thick UltraFlex Textured supplied by GSE Lining Technology. Manufacturers' data sheets are included in Appendix 2 of this report.

4.3.3 Delivery, Handling and Storage

The rolls of geomembrane were delivered to site and were off-loaded in the presence of the CQA Inspector. As the material was being off-loaded, the CQA Inspector inspected material to ensure it was free from cuts, holes, blisters, blemishes, abrasions, or other surface imperfections prior to installation.

Each roll of the material was clearly labelled with the manufacturers name, the product name and type, the batch number and the roll number, the roll length, width and weight along with the date of manufacture.

The storage area for the delivered rolls of geomembrane was inspected prior to the delivery of the material to ensure the area was free of any debris or material likely to cause damage to the geomembrane. The storage area was flat, clean and dry and was located away from areas of potential plant movement to minimise the risk of accidental damage.

The rolls were not stacked more than three rolls high.

Manufacturers' quality control certification for each roll of geomembrane was supplied to the CQA Inspector prior to lining works commencing. Copies of this information can be found in Appendix 2 of this report.

4.3.4 Conformance Testing and Summary

Conformance testing of the geomembrane was undertaken in accordance with the design specification by BICS Laboratories Ltd., West Yorkshire.

The results of the conformance testing are enclosed within Appendix 2 of this report and showed that the geomembrane capping material achieved the minimum requirements of the CQA Plan/Design Specification.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.3.5 LLDPE Deployment

LLDPE Deployment Contractor

The 1mm LLDPE Textured Geomembrane was installed by Dragon Lining Ltd.

Inspection of the underlying subgrade

The 1mm LLDPE textured geomembrane was deployed in direct contact with the approved regulating layer in accordance with the CQA Plan/Design Specification. The CQA Inspector inspected the regulating layer surface prior to deployment of the 1mm LLDPE textured geomembrane. No deployment took place until approval of the area to be lined had been given. Approval of the subgrade was recorded on the sub grade release forms which are included in Appendix 2 of this report.

Method of Deployment

The geomembrane was placed manually from a roll suspended on a spreader bar which was, in turn, suspended from a tracked excavator. Once placed, each geomembrane panel was aligned manually to give the required minimum overlap of 100mm between the adjoining panels in preparation for seaming. Sandbags were placed along the overlap to temporarily secure the panel in place and prevent any uplift from high winds.

The geomembrane was deployed in such a way as to minimise stresses or strains on the material and did not cause damage to the underlying regulating material. The geomembrane was deployed in intimate contact with the regulating layer in such a way as to minimise any wrinkles or creases in the geomembrane.

At the end of each period of deployment sandbags were placed along the free edge of the deployed geomembrane to prevent uplift of the material by strong winds.

Each geomembrane panel was assigned a unique identification number by the CQA Inspector to record the order of deployment. A drawing showing the panel placement layout is enclosed within Appendix 7 of this report.

4.3.6 Seaming of LLDPE

The principle seaming method employed was the double seam fusion process in which the geomembrane seam is heated to a controlled temperature and compressed between two rollers of a self propelled welding machine. This method of welding forms two parallel seams of continuously fused geomembrane sheet separated by a central hollow core. Fusion welding was tested using an air pressure test method.

Extrusion fillet weld was used at the location of all patching at seam test locations, to repair defects in the geomembrane and where fusion welding was

4.0 CONSTRUCTION QUALITY ASSURANCE

deemed impractical such as along the tie-in between capping areas. Any extrusion welds were tested using a vacuum-box method.

Any defects identified were ground down, re-welded and tested again. All pre-treatment measures to seams (e.g. grinding and cleaning) were carried out as specified in the CQA Plan.

The CQA Inspector ensured the surfaces of the geomembrane was clean, dry and free from dust, dirt, debris or foreign matter prior to any seaming taking place

4.3.7 Trial Seams

Trial seams were performed in the presence of the CQA Inspector for each piece of welding equipment at the start of each period of welding, following a period of machine shutdown for one hour or after change of machine operator. All trial weld records can be found in the appropriate proforma within Appendix 2.

No seaming took place until such time as an adequate trial seam had been undertaken and on-site destructive testing yielded satisfactory results and approval of the trial seam had been given by the CQA Inspector.

4.3.8 Testing of Seams and Welding Logs

All welding of seams, trial seam tests, on-site destructive and non-destructive testing of field seams on the LLDPE were undertaken by the Dragon Lining Ltd. in accordance with the requirements of the design specification and witnessed by the CQA Inspector.

Quantitative Destructive Testing

Destructive testing samples were recovered from the seams between panels of geomembrane at a minimum frequency of 1 per 200m of seaming or 1 per day for each type of seaming. The sampling was undertaken under the direction of the CQA Inspector.

The samples were sent for testing to a UKAS accredited testing laboratory. (BICS Laboratories Ltd., West Yorkshire).

Results of the laboratory destructive seam testing are enclosed within Appendix 2 of this report along with the seaming records produced by the CQA Inspector.

Non-Destructive Testing

All seams were non-destructively tested in the presence of the CQA Inspector by means of vac-box testing or air pressure testing. Results of this testing can be found in Appendix 2 of this Report.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.3.9 Defects and Repairs

All repairs carried out to the geomembrane were undertaken in accordance with the approved CQA Plan and in the presence of the CQA Inspector. Each repair was given a unique reference number and the position and type of defect were recorded by the CQA Inspector. All repairs were tested upon completion using either the vacuum box or air pressure test method. The defect and repair records can be found in Appendix 2 of this report.

4.3.10 Pipe-boots

Pre-fabricated pipe-boots were installed over any protruding existing installations on the capping area. The pipe-boots were lifted into position and welded to the deployed geomembrane. All seams were tested upon completion to the satisfaction of the CQA Inspector.

4.3.11 Surveys

An as-built survey of the deployed geomembrane was undertaken as the works progressed showing the location of all seam, geomembrane repairs and protrusions. The as-built drawing 'Cell 3A LLDPE Geomembrane Panel Layout' Dwg. No.PMS12168-01 can be found in Appendix 7 of this report.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.4 PROTECTION GEOTEXTILE

4.4.1 Design Specification Details

An upper protection geotextile was required above the installed geomembrane layer in areas where the maximum slope gradient did not exceed 1V:4H

The geotextile upper protection layer consisted of a non-woven, needle punched polypropylene geotextile. The geotextile upper protection layer conformed to the requirements of Table 4 contained within the CQA Plan/Design Specification.

A summary of the manufacturing quality control data for the rolls used during the works can be found within Appendix 3 of this report.

4.4.2 Delivery, Handling and Storage

The rolls of geotextile were delivered to site and were off-loaded in the presence of the CQA Inspector. As the material was being off-loaded, the CQA Inspector inspected material to ensure it was free from cuts, holes, blisters, blemishes, abrasions, or other surface imperfections prior to installation.

Each roll of the material was clearly labelled with the manufacturers name, the product name and type, the batch number and the roll number, the roll length, width and weight along with the date of manufacture.

The storage area for the delivered rolls of geotextile was inspected prior to the delivery of the material to ensure the area was free of any debris or material likely to cause damage to the material. The storage area was flat, clean and dry and was located away from areas of potential plant movement to minimise the risk of accidental damage.

The rolls were not stacked more than five rolls high.

4.4.3 Source of Protection Geotextile

The geotextile material used was a Terrex SNW 46 geotextile supplied by ABG Environmental Geosynthetics Ltd.

4.4.4 Conformance Testing

Conformance sampling was carried out on the geotextile as soon as practicable after the delivery of the material, with the results of conformance testing carried out by UKAS accredited testing laboratory BICS Laboratories Ltd., West Yorkshire.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.4.5 Geotextile Deployment

Geotextile Deployment Contractor

The installation of the protection geotextile was carried out by Dragon Lining Ltd.

Inspection of the Lining System

The geotextile was deployed in direct contact with the previously deployed geomembrane cap. No geotextile was deployed until the CQA Inspector had given approval of the underlying geomembrane layer.

4.4.6 Geotextile Deployment Method

The geotextile was deployed by hand onto the approved deployed geomembrane surface in accordance with the CQA Plan/Design Specification. The panels were placed with a minimum overlap of 300mm to the adjacent panels and were heat bonded into position. Sandbags or windrows of suitable soil material was placed along any free edges of the deployed material to prevent any uplift caused by strong winds.

Each panel was given a unique panel reference number to record the location and order of deployment. Geotextile deployment records can be found in Appendix 3 of this report.

In the areas of tie-in where the geotextile overlapped the geocomposite layer, the material was overlapped by 300mm and heat bonded.

All deployed geotextile was inspected by the CQA Inspector for signs of damage or defects and overlap widths were checked prior to the placement of any overlying layers of material. Prior to the placement of the restoration soils in any area, the CQA Inspector approved the underlying geotextile.

4.4.7 Tie-in to Existing Geotextile

Where the geotextile was to be tied into the existing geotextile of adjacent capping, the CQA Inspector ensured that a minimum overlap of 300mm was maintained and that there were no foreign bodies, dirt etc present in the welding area.

The existing geotextile was exposed as far back as required to achieve a suitable tie-in area free of any damage or defects.

4.4.8 Surveys

An as-built survey of the deployed geotextile was undertaken as the works progressed showing the location of all seam, geomembrane repairs and protrusions. The as-built drawing '3A Geotextile Panel Layout' Dwg. No. PMS12168-02 can be found in Appendix 7 of this Report.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.5 RESTORATION SOILS

4.5.1 General Description

The restoration soils were placed to a minimum thickness of 1200mm above the capping system. An initial layer of 500mm thickness was placed above the geotextile and drainage geocomposite layers; this consisted of fine material which was scrutinised by the CQA Inspector for the presence of any unsuitable material. Above this, a further 700mm of soils was placed to achieve the required 1200mm thickness.

The soils used for the construction of the restoration layer were sourced from on-site stockpiles from the area of cap strip. The soils were excavated from the designated areas of the site maintaining a minimum of 300mm above the waste layer. Any material considered to be unsuitable was removed from the works area. Any large clods of material were broken down prior to placement to prevent the formation of voids in the restoration layer.

The CQA Inspector inspected the soil stockpiles periodically to ensure the integrity of the soils was maintained during the works.

4.5.2 Placement

The restoration soils were placed as soon as practicable after the installation of the geocomposite and geotextile protection layer. The restoration soils were spread in layers to the required thickness to form a smooth even profile without undulations, hollows or depressions.

The Contractor undertook the placement of the restoration soils in a careful and systematic manner that did not affect the integrity, cause damage to or displacement of the capping system.

The restoration soils placed on the flanks of the capping area were placed from the toe of the flanks upwards to prevent any undue stresses on the deployed geomembrane or geotextile or geocomposite. Discrete mounds of material were placed onto the capping system to prevent the generation of excessive wrinkles or folds with the resultant voids between the mounds being in-filled by casting of the material with an excavator.

The final surface of the restoration layer was graded to achieve the required levels and profile without undulations, hollows or depressions using a low ground pressure dozer.

The depth of the restoration layer was controlled with the use of free standing profile boards/travellers and was visually monitored by the CQA Inspector as the works progressed. The restoration soils were surveyed upon completion by the principal contractor.

4.0 CONSTRUCTION QUALITY ASSURANCE

An as-built survey of the placed restoration soils was undertaken as the works progressed showing the location of all seam, geomembrane repairs and protrusions. The as-built drawing 'Cell 3A Capping Soil Levels' Dwg No. PMS12168-04 can be found in Appendix 7 of this Report.

5.0 PROBLEMS ENCOUNTERED

5.1 No problems were encountered during the works at Llanddulas Landfill Site.

6.0 CONCLUSIONS

- 6.1** From the information presented in this report, it can be concluded that to the best of our knowledge the construction of the permanent capping works at Llanddulas Landfill Site has been carried out in accordance with the requirements of the approved CQA Plan/Design Specification.

Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Regulating Layer

- Trial Pit Summary
- Shear Vane Testing Summary
- Trial Pit Location Plan
- Shear Vane Location Plan



Trial Pit Summary

GROUND ASSESSMENT SHEET

Site:		Llanddulas		Sheet No.	1
CQA Engineer		Malachi White			

Grid Ref.	Date	Layer Under Consideration. <i>(Formation, Regulating Layer, Restoration etc.)</i>	Thickness of layer	Shear Strength (kPa)	Pass/Fail
TH1 (H2)	07.09.12	Regulating Layer	310	N/A	Pass
TH2 (H2)	07.09.12	Regulating Layer	300	N/A	Pass
TH3 (H2)	07.09.12	Regulating Layer	310	N/A	Pass
TH4 (H2)	07.09.12	Regulating Layer	305	N/A	Pass
TH5 (G2)	07.09.12	Regulating Layer	300	N/A	Pass
TH6 (G2)	07.09.12	Regulating Layer	300	N/A	Pass
TH7 (G2)	07.09.12	Regulating Layer	310	N/A	Pass
TH8 (F2)	11.09.12	Regulating Layer	320	N/A	Pass
TH9 (F2)	11.09.12	Regulating Layer	300	N/A	Pass
TH10 (F2)	11.09.12	Regulating Layer	320	N/A	Pass
TH11 (F2)	11.09.12	Regulating Layer	330	N/A	Pass
TH12 (F2)	11.09.12	Regulating Layer	310	N/A	Pass
TH13 (F2)	11.09.12	Regulating Layer	380	N/A	Pass
TH14 (F2)	11.09.12	Regulating Layer	400	N/A	Pass
TH15 (F2)	11.09.12	Regulating Layer	340	N/A	Pass
TH16 (F2)	11.09.12	Regulating Layer	200	N/A	Fail
TH17 (F2)	11.09.12	Regulating Layer	400	N/A	Pass
TH18 (F2)	11.09.12	Regulating Layer	310	N/A	Pass
TH19 (E2)	11.09.12	Regulating Layer	330	N/A	Pass
TH20 (E2)	11.09.12	Regulating Layer	300	N/A	Pass
TH21 (E2)	11.09.12	Regulating Layer	340	N/A	Pass
TH22 (E2)	11.09.12	Regulating Layer	310	N/A	Pass
TH23 (E2)	11.09.12	Regulating Layer	300	N/A	Pass
TH24 (D2)	11.09.12	Regulating Layer	330	N/A	Pass
TH25 (D2)	11.09.12	Regulating Layer	320	N/A	Pass
TH26 (D2)	11.09.12	Regulating Layer	320	N/A	Pass

GROUND ASSESSMENT SHEET

Site:		Llanddulas		Sheet No.	2
CQA Engineer		Malachi White			
Grid Ref.	Date	Layer Under Consideration. <i>(Formation, Regulating Layer, Restoration etc.)</i>	Thickness of layer	Shear Strength (kPa)	Pass/Fail
TH27 (D2)	12.09.12	Regulating Layer	340	N/A	Pass
TH28 (D2)	12.09.12	Regulating Layer	330	N/A	Pass
TH29 (D2)	12.09.12	Regulating Layer	400	N/A	Pass
TH30 (D2)	12.09.12	Regulating Layer	350	N/A	Pass
TH31 (D2)	12.09.12	Regulating Layer	300	N/A	Pass
TH32 (D2)	12.09.12	Regulating Layer	320	N/A	Pass
TH33 (D2)	12.09.12	Regulating Layer	380	N/A	Pass
TH34 (E2)	12.09.12	Regulating Layer	320	N/A	Pass
TH35 (E2)	12.09.12	Regulating Layer	310	N/A	Pass
TH36 (E2)	12.09.12	Regulating Layer	310	N/A	Pass
TH37 (E2)	12.09.12	Regulating Layer	350	N/A	Pass
TH38 (D2)	12.09.12	Regulating Layer	300	N/A	Pass
TH39 (D2)	12.09.12	Regulating Layer	330	N/A	Pass
TH40 (D2)	12.09.12	Regulating Layer	350	N/A	Pass
TH41 (D2)	15.09.12	Regulating Layer	340	N/A	Pass
TH42 (D1)	15.09.12	Regulating Layer	330	N/A	Pass
TH43 (D2)	15.09.12	Regulating Layer	300	N/A	Pass
TH44 (D2)	15.09.12	Regulating Layer	300	N/A	Pass
TH45 (D1)	15.09.12	Regulating Layer	330	N/A	Pass
TH46 (C1)	15.09.12	Regulating Layer	340	N/A	Pass
TH47 (c2)	15.09.12	Regulating Layer	360	N/A	Pass
TH48 (C2)	15.09.12	Regulating Layer	300	N/A	Pass
TH49 (C2)	15.09.12	Regulating Layer	300	N/A	Pass
TH50 (C2)	15.09.12	Regulating Layer	305	N/A	Pass
TH51 (C1)	15.09.12	Regulating Layer	400	N/A	Pass
TH52 (C1)	15.09.12	Regulating Layer	350	N/A	Pass

GROUND ASSESSMENT SHEET

Site:	Llanddulas	Sheet No.	3
CQA Engineer	Malachi White		

[illegible]

| **Shear Vane Testing Summary** |

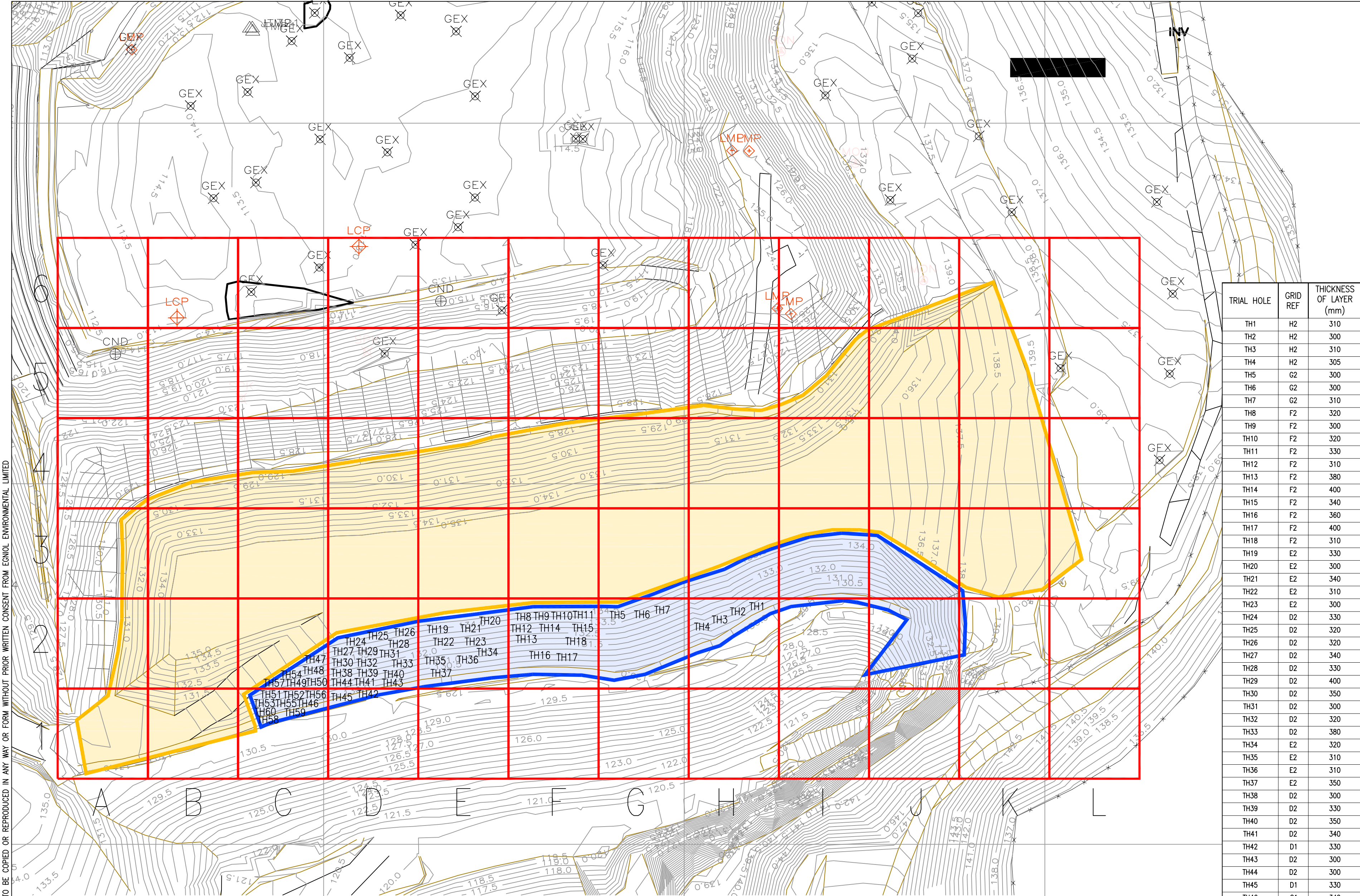
GROUND ASSESSMENT SHEET

[illegible]



Trial Pit Location Plan

© COPYRIGHT EGNOL ENVIRONMENTAL LIMITED — NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM EGNOL ENVIRONMENTAL LIMITED



NOTES

- DO NOT SCALE FROM THIS DRAWING.
- SURVEY INFORMATION PROVIDED BY FCC ENVIRONMENT LTD. DRAWING REF: 112D_NW_2011_27_01 – Phase 3
- KEY:
 - APPROXIMATE EXTENT OF PHASE 3A TEMPORARY CAPPING WORKS
 - APPROXIMATE EXTENT OF PHASE 3A PERMANENT CAPPING WORKS
 - LATEST SITE SURVEY CONTOURS
 - TH1 –DENOTES TRIAL HOLE LOCATION

TRIAL HOLE	GRID REF	THICKNESS OF LAYER (mm)
TH1	H2	310
TH2	H2	300
TH3	H2	310
TH4	H2	305
TH5	G2	300
TH6	G2	300
TH7	G2	310
TH8	F2	320
TH9	F2	300
TH10	F2	320
TH11	F2	330
TH12	F2	310
TH13	F2	380
TH14	F2	400
TH15	F2	340
TH16	F2	360
TH17	F2	400
TH18	F2	310
TH19	E2	330
TH20	E2	300
TH21	E2	340
TH22	E2	310
TH23	E2	300
TH24	D2	330
TH25	D2	320
TH26	D2	320
TH27	D2	340
TH28	D2	330
TH29	D2	400
TH30	D2	350
TH31	D2	300
TH32	D2	320
TH33	D2	380
TH34	E2	320
TH35	E2	310
TH36	E2	310
TH37	E2	350
TH38	D2	300
TH39	D2	330
TH40	D2	350
TH41	D2	340
TH42	D1	330
TH43	D2	300
TH44	D2	300
TH45	D1	330
TH46	C1	340
TH47	C2	360
TH48	C2	300
TH49	C2	300
TH50	C2	305
TH51	C1	400
TH52	C1	350
TH53	C1	330
TH54	C2	310
TH55	C1	410
TH56	C1	320
TH57	C2	400
TH58	C1	380
TH59	C1	350
TH60	C1	340



LLANDDULAS LANDFILL SITE
PHASE 3A PROPOSED
CAPPING WORK 2012

TRIAL HOLE
SAMPLE LOCATION PLAN
25m BY 25m GRID

DRAWN BY	DMD	DATE	31.10.2012
CHECKED BY	RF	SCALE	© A2 1:750
APPROVED BY	TA	ISSUE	-
REVISION	-		

DRAWING NUMBER
4665.THSLP.02

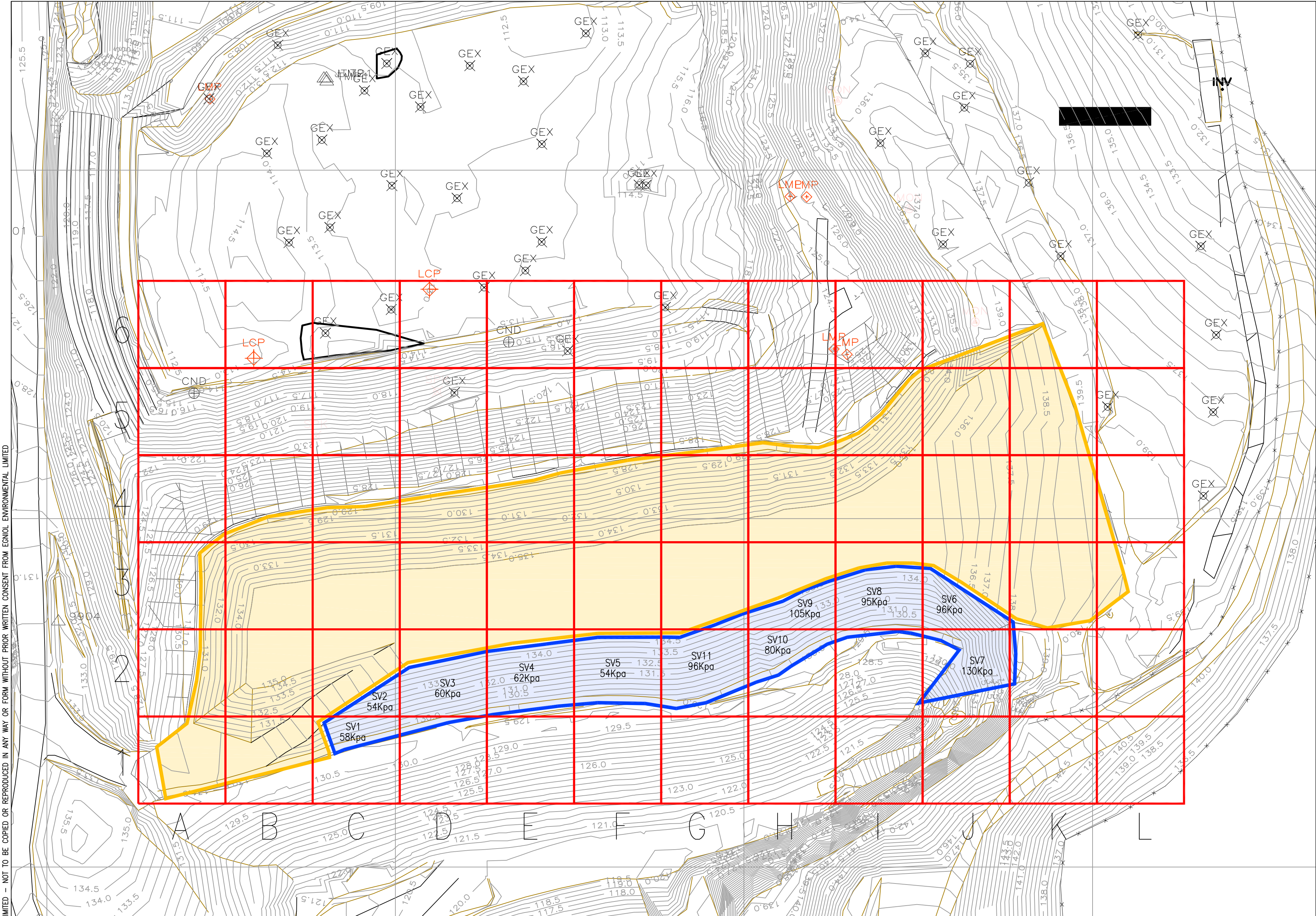


**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Shear Vane Location Plan

© COPYRIGHT EGNOL ENVIRONMENTAL LIMITED — NOT TO BE COPIED OR REPRODUCED IN ANY WAY OR FORM WITHOUT PRIOR WRITTEN CONSENT FROM EGNOL ENVIRONMENTAL LIMITED



- NOTES
- DO NOT SCALE FROM THIS DRAWING.
 - SURVEY INFORMATION PROVIDED BY FCC ENVIRONMENT LTD. DRAWING REF: 112D_NW_2011_27_01 - Phase 3
 - KEY:
 - APPROXIMATE EXTENT OF PHASE 3A TEMPORARY CAPPING WORKS
 - APPROXIMATE EXTENT OF PHASE 3A PERMANENT CAPPING WORKS
 - LATEST SITE SURVEY CONTOURS
 - DENOTES SHEAR VANE LOCATION



LLANDDULAS LANDFILL SITE
PHASE 3A PROPOSED
CAPPING WORK 2012

SHEAR VANE
SAMPLE LOCATION PLAN
25m BY 25m GRID

DRAWN BY DMD	DATE 31.10.2012
CHECKED BY RF	SCALE @ A2 1:750
APPROVED BY TA	ISSUE - REVISION -

DRAWING NUMBER
4665.SVSLP.02

ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY



Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Geomembrane Liner Requirements

- Subgrade Release Forms
- Delivery and Inspection Records
- Quality Control Certificates
- Conformance Certificates
- Panel Deployment Records
- Trial Weld Record
- Seaming and Non-Destructive Testing Record
- Panel Repair Record
- Destructive Testing Record
- Welding Operative Certificates

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**

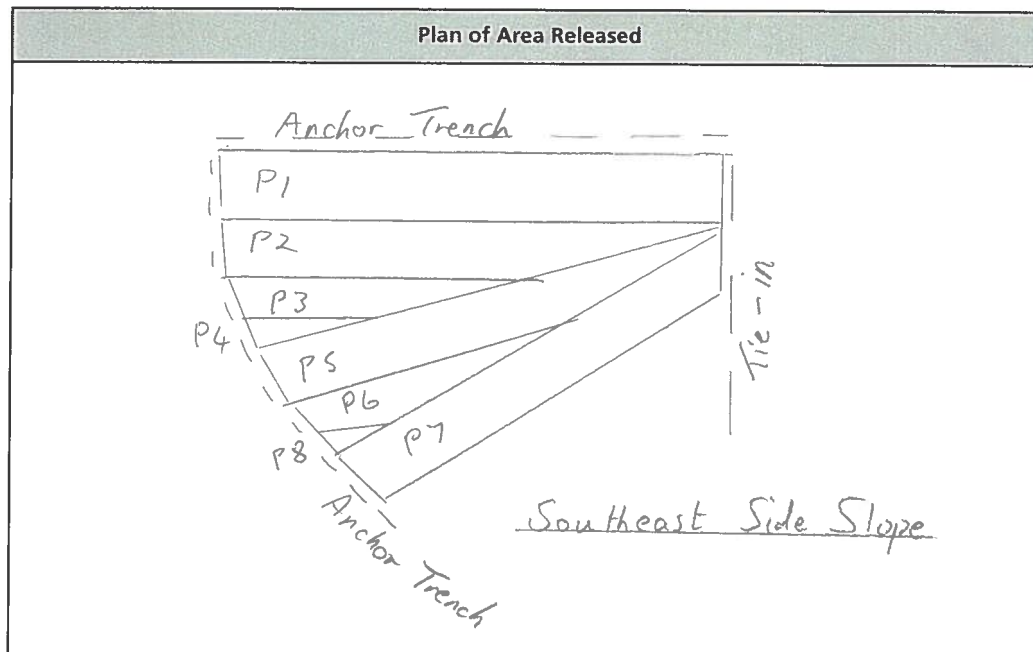


Subgrade Release Forms

Surface Release Form

Landfill Site: Llanddulas
 Project: Cell 31 3A Capping Works 2012
 Date: 07/09/12
 Surface being inspected for release:

Area /Panel Ref	<u>P1 - P8</u>
Remediation Carried Out	<u>The area released was smoothed with the back of excavator bucket, & hand picked for stones /unsuitable materials.</u>



The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

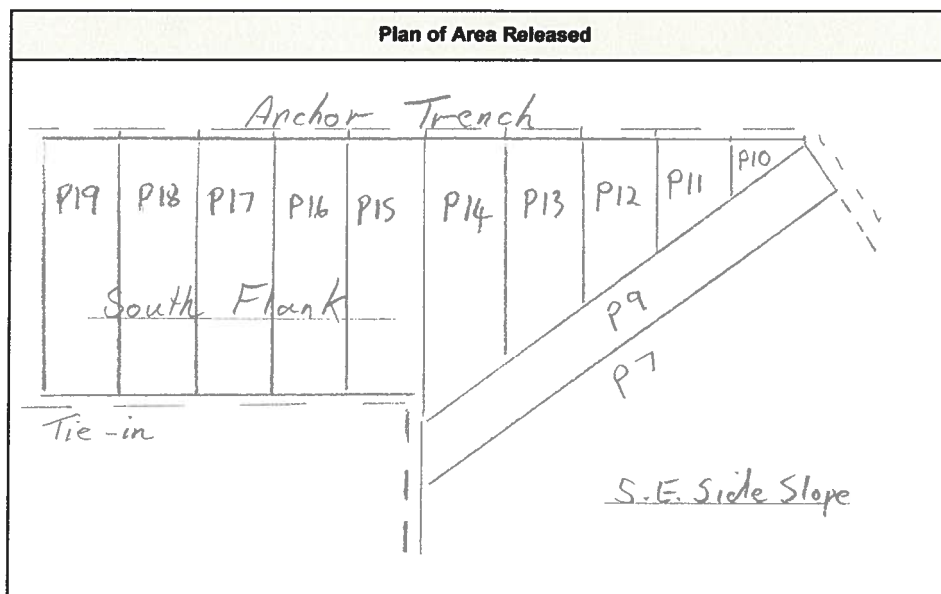
Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: _____ CQA Inspector : _____ Print Name M. WHITE
 Signature [Signature]

Surface Release Form

Landfill Site: Llanddulas
 Project: Cell 3/3A Capping Works 2012
 Date: 10.09.12
 Surface being inspected for release:

Area /Panel Ref	P9 - P19
Remediation Carried Out	The area released was smoothed with the back of excavator bucket & hand picked for oversize stones / unsuitable materials.



The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: CQA Inspector : Print Name Malachi White

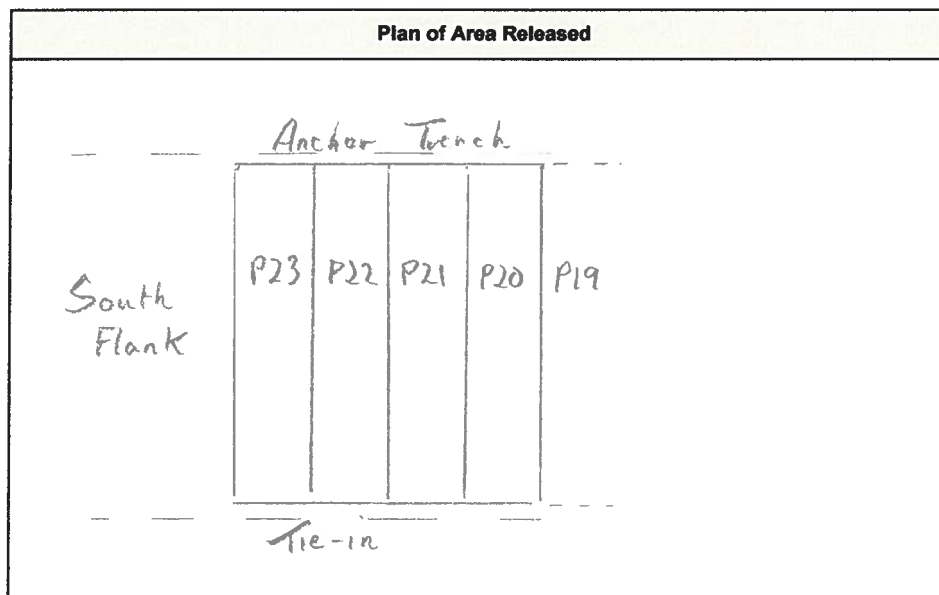
Signature



Surface Release Form

Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012
Date: 11.09.12
Surface being inspected for release:

Area /Panel Ref	P20 - P23
Remediation Carried Out	The area released was smoothed with the back of excavator bucket & hand picked for oversize stones / unsuitable materials.

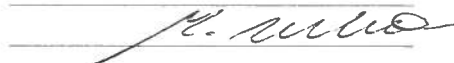


The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: CQA Inspector : Print Name Malachi White

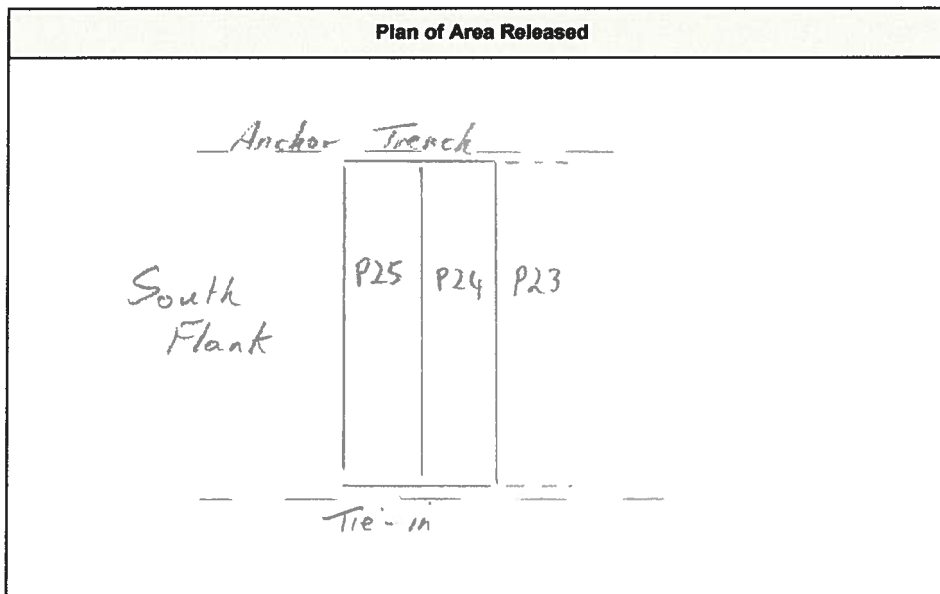
Signature



Surface Release Form

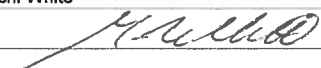
Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012
Date: 12.09.12
Surface being inspected for release:

Area /Panel Ref	P24 - P25
Remediation Carried Out	The area released was smoothed with the back of excavator bucket & hand picked for oversize stones / unsuitable materials.



The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

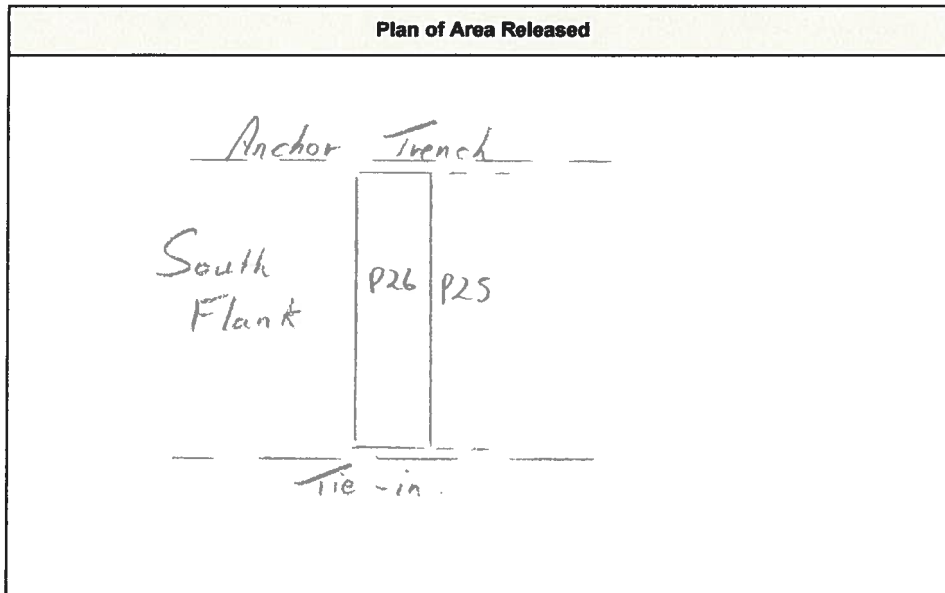
Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: CQA Inspector : Print Name Malachi White
Signature 

Surface Release Form

Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012
Date: 14.09.12
Surface being inspected for release:

Area /Panel Ref	P26
Remediation Carried Out	The area released was smoothed with the back of excavator bucket & hand picked for oversize stones / unsuitable materials.

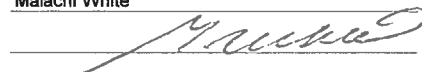


The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: CQA Inspector : Print Name Malachi White

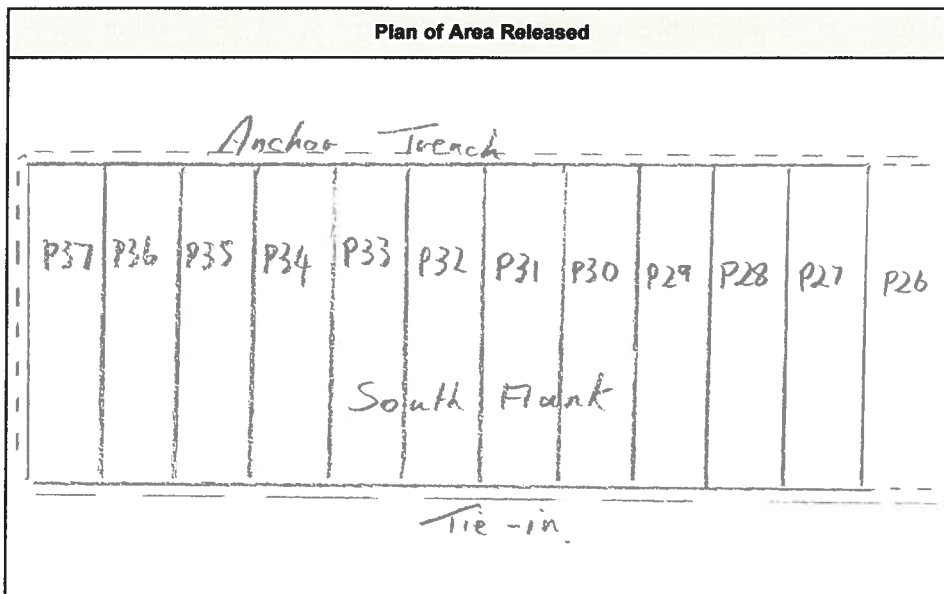
Signature



Surface Release Form

Landfill Site: Llanddulas
 Project: Cell 3/3A Capping Works 2012
 Date: 15.09.12
 Surface being inspected for release:

Area /Panel Ref	P27 - P37
Remediation Carried Out	The area released was smoothed with the back of excavator bucket & hand picked for oversize stones / unsuitable materials.



The surface has been inspected and the signature of confirmation below indicates that the preparation has been carried out in accordance with the Construction Quality Assurance Plan, Specification and Installers method statement (as applicable)

Release is subject to the surface not being adversely affected by subsequent events prior to the installation of the following layers of the lining system.

Released By: CQA Inspector : Print Name Malachi White
Signature 

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



| Delivery and Inspection Records |



Geomembrane Delivery and Inspection Record

Landfill Site: Llanddulas
Project: Cell 3 / 3A Capping 2012
Material: GSE 1mm LDPE Ultraflex Textured

[illegible]

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**

egniol

Quality Control Certificates



GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420042264
Bill of Lading VKL+102706

ENVIRONMENTAL™

Roll Identification

Roll Number	420042264				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Jul 09, 2012	Width	6.95 meters	Weight	1,020 kilograms

Resin Information

Batch number AO12013-2400003484

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,92
Core Thickness Maximum [mm]	ASTM D5994 MA	1,11
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.934
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	24
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	590
Break Elongation [%] CMD	ASTM D6693 BD	547
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	134
Asperity Height [mm]	ASTM D7466 /A	0.34
Puncture Resistance [N]	ASTM D4833	384
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 420042933
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420042933				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m²
Production Date	Jul 30, 2012	Width	6.95 meters	Weight	1,024 kilograms

Resin Information

Batch number CO12028-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,05
Core Thickness Minimum [mm]	ASTM D5994 MI	0,96
Core Thickness Maximum [mm]	ASTM D5994 MA	1,11
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	26
Break Strength [N/mm] CMD	ASTM D6693 ZF	20
Break Elongation [%] MD	ASTM D6693 BD	603
Break Elongation [%] CMD	ASTM D6693 BD	475
Tear Resistance [N] MD	ASTM D1004	154
Tear Resistance [N] CMD	ASTM D1004	127
Asperity Height [mm]	ASTM D7466 /A	0.42
Puncture Resistance [N]	ASTM D4833	408
OIT [min]	ASTM D3895	138

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT
Inspection Certificate 3.1 (DIN EN 10204)Roll No 420042934
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420042934				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m²
Production Date	Jul 30, 2012	Width	6.95 meters	Weight	1,028 kilograms

Resin Information**Batch number** CO12029-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,94
Core Thickness Maximum [mm]	ASTM D5994 MA	1,08
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	27
Break Strength [N/mm] CMD	ASTM D6693 ZF	19
Break Elongation [%] MD	ASTM D6693 BD	608
Break Elongation [%] CMD	ASTM D6693 BD	463
Tear Resistance [N] MD	ASTM D1004	154
Tear Resistance [N] CMD	ASTM D1004	127
Asperity Height [mm]	ASTM D7466 /A	0.42
Puncture Resistance [N]	ASTM D4833	408
OIT [min]	ASTM D3895	138

Sales order VK102100**Customer Name** Jones Bros. Ruthin Civil Engineering Co. Ltd.**Project Name** Llandulas Landfill Site**Location** LL22 8HP Abergele, Clwyd

* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 420042935
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420042935	Length	130 meters	Sheet Area	904 m²
Product Name	LDT-100AM-BBB-V-00	Width	6.95 meters	Weight	1,032 kilograms
Production Date	Jul 30, 2012				

Resin Information

Batch number CO12029-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,94
Core Thickness Maximum [mm]	ASTM D5994 MA	1,08
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	27
Break Strength [N/mm] CMD	ASTM D6693 ZF	19
Break Elongation [%] MD	ASTM D6693 BD	608
Break Elongation [%] CMD	ASTM D6693 BD	463
Tear Resistance [N] MD	ASTM D1004	154
Tear Resistance [N] CMD	ASTM D1004	127
Asperity Height [mm]	ASTM D7466 /A	0.42
Puncture Resistance [N]	ASTM D4833	408
OIT [min]	ASTM D3895	138

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420042988
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420042988				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 02, 2012	Width	6.95 meters	Weight	1,024 kilograms

Resin Information

Batch number CO12031-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,98
Core Thickness Maximum [mm]	ASTM D5994 MA	1,09
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	23
Break Strength [N/mm] CMD	ASTM D6693 ZF	19
Break Elongation [%] MD	ASTM D6693 BD	514
Break Elongation [%] CMD	ASTM D6693 BD	418
Tear Resistance [N] MD	ASTM D1004	133
Tear Resistance [N] CMD	ASTM D1004	134
Asperity Height [mm]	ASTM D7466 /A	0.57
Puncture Resistance [N]	ASTM D4833	427
OIT [min]	ASTM D3895	156

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 420042989
Bill of Lading VKL+102708

ENVIRONMENTAL

Roll Identification

Roll Number	420042989				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,022 kilograms

Resin Information

Batch number CO12031-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,97
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	26
Break Strength [N/mm] CMD	ASTM D6693 ZF	17
Break Elongation [%] MD	ASTM D6693 BD	600
Break Elongation [%] CMD	ASTM D6693 BD	405
Tear Resistance [N] MD	ASTM D1004	133
Tear Resistance [N] CMD	ASTM D1004	134
Asperity Height [mm]	ASTM D7466 /A	0.57
Puncture Resistance [N]	ASTM D4833	427
OIT [min]	ASTM D3895	156

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420042990
Bill of Lading VKL+102708

ENVIRONMENTAL[®]

Roll Identification

Roll Number	420042990				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,022 kilograms

Resin Information

Batch number CO12031-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,04
Core Thickness Minimum [mm]	ASTM D5994 MI	0,98
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	26
Break Strength [N/mm] CMD	ASTM D6693 ZF	17
Break Elongation [%] MD	ASTM D6693 BD	600
Break Elongation [%] CMD	ASTM D6693 BD	405
Tear Resistance [N] MD	ASTM D1004	133
Tear Resistance [N] CMD	ASTM D1004	134
Asperity Height [mm]	ASTM D7466 /A	0.54
Puncture Resistance [N]	ASTM D4833	427
OIT [min]	ASTM D3895	156

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420042998
Bill of Lading VKL+102701

ENVIRONMENTAL™

Roll Identification

Roll Number	420042998				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,022 kilograms

Resin Information

Batch number CO12032-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,01
Core Thickness Minimum [mm]	ASTM D5994 MI	0,90
Core Thickness Maximum [mm]	ASTM D5994 MA	1,09
Carbon Black Content [%]	ASTM D1603	2.4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	20
Break Strength [N/mm] CMD	ASTM D6693 ZF	20
Break Elongation [%] MD	ASTM D6693 BD	466
Break Elongation [%] CMD	ASTM D6693 BD	496
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	153
Asperity Height [mm]	ASTM D7466 /A	0.52
Puncture Resistance [N]	ASTM D4833	416
OIT [min]	ASTM D3895	138

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420042999
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420042999				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,030 kilograms

Resin Information

Batch number CO12032-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,02
Core Thickness Minimum [mm]	ASTM D5994 MI	0,92
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.933
Dimensional Stability [%] MD	ASTM D1204	-0.3
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	25
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	597
Break Elongation [%] CMD	ASTM D6693 BD	499
Tear Resistance [N] MD	ASTM D1004	154
Tear Resistance [N] CMD	ASTM D1004	135
Asperity Height [mm]	ASTM D7466 /A	0.52
Puncture Resistance [N]	ASTM D4833	416
OIT [min]	ASTM D3895	138

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043000
Bill of Lading VKL+102708

ENVIRONMENTAL

Roll Identification

Roll Number	420043000				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,030 kilograms

Resin Information

Batch number CO12032-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,01
Core Thickness Minimum [mm]	ASTM D5994 MI	0,90
Core Thickness Maximum [mm]	ASTM D5994 MA	1,09
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.3
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	25
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	597
Break Elongation [%] CMD	ASTM D6693 BD	499
Tear Resistance [N] MD	ASTM D1004	154
Tear Resistance [N] CMD	ASTM D1004	135
Asperity Height [mm]	ASTM D7466 /A	0.53
Puncture Resistance [N]	ASTM D4833	416
OIT [min]	ASTM D3895	138

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043001
Bill of Lading VKL+102708

ENVIRONMENTAL

Roll Identification

Roll Number	420043001				
Product Name	LDT-100AM-BBB-V-00	Length	130 meters	Sheet Area	904 m ²
Production Date	Aug 03, 2012	Width	6.95 meters	Weight	1,030 kilograms

Resin Information

Batch number CO12032-2400003590

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,02
Core Thickness Minimum [mm]	ASTM D5994 MI	0,92
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.3
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	24
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	546
Break Elongation [%] CMD	ASTM D6693 BD	517
Tear Resistance [N] MD	ASTM D1004	125
Tear Resistance [N] CMD	ASTM D1004	126
Asperity Height [mm]	ASTM D7466 /A	0.53
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	138

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043451
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420043451				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,630 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,04
Core Thickness Minimum [mm]	ASTM D5994 MI	0,95
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	22
Break Strength [N/mm] CMD	ASTM D6693 ZF	21
Break Elongation [%] MD	ASTM D6693 BD	496
Break Elongation [%] CMD	ASTM D6693 BD	479
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.46
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd

* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043452
Bill of Lading VKL+102708

ENVIRONMENTAL

Roll Identification

Roll Number	420043452				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,624 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,04
Core Thickness Minimum [mm]	ASTM D5994 MI	0,93
Core Thickness Maximum [mm]	ASTM D5994 MA	1,18
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	21
Break Strength [N/mm] CMD	ASTM D6693 ZF	20
Break Elongation [%] MD	ASTM D6693 BD	486
Break Elongation [%] CMD	ASTM D6693 BD	501
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.44
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd

* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043453
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420043453				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,614 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,05
Core Thickness Minimum [mm]	ASTM D5994 MI	0,97
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	23
Break Strength [N/mm] CMD	ASTM D6693 ZF	16
Break Elongation [%] MD	ASTM D6693 BD	574
Break Elongation [%] CMD	ASTM D6693 BD	411
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.44
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd

* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043454
Bill of Lading VKL+102708

ENVIRONMENTAL

Roll Identification

Roll Number	420043454				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,616 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,06
Core Thickness Minimum [mm]	ASTM D5994 MI	0,94
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	22
Break Strength [N/mm] CMD	ASTM D6693 ZF	21
Break Elongation [%] MD	ASTM D6693 BD	520
Break Elongation [%] CMD	ASTM D6693 BD	513
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.48
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 420043456
Bill of Lading VKL+102708

ENVIRONMENTALTM

Roll Identification

Roll Number	420043456				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,644 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,05
Core Thickness Minimum [mm]	ASTM D5994 MI	0,92
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	23
Break Strength [N/mm] CMD	ASTM D6693 ZF	21
Break Elongation [%] MD	ASTM D6693 BD	525
Break Elongation [%] CMD	ASTM D6693 BD	525
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.50
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 42004345
Bill of Lading VKL+10270

ENVIRONMENTAL™

Roll Identification

Roll Number	420043457				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,648 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,04
Core Thickness Minimum [mm]	ASTM D5994 MI	0,98
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	20
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	464
Break Elongation [%] CMD	ASTM D6693 BD	521
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.50
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100

Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.

Project Name Llandulas Landfill Site

Location LL22 8HP Abergele, Clwyd

* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043458
Bill of Lading VKL+102708

ENVIRONMENTAL™

Roll Identification

Roll Number	420043458				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,606 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,02
Core Thickness Minimum [mm]	ASTM D5994 MI	0,96
Core Thickness Maximum [mm]	ASTM D5994 MA	1,07
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	25
Break Strength [N/mm] CMD	ASTM D6693 ZF	19
Break Elongation [%] MD	ASTM D6693 BD	599
Break Elongation [%] CMD	ASTM D6693 BD	494
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.46
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043459
Bill of Lading VKL+102706

ENVIRONMENTAL™

Roll Identification

Roll Number	420043459				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,600 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	1,00
Core Thickness Maximum [mm]	ASTM D5994 MA	1,08
Carbon Black Content [%]	ASTM D1603	2.3
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.2
Dimensional Stability [%] CMD	ASTM D1204	0.2
Break Strength [N/mm] MD	ASTM D6693 ZF	16
Break Strength [N/mm] CMD	ASTM D6693 ZF	24
Break Elongation [%] MD	ASTM D6693 BD	388
Break Elongation [%] CMD	ASTM D6693 BD	585
Tear Resistance [N] MD	ASTM D1004	135
Tear Resistance [N] CMD	ASTM D1004	131
Asperity Height [mm]	ASTM D7466 /A	0.46
Puncture Resistance [N]	ASTM D4833	374
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043460
Bill of Lading VKL+102700

ENVIRONMENTAL

Roll Identification

Roll Number	420043460				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,618 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,02
Core Thickness Minimum [mm]	ASTM D5994 MI	0,98
Core Thickness Maximum [mm]	ASTM D5994 MA	1,07
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.1
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	21
Break Strength [N/mm] CMD	ASTM D6693 ZF	20
Break Elongation [%] MD	ASTM D6693 BD	495
Break Elongation [%] CMD	ASTM D6693 BD	484
Tear Resistance [N] MD	ASTM D1004	119
Tear Resistance [N] CMD	ASTM D1004	135
Asperity Height [mm]	ASTM D7466 /A	0.48
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043463
Bill of Lading VKL+102706

ENVIRONMENTAL

Roll Identification

Roll Number	420043463				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 30, 2012	Width	6.95 meters	Weight	1,628 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,05
Core Thickness Minimum [mm]	ASTM D5994 MI	0,97
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.1
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	24
Break Strength [N/mm] CMD	ASTM D6693 ZF	23
Break Elongation [%] MD	ASTM D6693 BD	548
Break Elongation [%] CMD	ASTM D6693 BD	547
Tear Resistance [N] MD	ASTM D1004	119
Tear Resistance [N] CMD	ASTM D1004	113
Asperity Height [mm]	ASTM D7466 /A	0.51
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 420043465
Bill of Lading VKL+102706

ENVIRONMENTAL™

Roll Identification

Roll Number	420043465				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 31, 2012	Width	6.95 meters	Weight	1,628 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,06
Core Thickness Minimum [mm]	ASTM D5994 MI	0,99
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.1
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	26
Break Strength [N/mm] CMD	ASTM D6693 ZF	22
Break Elongation [%] MD	ASTM D6693 BD	576
Break Elongation [%] CMD	ASTM D6693 BD	506
Tear Resistance [N] MD	ASTM D1004	119
Tear Resistance [N] CMD	ASTM D1004	119
Asperity Height [mm]	ASTM D7466 /A	0.51
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	133

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043466
Bill of Lading VKL+102701

ENVIRONMENTAL[®]

Roll Identification

Roll Number	420043466				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 31, 2012	Width	6.95 meters	Weight	1,632 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,05
Core Thickness Minimum [mm]	ASTM D5994 MI	0,95
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2, 16) [g/10min]	ASTM D1238(190/2, 16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.1
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	24
Break Strength [N/mm] CMD	ASTM D6693 ZF	20
Break Elongation [%] MD	ASTM D6693 BD	541
Break Elongation [%] CMD	ASTM D6693 BD	456
Tear Resistance [N] MD	ASTM D1004	119
Tear Resistance [N] CMD	ASTM D1004	113
Asperity Height [mm]	ASTM D7466 /A	0.51
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	128

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified





GSE Lining Technology GmbH

ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

Roll No 420043467
Bill of Lading VKL+102706

ENVIRONMENTALTM

Roll Identification

Roll Number	420043467				
Product Name	LDT-100AM-BBB-V-00	Length	210 meters	Sheet Area	1,460 m ²
Production Date	Aug 31, 2012	Width	6.95 meters	Weight	1,628 kilograms

Resin Information

Batch number CO12041-2400003681

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	1,03
Core Thickness Minimum [mm]	ASTM D5994 MI	0,92
Core Thickness Maximum [mm]	ASTM D5994 MA	1,10
Carbon Black Content [%]	ASTM D1603	2.2
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0.2
Density [g/cm ³]	ASTM D792	0.932
Dimensional Stability [%] MD	ASTM D1204	-0.1
Dimensional Stability [%] CMD	ASTM D1204	0.1
Break Strength [N/mm] MD	ASTM D6693 ZF	25
Break Strength [N/mm] CMD	ASTM D6693 ZF	24
Break Elongation [%] MD	ASTM D6693 BD	560
Break Elongation [%] CMD	ASTM D6693 BD	562
Tear Resistance [N] MD	ASTM D1004	119
Tear Resistance [N] CMD	ASTM D1004	113
Asperity Height [mm]	ASTM D7466 /A	0.51
Puncture Resistance [N]	ASTM D4833	372
OIT [min]	ASTM D3895	128

Sales order VK102100
Customer Name Jones Bros. Ruthin Civil Engineering Co. Ltd.
Project Name Llandulas Landfill Site
Location LL22 8HP Abergele, Clwyd
* Modified



**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Conformance Certificates



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H825/a

Report Date 28/09/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3A Capping}
Client PO/Ref No C2066/33241

Material Tested 1mm LLDPE Textured Geomembrane
Date Received 18/09/2012
Sample IDs GM1 through to GM5

Tests Requested Thickness - ASTM D5994-10
Density - ASTM D1505-10
Carbon Black Content - ASTM D1603-11
Carbon Black Dispersion - ASTM D5596-03
Tensile Properties - ASTM D6693-04
Puncture Resistance - ASTM D4833-07
Tear Resistance - ASTM D1004-09
Oxidative Induction Time - ASTM D3895-07

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

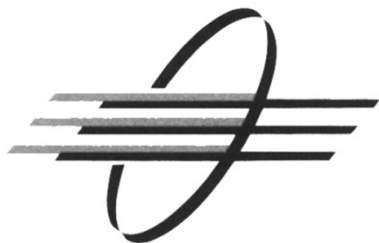
Ryan Hackney
Laboratory Manager
28/09/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: 1mm LLDPE Textured Geomembrane
Sample ID: GM 1, Roll No: 420043465

Report Ref No: BS-H825/a
BICS Labs ID: 01
Dates Tested: 21-28/09/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10) mm	1	2	3	4	5	6	7	8	9	10	1.08	0.04
	1.08	1.07	1.08	1.12	1.12	1.04	1.06	1.00	1.12	1.09		
Density (ASTM D1505-10) g/ml	0.929	0.927	0.928								0.928	0.001
Carbon Black Content (ASTM D1603-11) %	2.27	2.33									2.30	0.04
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st R _f Category Rating - 2nd R _f	1 1	1 1	1 1	1 1	1 1						1 1	0 0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	22.1 19.6 592 553	25.6 17.6 627 436	21.2 17.4 566 469	27.6 19.7 677 531	20.1 19.3 536 543						23.3 18.7 599 506	3.1 1.1 55 51
Puncture Resistance (ASTM D4833-07) N	386.0	417.8	405.2	364.3	394.1						393.5	20.2
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	140 138	146 162	140 152	165 149	135 146	136 162	167 154	156 162	139 170	154 142	148 154	12 10
Oxidative Induction Time (ASTM D3895-07) min	152	153									153	1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 ° C, Relative Humidity : 65 ± 5 % RH



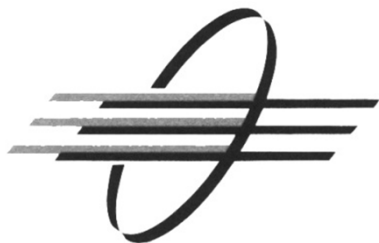
Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: 1mm LLDPE Textured Geomembrane
Sample ID: GM 2, Roll No: 420043460

Report Ref No: BS-H825/a
BICS Labs ID: 02
Dates Tested: 21-28/09/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10) mm	1	2	3	4	5	6	7	8	9	10		
	1.02	1.10	1.09	1.12	1.18	1.04	1.04	1.13	1.09	1.08	1.09	0.05
Density (ASTM D1505-10) g/ml	0.928	0.928	0.928								0.928	0.000
Carbon Black Content (ASTM D1603-11) %	2.26	2.28									2.27	0.01
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st R _f Category Rating - 2nd R _f	1 1	1 1	1 1	1 1	1 1						1 1	0 0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	22.6 18.1 589 468	22.6 23.9 575 583	22.5 19.3 591 537	25.0 23.6 624 595	19.6 19.0 524 494						22.5 20.8 581 535	1.9 2.7 37 55
Puncture Resistance (ASTM D4833-07) N	380.4	403.3	410.5	397.3	371.9						392.7	16.1
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	161 147	154 170	170 166	172 172	135 151	145 155	148 164	164 137	179 145	142 145	157 155	15 12

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH



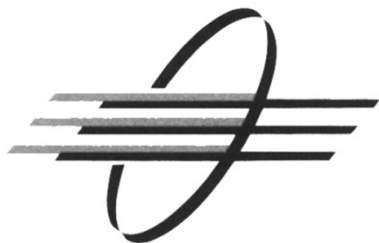
Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: 1mm LLDPE Textured Geomembrane
Sample ID: GM 3, Roll No: 420042264

Report Ref No: BS-H825/a
BICS Labs ID: 03
Dates Tested: 21-28/09/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Thickness (ASTM D5994-10) mm	1.00	1.00	1.06	0.99	1.00	1.06	1.02	1.08	1.01	1.08	1.03	0.04
Density (ASTM D1505-10) g/ml	0.929	0.928	0.927								0.928	0.001
Carbon Black Content (ASTM D1603-11) %	2.29	2.31									2.30	0.01
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st R _f Category Rating - 2nd R _f	1 1	1 1	1 1	1 1	1 1						1 1	0 0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	23.5 19.9 598 547	20.9 19.1 547 536	24.3 20.3 616 541	23.7 18.1 612 484	24.6 19.8 625 547						23.4 19.4 599 531	1.5 0.9 31 26
Puncture Resistance (ASTM D4833-07) N	381.8	397.9	397.8	404.8	397.0						395.9	8.4
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	137 152	158 151	164 148	151 144	163 151	162 155	169 147	147 161	159 164	147 147	156 152	10 6
Oxidative Induction Time (ASTM D3895-07) min	152	150									151	1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 ° C, Relative Humidity : 65 ± 5 % RH



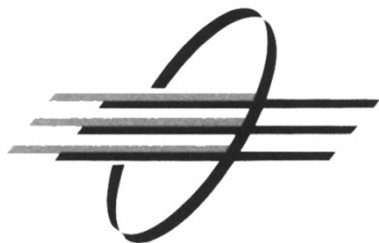
Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: 1mm LLDPE Textured Geomembrane
Sample ID: GM 4, Roll No: 420043463

Report Ref No: BS-H825/a
BICS Labs ID: 04
Dates Tested: 21-28/09/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10) mm	1	2	3	4	5	6	7	8	9	10		
	1.06	1.16	1.14	1.08	1.12	1.04	1.14	1.15	1.11	1.02	1.10	0.05
Density (ASTM D1505-10) g/ml	0.927	0.927	0.928								0.927	0.001
Carbon Black Content (ASTM D1603-11) %	2.35	2.35									2.35	0.00
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st R _f Category Rating - 2nd R _f	1 1	1 1	1 1	1 1	1 1						1 1	0 0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	24.6 18.7 609 521	24.7 20.7 632 530	22.2 22.7 552 586	24.5 22.4 613 566	19.7 18.0 544 508						23.1 20.5 590 542	2.2 2.1 39 32
Puncture Resistance (ASTM D4833-07) N	412.8	385.9	431.3	406.3	395.1						406.3	17.4
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	165 164	170 164	158 144	166 159	162 160	145 159	154 172	139 148	165 169	167 123	159 156	10 14

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

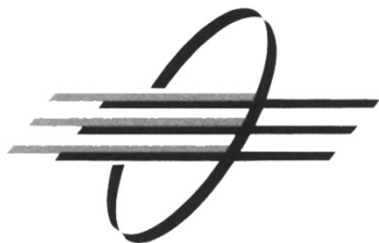


Cert No: 7495
ISO 9001

4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: 1mm LLDPE Textured Geomembrane
Sample ID: GM 5, Roll No: 420043467

Report Ref No: BS-H825/a
BICS Labs ID: 05
Dates Tested: 21-28/09/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Thickness (ASTM D5994-10) mm	1.10	1.09	1.05	1.11	1.06	1.10	1.10	1.05	1.03	1.09	1.08	0.03
Density (ASTM D1505-10) g/ml	0.927	0.927	0.928								0.927	0.001
Carbon Black Content (ASTM D1603-11) %	2.43	2.42									2.43	0.01
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st R _f Category Rating - 2nd R _f	1 1	1 1	1 1	1 1	1 1						1 1	0 0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	25.3 17.5 632 487	25.3 20.8 634 532	22.4 18.6 574 531	23.4 21.8 601 544	23.0 20.3 605 536						23.9 19.8 609 526	1.3 1.7 25 22
Puncture Resistance (ASTM D4833-07) N	395.4	420.2	364.5	402.2	392.4						394.9	20.2
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	143 155	154 168	159 148	133 172	144 162	163 148	165 171	147 166	174 172	132 158	151 162	14 9
Oxidative Induction Time (ASTM D3895-07) min	156	155									155	1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 ° C, Relative Humidity : 65 ± 5 % RH



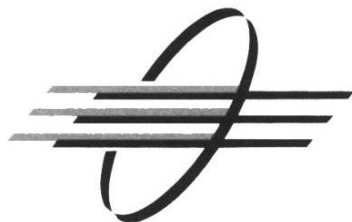
Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757

E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H821/a

Report Date 22/10/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3 Capping}
Client PO/Ref No C2066/33241

Material Tested 1mm LLDPE Textured Geomembrane
Date Received 09/10/2012
Sample IDs GM6, Roll No: 420043001
GM7, Roll No: 420042998

Tests Requested Thickness - ASTM D5994-10
Density - ASTM D1505-10
Carbon Black Content - ASTM D1603-11
Carbon Black Dispersion - ASTM D5596-03
Tensile Properties - ASTM D6693-04
Puncture Resistance - ASTM D4833-07
Tear Resistance - ASTM D1004-09
Oxidative Induction Time - ASTM D3895-07

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

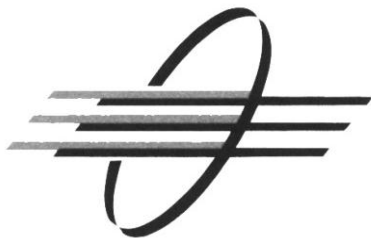
Clifford Butt
Managing Director
22/10/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN

T +44 (0) 1484 717776 F +44 (0) 1484 717757

E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3 Capping}

Material: 1mm LLDPE Textured Geomembrane

Sample ID: GM6, Roll No: 420043001

Report Ref No: BS-H821/a

BICS Labs ID: 01

Dates Tested: 09-22/10/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10)	1	2	3	4	5	6	7	8	9	10		
mm	1.02	1.02	1.06	1.02	1.01	1.01	1.02	1.03	1.08	1.01	1.03	0.02
Density (ASTM D1505-10)												
g/ml	0.924	0.925	0.925								0.925	0.001
Carbon Black Content (ASTM D1603-11)												
%	2.41	2.42									2.42	0.01
Carbon Black Dispersion (ASTM D5596-06)												
Category Rating - 1st Rf	1	1	1	1	1						1.0	0.0
Category Rating - 2nd Rf	1	1	1	1	1						1.0	0.0
Tensile Properties (ASTM D6693-04)												
Break Strength N/mm (MD)	24.6	27.0	25.9	23.2	24.9						25.1	1.4
Break Strength N/mm (CD)	18.9	16.8	19.3	16.9	19.8						18.3	1.4
Break Elongation % (MD)	619	632	647	603	609						622.0	17.8
Break Elongation % (CD)	493	421	531	441	532						483.8	51.3
Puncture Resistance (ASTM D4833-07)												
N	360.7	382.9	387.7	394.8	392.6						383.7	13.7
Tear Resistance (ASTM D1004-09)												
N (MD)	160	156	152	166	121	124	154	150	154	116	145.3	17.8
N (CD)	162	146	152	147	150	166	139	177	144	153	153.7	11.4
Oxidative Induction Time (ASTM D3895-07)												
min	147	142									144.6	3.9

Atmospheric Conditions at Test / Conditioning : 21 ± 2 ° C, Relative Humidity : 65 ± 5 % RH



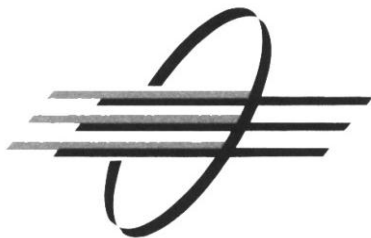
Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN

T +44 (0) 1484 717776 F +44 (0) 1484 717757

E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3 Capping}

Material: 1mm LLDPE Textured Geomembrane

Sample ID: GM7, Roll No: 420042998

Report Ref No: BS-H821/a

BICS Labs ID: 02

Dates Tested: 09-22/10/2012

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10) mm	1	2	3	4	5	6	7	8	9	10		
	1.00	1.06	1.02	1.01	1.01	1.01	1.00	1.04	1.00	1.02	1.02	0.02
Density (ASTM D1505-10) g/ml	0.925	0.925	0.925								0.925	0.0
Carbon Black Content (ASTM D1603-11) %	2.47	2.42									2.45	0.04
Carbon Black Dispersion (ASTM D5596-06) Category Rating - 1st Rf Category Rating - 2nd Rf	1 1	1 1	1 1	1 1	1 1						1.0 1.0	0.0 0.0
Tensile Properties (ASTM D6693-04) Break Strength N/mm (MD) Break Strength N/mm (CD) Break Elongation % (MD) Break Elongation % (CD)	22.0 19.6 294 258	23.5 18.6 288 251	19.9 20.8 273 274	22.0 19.0 284 249	22.1 20.4 296 278						21.9 19.7 286.9 261.8	1.3 0.9 9.0 13.2
Puncture Resistance (ASTM D4833-07) N	410.5	342.9	331.9	332.9	378.5						359.3	34.3
Tear Resistance (ASTM D1004-09) N (MD) N (CD)	163 135	155 153	150 154	158 164	143 129	122 132	123 162	122 137	131 168	107 138	137.4 147.2	18.9 14.6

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



Panel Deployment Records

Geomembrane Deployment Record

Landfill Site: Llanddulas
 Project: Cell 3/3A Capping Works 2012
 Material: 1mm GSE LDPE Ultraflex Textured

Date	Batch Number	Roll No.	Panel No.	Thickness of liner at (x)m intervals						Dimensions		CQA S.I	Remarks
				10	20	30	40	50	60	Length (m)	Width (m)		
07.09.12	2400003681	420043465	P1	1mm	1mm	1mm	1mm	1mm	1mm	58.0	6.80	M.White	Pie
07.09.12	2400003681	420043465	P2	1mm	1mm	1mm	1mm	1mm	1mm	58.0	6.80	M.White	Pie
07.09.12	2400003681	420043465	P3	1mm	1mm	1mm	1mm	1mm	1mm	50.0	6.80	M.White	Pie
07.09.12	2400003681	420043465	P4	1mm	1mm	1mm				23.0	6.80	M.White	Pie
07.09.12	2400003681	420043465	P5	1mm	1mm	1mm	1mm	1mm		50.0	6.80	M.White	Pie
07.09.12	2400003681	420043465	P6	1mm	1mm	1mm				26.0	6.80	M.White	Pie
07.09.12	2400003681	420043460	P7	1mm	1mm	1mm	1mm	1mm	1mm	58.0	6.80	M.White	
07.09.12	2400003681	420043460	P8	1mm						7.0	3.00	M.White	Pie
10.09.12	2400003681	420043460	P9	1mm	1mm	1mm	1mm	1mm	1mm	55.0	6.80	M.White	Pie
10.09.12	2400003681	420043460	P10	1mm						8.5	6.80	M.White	Pie
10.09.12	2400003681	420043463	P11	1mm	1mm					16.5	6.80	M.White	Pie
10.09.12	2400003681	420043463	P12	1mm	1mm	1mm				21.0	6.80	M.White	Pie
10.09.12	2400003681	420043463	P13	1mm	1mm	1mm				27.0	6.80	M.White	Pie
10.09.12	2400003681	420043463	P14	1mm	1mm	1mm	1mm			31.5	6.80	M.White	Pie
10.09.12	2400003681	420043463	P15	1mm	1mm	1mm				29.0	6.80	M.White	
10.09.12	2400003681	420043463	P16	1mm	1mm	1mm				29.0	6.80	M.White	
10.09.12	2400003681	420043463	P17	1mm	1mm	1mm				28.0	6.80	M.White	
10.09.12	2400003681	420043463	P18	1mm	1mm	1mm				28.0	6.80	M.White	
10.09.12	2400003681	420043459	P19	1mm	1mm	1mm				27.0	6.80	M.White	
11.09.12	2400003681	420043459	P20	1mm	1mm	1mm				27.5	6.80	M.White	
11.09.12	2400003681	420043459	P21	1mm	1mm	1mm				27.5	6.80	M.White	
11.09.12	2400003681	420043459	P22	1mm	1mm	1mm				27.0	6.80	M.White	
11.09.12	2400003681	420043459	P23	1mm	1mm	1mm				27.0	6.80	M.White	
12.09.12	2400003681	420043459	P24	1mm	1mm	1mm				26.5	6.80	M.White	
12.09.12	2400003681	420043459	P25	1mm	1mm	1mm				24.5	6.80	M.White	

Geomembrane Deployment Record

Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012
Material: 1mm GSE LDPE Ultraflex Textured

[illegible]

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Trial Weld Record

Geomembrane Trial Weld Record

Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012 --- Permanent Capping
Material 1mm GSE LDPE Utraflex Textured

[illegible]



Seaming and Non-Destructive Testing Records

Geomembrane Seaming and Non-destructive Testing

Landfill Site: Llanddulas
Project: Cell 3A Capping works 2012

Test Method Key

APT : Air Pressure Test

HVE : High Voltage Electricity

VB : Vacuum Box

Date	WELDING INFORMATION											Destructive Field tests	NON-DESTRUCTIVE TESTING INFORMATION								CQA S.I	D.S Sample Ref.
	Seaming Ref.	Trial Weld	Weld Type	Seaming Times		Ambient Temp	Weld Temp	Speed	Preheat Temp	Seam Length	Welding Operator		Test Method	Air Pressure Test				Result	Date (if different from that of seaming)			
				Start Time	Finish Time									°C	°C	M/min	°C			m		
07.09.12	P1/P2	TW1	F	10.41	11.07	16.0	400.0	2.50		58.0	M.Cullen	P	APT	11.50	2.0	11.55	2.0	P		M.White	DS1	
07.09.12	P2/P3	TW1	F	11.10	11.34	18.0	400.0	2.50		50.0	M.Cullen	P	APT	12.05	2.0	12.10	2.0	P		M.White		
07.09.12	P3/P4	TW1	F	11.38	11.48	18.0	400.0	2.50		23.0	M.Cullen	P	APT	12.19	2.0	12.24	2.0	P		M.White		
07.09.12	P5/P4,3,2	TW1	F	11.55	12.15	18.0	400.0	2.50		50.0	M.Cullen	P	APT	14.45	2.0	14.50	2.0	P		M.White	DS2	
07.09.12	P5/P6	TW1	F	12.25	12.36	20.0	400.0	2.50		26.0	M.Cullen	P	APT	14.20	2.0	14.25	2.0	P		M.White		
07.09.12	P6/P8	TW1	F	12.50	12.53	20.0	400.0	2.50		7.0	M.Cullen	P	APT	15.01	2.0	15.06	2.0	P		M.White		
07.09.12	P7/P8,6,5,2	TW1	F	13.15	13.41	20.0	400.0	2.50		58.0	M.Cullen	P	APT	15.10	2.0	15.15	2.0	P		M.White		
07.09.12	P1/P2/P7/EX	TW2	E	15.30	15.47	20.0	210.0		210.0	11.0	D.Ellis	P	VB					P		M.White		
10.09.12	P7/P9	TW3	F	8.05	8.27	15.0	400.0	2.50		55.0	R.Evans	P	APT	9.00	2.0	9.05	2.0	P		M.White	DS4	
10.09.12	P10/P11	TW3	F	8.42	8.46	15.0	400.0	2.50		8.5	R.Evans	P	APT	9.10	2.0	9.15	2.0	P		M.White		
10.09.12	P11/P12	TW3	F	8.54	9.01	15.0	400.0	2.50		16.5	R.Evans	P	APT	9.40	2.0	9.45	2.0	P		M.White		
10.09.12	P12/P13	TW3	F	9.29	9.29	15.0	400.0	2.50		21.0	R.Evans	P	APT	10.02	2.0	10.07	2.0	P		M.White		
10.09.12	P13/P14	TW3	F	9.48	10.01	15.0	400.0	2.50		27.0	R.Evans	P	APT	11.25	2.0	11.30	2.0	P		M.White		
10.09.12	P9/P10-14	TW3	F	10.14	10.33	15.0	400.0	2.50		45.0	R.Evans	P	APT	11.42	2.0	11.47	2.0	P		M.White		
10.09.12	P14/P15	TW3	F	10.50	11.01	15.0	400.0	2.50		29.0	R.Evans	P	APT	11.53	2.0	11.58	2.0	P		M.White	DS5	
10.09.12	P15/P16	TW4	F	11.42	11.54	16.0	400.0	2.50		28.0	R.Evans	P	APT	12.17	2.0	12.22	2.0	P		M.White		
10.09.12	P16/P17	TW4	F	11.58	12.10	16.0	400.0	2.50		28.0	R.Evans	P	APT	12.33	2.0	12.38	2.0	P		M.White		
10.09.12	P17/P18	TW4	F	12.15	12.27	16.0	400.0	2.50		28.0	R.Evans	P	APT	12.44	2.0	12.49	2.0	P		M.White		
10.09.12	P18/P19	TW4	F	12.40	12.52	16.0	400.0	2.50		28.0	R.Evans	P	APT	13.06	2.0	13.11	2.0	P		M.White		
11.09.12	P17,16 / EX	TW5	E	9.04	9.19	10.0	210.0		210.0	10.0	D.Ellis	P	VB					P		M.White		
11.09.12	P15 / EX	TW5	E	9.23	9.40	12.0	210.0		210.0	6.8	D.Ellis	P	VB					P		M.White		
11.09.12	P9,P7 / EX	TW5	E	9.51	10.07	13.0	210.0		210.0	10.0	D.Ellis	P	VB					P		M.White		
11.09.12	P17,18,19 / EX	TW5	E	10.30	10.53	15.0	210.0		210.0	17.0	D.Ellis	P	VB					P		M.White		
11.09.12	P19 / P20	TW6	F	14.55	15.07	17.0	400.0	2.50		27.5	R.Evans	P	APT	15.10	2.0	15.15	2.0	P		M.White	DS7	
11.09.12	P20 / P21	TW6	F	15.20	15.31	17.0	400.0	2.50		27.0	R.Evans	P	APT	15.34	2.0	15.39	2.0	P		M.White		
11.09.12	P21 / P22	TW6	F	15.58	16.09	17.0	400.0	2.50		27.0	R.Evans	P	APT	16.42	2.0	16.47	2.0	P		M.White		
11.09.12	P22 / P23	TW6	F	16.20	16.31	17.0	400.0	2.50		26.0	R.Evans	P	APT	16.50	2.0	16.55	2.0	P		M.White		
12.09.12	P23/P24	TW7	F	10.46	10.56	11.0	400.0	2.50		24.5	R.Evans	P	APT	11.25	2.0	11.30	2.0	P		M.White	DS8	
12.09.12	P24/P25	TW7	F	11.08	11.18	11.0	400.0	2.50		24.0	R.Evans	P	APT	11.36	2.0	11.41	2.0	P		M.White		
13.09.12	PB1/P12	TW8	F	8.58	9.05	8.0	400.0	2.50		16.0	R.Evans	P	APT	9.12	2.0	9.17	2.0	P		D.Durrans	DS9	
13.09.12	PB2/P14	TW8	F	9.32	9.39	10.0	400.0	2.50		16.0	R.Evans	P	APT	11.49	2.0	11.54	2.0	P		D.Durrans		
13.09.12	P19,20 / EX	TW9	E	10.25	10.37	10.0	210.0		210.0	8.0	D.Ellis	P	VB					P		D.Durrans		
13.09.12	P21,22/ EX	TW9	E	10.44	11.04	11.0	210.0		210.0	13.6	D.Ellis	P	VB					P		D.Durrans		
13.09.12	P23,24,25/EX	TW9	E	11.08	11.37	14.0	210.0		210.0	22.0	D.Ellis	P	VB					P		D.Durrans		
14.09.12	P25/P26	TW10	F	8.16	8.27	14.0	400.0	2.50		26.0	R.Evans	P	APT	8.41	2.0	8.46	2.0	P		M.White	DS11	
14.09.12	PB3/P15	TW11	F	14.52	14.59	15.0	400.0	2.50		16.0	R.Evans	P	APT	15.05	2.0	15.10	2.0	P		M.White		
14.09.12	PB4/P18	TW11	F	15.20	15.27	15.0	400.0	2.50		15.5	R.Evans	P	APT	16.01	2.0	16.06	2.0	P		M.White		



Geomembrane Seaming and Non-destructive Testing

Landfill Site: Llanddulas
Project: Cell 3A Capping works 2012

Test Method Key

APT: Air Pressure Test

HVE: High Voltage Electricity

VB : Vacuum Box

[illegible]

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Destructive Testing Records

Landfill Site: Llanddulas
Project: Cell 3A Capping Works 2012

Landfill Site: Llanddulas
Project: Cell 3A Capping Works 2012

[illegible]



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757

E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H826/a

Report Date 21/09/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3A Permanent Capping}
Client PO/Ref No C2066/33241

Material Tested 1mm LLDPE Geomembrane
Date Received 21/09/2012
Sample ID(s) DS-1 through to DS-7 {Fusion & Extrusion Welds}

Tests Requested Shear Strength – ASTM D6392-08
Peel Strength – ASTM D6392-08

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

Clifford Butt
Managing Director
21/09/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-1, P1/P2 {Fusion}

Report Ref. No: BS-H826/a

BICS Labs ID: 01

Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	15.94	>50%	SE1
2	17.23	>50%	SE1
3	17.48	>50%	SE1
4	17.60	>50%	SE1
5	17.45	>50%	SE1
Mean	17.14	>50%	
STD DEV	0.68		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.14	0%	SE1
2A	15.83	0%	SE1
3A	16.24	0%	SE1
4A	15.24	0%	SE1
5A	14.60	0%	SE1
1B	15.27	0%	SE1
2B	14.52	0%	SE1
3B	15.00	0%	SE1
4B	15.68	0%	SE1
5B	15.00	0%	SE1
Mean	15.15		
STD DEV	0.64		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-2, P4/P5 {Fusion}

Report Ref. No: BS-H826/a

BICS Labs ID: 02

Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.14	>50%	SE1
2	16.77	>50%	SE1
3	16.23	>50%	SE1
4	16.46	>50%	SE1
5	17.31	>50%	SE1
Mean	16.58	>50%	
STD DEV	0.48		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.92	0%	SE1
2A	15.70	0%	SE1
3A	16.03	0%	SE1
4A	16.20	0%	SE1
5A	15.39	0%	SE1
1B	15.22	0%	SE1
2B	14.10	0%	SE1
3B	15.21	0%	SE1
4B	15.31	0%	SE1
5B	14.30	0%	SE1
Mean	15.24		
STD DEV	0.67		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-3, TW2 {Extrusion}

Report Ref. No: BS-H826/a
BICS Labs ID: 03
Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	15.20	>50%	SE1
2	13.98	>50%	SE1
3	15.42	>50%	SE1
4	15.29	>50%	SE1
5	15.62	>50%	SE2
Mean	15.10	>50%	
STD DEV	0.65		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	11.41	0%	BRK1
2A	14.45	0%	BRK1
3A	10.78	0%	BRK1
4A	10.31	0%	BRK1
5A	13.80	0%	BRK1
Mean	12.15		
STD DEV	1.86		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-4, P7/P9 {Fusion}

Report Ref. No: BS-H826/a

BICS Labs ID: 04

Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.70	>50%	SE1
2	16.90	>50%	SE1
3	16.33	>50%	SE1
4	16.88	>50%	SE1
5	16.52	>50%	SE1
Mean	16.67	>50%	
STD DEV	0.24		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.30	0%	SE1
2A	15.63	0%	SE1
3A	15.47	0%	SE1
4A	14.69	0%	SE1
5A	15.25	0%	SE1
1B	15.24	0%	SE1
2B	15.11	0%	SE1
3B	14.80	0%	SE1
4B	15.73	0%	SE1
5B	14.59	0%	SE1
Mean	15.18		
STD DEV	0.39		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-5, P14/P15 {Fusion}

Report Ref. No: BS-H826/a
BICS Labs ID: 05
Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.89	>50%	SE1
2	16.62	>50%	SE1
3	16.96	>50%	SE1
4	17.09	>50%	SE1
5	16.85	>50%	SE1
Mean	16.88	>50%	
STD DEV	0.17		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.32	0%	SE1
2A	14.91	0%	SE1
3A	15.04	0%	SE1
4A	15.45	0%	SE1
5A	14.58	0%	SE1
1B	14.56	0%	SE1
2B	14.65	0%	SE1
3B	14.78	0%	SE1
4B	15.20	0%	SE1
5B	14.91	0%	SE1
Mean	14.84		
STD DEV	0.33		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-6, TW5 {Extrusion}

Report Ref. No: BS-H826/a

BICS Labs ID: 06

Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	14.90	>50%	SE2
2	15.00	>50%	SE2
3	14.88	>50%	SE2
4	15.17	>50%	SE1
5	14.57	>50%	NO-BRK
Mean	14.90	>50%	
STD DEV	0.22		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	11.28	0%	SE3
2A	11.37	0%	BRK1
3A	12.26	0%	SE3
4A	13.22	0%	SE3
5A	10.90	0%	SE3
Mean	11.81		
STD DEV	0.93		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-7, P19/P20 {Fusion}

Report Ref. No: BS-H826/a
BICS Labs ID: 07
Date Tested: 21/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	15.46	>50%	SE1
2	15.90	>50%	SE1
3	15.98	>50%	SE1
4	16.31	>50%	SE1
5	15.92	>50%	SE1
Mean	15.91	>50%	
STD DEV	0.30		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	13.92	0%	SE1
2A	15.03	0%	SE1
3A	14.70	0%	SE1
4A	14.88	0%	SE1
5A	14.40	0%	SE1
1B	13.27	0%	SE1
2B	13.96	0%	SE1
3B	14.30	0%	SE1
4B	15.30	0%	SE1
5B	14.48	0%	SE1
Mean	14.42		
STD DEV	0.60		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757

E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H826/b

Report Date 24/09/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3A Permanent Capping}
Client PO/Ref No C2066/33241

Material Tested 1mm LLDPE Geomembrane
Date Received 24/09/2012
Sample ID(s) DS-8 through to DS-18 {Fusion & Extrusion Welds}

Tests Requested Shear Strength – ASTM D6392-08
Peel Strength – ASTM D6392-08

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

Clifford Butt
Managing Director
24/09/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-8, P23/P24 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 08

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.65	>50%	SE1
2	14.48	>50%	SE1
3	16.06	>50%	SE1
4	15.50	>50%	SE1
5	16.14	>50%	SE1
Mean	15.77	>50%	
STD DEV	0.83		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.69	0%	SE1
2A	15.78	0%	SE1
3A	16.84	0%	SE1
4A	15.14	0%	SE1
5A	16.18	0%	SE1
1B	14.84	0%	SE1
2B	13.02	0%	SE1
3B	15.27	0%	SE1
4B	16.04	0%	SE1
5B	15.19	0%	SE1
Mean	15.30		
STD DEV	1.04		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-9, TW8 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 09

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.12	>50%	SE1
2	15.60	>50%	SE1
3	15.20	>50%	SE1
4	15.32	>50%	SE1
5	15.31	>50%	SE1
Mean	15.51	>50%	
STD DEV	0.37		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.05	0%	SE1
2A	14.77	0%	SE1
3A	15.51	0%	SE1
4A	15.48	0%	SE1
5A	14.88	0%	SE1
1B	14.63	0%	SE1
2B	14.74	0%	SE1
3B	15.27	0%	SE1
4B	15.01	0%	SE1
5B	14.48	0%	SE1
Mean	14.98		
STD DEV	0.35		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-10, TW9 {Extrusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 10

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	14.51	>50%	SE2
2	15.77	>50%	SE2
3	12.31	>50%	SE1
4	15.66	>50%	SE2
5	11.96	>50%	SE1
Mean	14.04	>50%	
STD DEV	1.82		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.49	0%	BRK1
2A	15.26	0%	SE3
3A	13.43	0%	BRK1
4A	13.35	0%	SE3
5A	13.59	0%	SE3
Mean	14.02		
STD DEV	0.83		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-11, P25/P26 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 11

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.02	>50%	SE1
2	17.09	>50%	SE1
3	17.04	>50%	SE1
4	16.95	>50%	SE1
5	16.24	>50%	SE1
Mean	16.67	>50%	
STD DEV	0.50		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.48	0%	SE1
2A	15.03	0%	SE1
3A	15.17	0%	SE1
4A	15.87	0%	SE1
5A	15.48	0%	SE1
1B	14.15	0%	SE1
2B	14.00	0%	SE1
3B	15.03	0%	SE1
4B	16.06	0%	SE1
5B	15.38	0%	SE1
Mean	15.16		
STD DEV	0.66		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-12, TW11 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 12

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.71	>50%	SE1
2	17.30	>50%	SE1
3	16.26	>50%	SE1
4	17.15	>50%	SE1
5	17.46	>50%	SE1
Mean	16.97	>50%	
STD DEV	0.49		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.80	0%	SE1
2A	15.40	0%	SE1
3A	15.39	0%	SE1
4A	16.01	0%	SE1
5A	15.18	0%	SE1
1B	15.44	0%	SE1
2B	15.82	0%	SE1
3B	15.27	0%	SE1
4B	15.07	0%	SE1
5B	14.36	0%	SE1
Mean	15.37		
STD DEV	0.47		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-13, TW12 {Extrusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 13

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	14.59	>50%	SE2
2	15.37	>50%	SE1
3	15.10	>50%	SE1
4	15.20	>50%	SE2
5	14.56	>50%	SE1
Mean	14.97	>50%	
STD DEV	0.37		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	11.92	0%	SE3
2A	10.01	0%	SE3
3A	10.38	0%	SE3
4A	8.27	0%	SE3
5A	10.44	0%	SE3
Mean	10.20		
STD DEV	1.31		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-14, P27/P28 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 14

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	16.44	>50%	SE1
2	16.57	>50%	SE1
3	15.87	>50%	SE1
4	17.01	>50%	SE1
5	16.96	>50%	SE1
Mean	16.57	>50%	
STD DEV	0.46		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.67	0%	SE1
2A	15.73	0%	SE1
3A	15.66	0%	SE1
4A	15.23	0%	SE1
5A	14.32	0%	SE1
1B	13.87	0%	SE1
2B	14.94	0%	SE1
3B	14.87	0%	SE1
4B	15.54	0%	SE1
5B	14.93	0%	SE1
Mean	15.07		
STD DEV	0.62		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-15, P34/P35 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 15

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	15.85	>50%	SE1
2	16.66	>50%	SE1
3	15.56	>50%	SE1
4	16.39	>50%	SE1
5	16.78	>50%	SE1
Mean	16.25	>50%	
STD DEV	0.52		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	14.92	0%	SE1
2A	14.98	0%	SE1
3A	15.61	0%	SE1
4A	15.21	0%	SE1
5A	15.71	0%	SE1
1B	14.31	0%	SE1
2B	14.85	0%	SE1
3B	14.62	0%	SE1
4B	14.52	0%	SE1
5B	13.89	0%	SE1
Mean	14.86		
STD DEV	0.56		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-16, TW16 {Extrusion}

Report Ref. No: BS-H826/b
BICS Labs ID: 16
Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	13.83	>50%	SE1
2	14.20	>50%	SE1
3	15.24	>50%	SE2
4	14.96	>50%	SE1
5	15.06	>50%	SE1
Mean	14.66	>50%	
STD DEV	0.61		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	10.30	0%	SE3
2A	8.79	0%	SE3
3A	10.92	0%	SE3
4A	9.56	0%	SE3
5A	9.27	0%	SE3
Mean	9.77		
STD DEV	0.85		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}

Material: 1mm LLDPE Geomembrane

Sample ID: DS-17, TW15 {Fusion}

Report Ref. No: BS-H826/b

BICS Labs ID: 17

Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	15.88	>50%	SE1
2	16.20	>50%	SE1
3	16.56	>50%	SE1
4	16.36	>50%	SE1
5	16.22	>50%	SE1
Mean	16.24	>50%	
STD DEV	0.25		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	15.11	0%	SE1
2A	15.13	0%	SE1
3A	14.69	0%	SE1
4A	16.17	0%	SE1
5A	16.05	0%	SE1
1B	13.91	0%	SE1
2B	15.50	0%	SE1
3B	15.54	0%	SE1
4B	14.88	0%	SE1
5B	14.10	0%	SE1
Mean	15.11		
STD DEV	0.75		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-18, TW16 {Extrusion}

Report Ref. No: BS-H826/b
BICS Labs ID: 18
Date Tested: 24/09/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	14.98	>50%	SE2
2	15.16	>50%	SE1
3	15.01	>50%	SE2
4	15.76	>50%	SE2
5	16.19	>50%	SE1
Mean	15.42	>50%	
STD DEV	0.53		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	12.18	0%	SE3
2A	12.34	0%	SE3
3A	13.45	0%	SE3
4A	11.85	0%	SE3
5A	11.78	0%	SE3
Mean	12.32		
STD DEV	0.67		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H826/c {Revised¹}

Report Date 03/12/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3A Permanent Capping}
Client PO/Ref No C2066/33241

Material Tested 1mm LLDPE Geomembrane
Date Received 11/10/2012
Sample ID(s) DS-19 {Extrusion Weld}

Tests Requested Shear Strength – ASTM D6392-08
Peel Strength – ASTM D6392-08

If you have any questions or require additional information, please do not hesitate to contact us.

¹ Revised Test Report - amended Sample ID

Report Authorisation:

Ryan Hackney
Laboratory Manager
03/12/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD JOB NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Permanent Capping}
Material: 1mm LLDPE Geomembrane
Sample ID: DS-19, TW17 {Extrusion}

Report Ref. No: BS-H826/c
BICS Labs ID: 19 {Revised}
Date Tested: 11/10/2012

Test Method: ASTM D6392-08

SPECIMEN No.	Shear Strength N/mm	% Elongation	Break Classification
1	14.91	>50%	SE1
2	14.07	>50%	SE2
3	13.78	>50%	SE2
4	14.25	>50%	SE2
5	14.07	>50%	SE2
Mean	14.22	>50%	
STD DEV	0.42		

SPECIMEN No.	Peel Strength N/mm	% Peel Separation	Break Classification
1A	10.09	0%	SE3
2A	10.86	0%	SE3
3A	13.12	0%	SE3
4A	12.68	0%	SE3
5A	12.87	0%	SE3
Mean	11.92		
STD DEV	1.36		

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : $21 \pm 2^{\circ}\text{C}$, Relative Humidity : $65 \pm 5\% \text{ RH}$



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Panel Repair Records

Landfill Site: Llanddulas
Project: Cell 3/3A Capping works 2012

[illegible]

Key for Defect Codes		
APT:	Air Pressure Test Hole	BT: Boot
BO:	Welder Burn Out	PT: Protrusion
DS:	Destructive Sample	
FS:	Failed Seam	
INT:	Panel Intersection	
IO:	Insufficient Overlap	
PD:	Panel Damage	
WR:	Wrinkle	
WS:	Welder Restart	

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Welding Operative Certificates



Approval Certificate

EN 13067 Plastic Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 55484/2

This is to certify that:

Dewi LLoyd Ellis

Date of birth 27 April 1970

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 3 May 2012

Date of expiry 29 March 2013


EXAMINER

Signed 
(For CSWIP)

SIGNATURE OF HOLDER
(Person named above) _____

Date _____

PLEASE READ THE NOTES OVERLEAF

Photocopies are unauthorised by
TWI Certification Ltd

Issued by:
TWI Certification Ltd, Granta Park
Great Abington, Cambridge CB21 6AL, UK

The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered by Accreditation Certificate No. 025
This certificate is the property of TWI Certification Ltd and must be surrendered on request



Approval Certificate

EN 13067 Plastic Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 66005

This is to certify that:

Eirion Lloyd Evans

Date of birth 15 June 1967

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 17 July 2012

Date of expiry 17 May 2013

A handwritten signature in black ink, appearing to be 'P. H.', written over a horizontal line.

EXAMINER

Signed

A handwritten signature in black ink, appearing to be 'T. H.', written over a horizontal line.

(For CSWIP)

SIGNATURE OF HOLDER

(Person named above)

Date

PLEASE READ THE NOTES OVERLEAF

Photocopies are unauthorised by
TWI Certification Ltd

Issued by:
TWI Certification Ltd, Granta Park
Great Abington, Cambridge CB21 6AL, UK

The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered by Accreditation Certificate No. 025
This certificate is the property of TWI Certification Ltd and must be surrendered on request



Approval Certificate

EN 13067 Plastic Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 66007

This is to certify that:

Mark Cullen

Date of birth 12 February 1973

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 17 July 2012

Date of expiry 17 May 2013

A handwritten signature in black ink, appearing to be 'J. H. ...', written over a horizontal line.

EXAMINER

Signed

A handwritten signature in black ink, appearing to be 'G. ...', written over a horizontal line.

(For CSWIP)

SIGNATURE OF HOLDER
(Person named above)

Date

PLEASE READ THE NOTES OVERLEAF

Photocopies are unauthorised by
TWI Certification Ltd

Issued by:
TWI Certification Ltd, Granta Park
Great Abington, Cambridge CB21 6AL, UK

The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered by Accreditation Certificate No. 025
This certificate is the property of TWI Certification Ltd and must be surrendered on request



Approval Certificate

EN 13067 Plastic Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 66006

This is to certify that:

Richard Lloyd Evans

Date of birth 31 December 1990

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 17 July 2012

Date of expiry 17 May 2013

A handwritten signature in black ink, appearing to be 'C. P. D.', written over a horizontal line.

EXAMINER

Signed

A handwritten signature in black ink, appearing to be 'B. Evans', written over a horizontal line.

(For CSWIP)

SIGNATURE OF HOLDER

(Person named above) _____

Date _____

PLEASE READ THE NOTES OVERLEAF

Photocopies are unauthorised by
TWI Certification Ltd

Issued by:
TWI Certification Ltd, Granta Park
Great Abington, Cambridge CB21 6AL, UK

The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered by Accreditation Certificate No. 025
This certificate is the property of TWI Certification Ltd and must be surrendered on request

Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Geotextile Protection Layer Requirements

- Delivery and Inspection Records
- Quality Control Certificates
- Conformance Certificates
- Panel Deployment Record
- Panel Repair Record

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Delivery and Inspection Records

Geotextile Delivery, Inspection and Conformance Record

Landfill Site: Llanddulas
Project: Cell 3/3A Capping Works 2012
Material: Terrex SNW 46

[illegible]

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Quality Control Certificates

CERTIFICATE OF CONFORMITY



ABG Ltd
E7 Meltham Mills Road
Meltham, Holmfirth
West Yorkshire
HD9 4DS
United Kingdom

E: info@abgltd.com
W: www.abgltd.com

Scheme:	Arpley Landfill Site		
Product:	Terrex SNW46 5.25m x 100m		
Manufacturer:	ABG Ltd, E7 Meltham Mills Road, Meltham, Holmfirth, HD9 4DS		
Date of manufacture:	Jun 12	Date of dispatch:	19 Jun 12
Consignment No:	01	Delivery note no:	DH30176
Number of rolls	35		
Batch Information — Date/Job/Roll No:	See Attached Sheet		
Product conforms to datasheet reference (attached)	TERREX SNW		
Additional test data details	None		

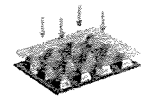
I certify that the above information is a true and correct statement relating to the goods supplied.

Signed by:

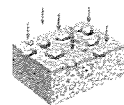
Name and title : Peter van Ruiten, Operations Director

Date: 27/6/2012

Certificate issued by: ABG Ltd



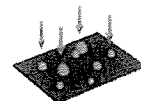
Landfill Drainage & Gas Dispersal Layers



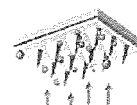
Geotextiles & Geogrids



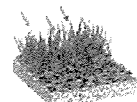
Structural Drainage



Geomembranes & GCL's

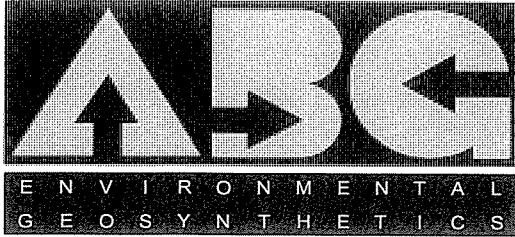


Cavity Drainage



Erosion Control





Arpley Landfill Site
Terrex SNW46 5.25m 100m
PH32699

22433313
22433317
22433331
22433333
22433340
22433349
22433351
22433363
22433367
22433381
22433386
22433393

22433396
22433428
22433432
22433444
22433453
22433455
22433314
22433329
22433332
22433339
22433348
22433350

22433362
22433365
22433370
22433384
22433387
22433394
22433397
22433429
22433434
22433446
22433454

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Conformance Certificates



BICS Laboratories Ltd

Reliable testing, Superior service

T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-H827/a

Report Date 27/09/2012
Client Jones Bros Ruthin Ltd, Ruthin, Denbighshire, LL15 2YH
Contact Mike Davies
Contract Reference Llandulas Landfill Site {Phase 3A Capping}
Client PO/Ref No C2066/33241

Material Tested Geotextile {Protector}
Date Received 24/09/2012
Sample IDs GT1 through to GT3

Tests Requested Thickness - BSEN ISO 9863-1:2005
Mass per Unit Area - BSEN ISO 9864:2005
Tensile Properties - BSEN ISO 10319:2008
Puncture Resistance - BSEN ISO 12236:2006
Cone Drop - BSEN ISO 13433:2006

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

Ryan Hackney
Laboratory Manager
27/09/2012



Cert No: 7495
ISO 9001



4438



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: Geotextile {Protector}
Sample ID: GT1, Roll No: 22433313

Report Ref No: BS-H827/a
BICS Labs ID: 01
Dates Tested: 24-25/09/2012

PARAMETER	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Thickness @ 2 kPa (BSEN ISO 9863-1:2005)												
mm	2.66	2.79	2.56	2.57	2.68	2.84	2.68	2.97	2.56	2.72	2.70	0.13
Mass Per Unit Area (BSEN ISO 9864:2005)												
g/m ²	325	329	333	325	325	339	332	330	334	331	330	5
Tensile Properties (BSEN ISO 10319:2008)												
Tensile Strength kN/m (MD)	30.5	31.2	31.0	31.9	29.6						30.8	0.9
Tensile Strength kN/m (CD)	29.8	30.6	30.4	30.8	33.7						31.1	1.5
Tensile Strain % (MD)	41.3	44.1	44.8	41.7	41.2						42.6	1.7
Tensile Strain % (CD)	41.0	44.6	45.0	47.0	45.5						44.6	2.2
Puncture Resistance (BSEN ISO 12236:2006)												
Puncture Force kN	4.94	5.69	4.76	4.90	4.95						5.05	0.37
Puncture Displacement mm	45.8	48.2	45.1	47.4	45.7						46.4	1.3
Cone Drop (BSEN ISO 13433:2006)												
mm	11	8	9	10	10						10	1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 ° C, Relative Humidity : 65 ± 5 % RH



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN
T +44 (0) 1484 717776 F +44 (0) 1484 717757
E info@bics-labs.co.uk W www.bics-labs.co.uk

GEOSYNTHETICS TEST RESULTS

JONES BROS RUTHIN (CIVIL ENGINEERING) CO. LTD

P.O NO: C2066/33241

Contract Ref: Llandulas Landfill Site {Phase 3A Capping}
Material: Geotextile {Protector}
Sample ID: See Below

Report Ref No: BS-H827/a
BICS Labs ID: 02, 03
Dates Tested: 24-25/09/2012

PARAMETER	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Sample ID: GT2, Roll No: 22433363												
Thickness @ 2 kPa (BSEN ISO 9863-1:2005)												
mm	2.48	2.77	2.61	2.60	2.81	2.43	2.66	2.58	2.33	2.79	2.61	0.16
Mass Per Unit Area (BSEN ISO 9864:2005)												
g/m ²	336	328	330	336	334	339	332	337	329	332	333	3
Tensile Properties (BSEN ISO 10319:2008)												
Tensile Strength kN/m (MD)	33.5	32.1	31.1	29.6	31.5						31.5	1.4
Tensile Strength kN/m (CD)	30.3	28.2	30.1	32.1	31.7						30.5	1.5
Tensile Strain % (MD)	40.1	45.1	43.4	34.9	42.6						41.2	4.0
Tensile Strain % (CD)	55.5	50.3	50.3	42.6	48.3						49.4	4.6
Puncture Resistance (BSEN ISO 12236:2006)												
Puncture Force kN	4.86	5.37	5.25	5.01	4.95						5.09	0.21
Puncture Displacement mm	45.4	46.5	45.6	46.6	45.6						46.0	0.5
Cone Drop (BSEN ISO 13433:2006)												
mm	10	8	9	9	8						9	1
Sample ID: GT3, Roll No: 22433340												
Thickness @ 2 kPa (BSEN ISO 9863-1:2005)												
mm	2.66	2.87	2.84	2.68	2.62	2.83	2.92	2.74	3.01	2.83	2.80	0.12
Mass Per Unit Area (BSEN ISO 9864:2005)												
g/m ²	340	324	328	337	332	339	335	328	339	332	333	5

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH



Cert No: 7495
ISO 9001



4438

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Panel Deployment Record

Geotextile Panel Deployment and Overlap Record

Landfill Site: Llanddulas
Project: Cell 3A Permanent Capping
Material: Terrex SNW 46

Geotextile Deployment Information																									
Deployment Date	Panel No.	Batch No.	Roll No.	Panel Dimensions		CQA S.I	Seam Ref	Length of Seam	Overlaps Between Adjacent Panels Verified @ 10 metres Intervals (>300mm = 0)															CQA S.I	
				Deployed Length	Deployed Width																				
									(m)	(m)	10	20	30	40	50	60	70	80	90	100	110	120	130		140
07.09.12	G1	22433	365	57.00	4.95	M.White																			M.White
12.09.12	G2	22433	349	47.00	4.95	M.White	G2/G1	47.00																	M.White
12.09.12	G3	22433	349	30.00	4.95	M.White	G3/G2	30.00																	M.White
12.09.12	G4	22433	387	22.00	4.95	M.White	G4/G3	22.00																	M.White
12.09.12	G5	22433	349	9.00	4.95	M.White	G5/G4	4.95																	M.White
							G5/G3	9.00																	M.White
12.09.12	G6	22433	362	21.00	4.95	M.White	G6/G4	26.00																	M.White
12.09.12	G7	22433	387	11.00	4.95	M.White	G7/G6	11.00																	M.White
12.09.12	G8	22433	363	28.00	4.95	M.White	G8/G7.G6.G5	28.00																	M.White
12.09.12	G9	22433	363	54.00	4.95	M.White	G9/G8	27.00																	M.White
12.09.12	G10	22433	363	10.00	3.00	M.White	G10/G3	4.95																	M.White
							G10/G2	8.00																	M.White
12.09.12	G11	22433	363	5.00	2.00	M.White	G11/G9	2.00																	M.White
							G9.G11/G5.G10.G2.G1	33.00																	M.White
12.09.12	G12	22433	340	44.00	4.95	M.White	G12/G9	44.00																	M.White
12.09.12	G13	22433	349	13.00	4.95	M.White	G13/G12	4.95																	M.White
							G13/G9.G11	13.00																	M.White
12.09.12	G14	22433	340	54.00	4.95	M.White	G14/G13.G12	54.00																	M.White
12.09.12	G15	22433	331	47.00	4.95	M.White	G15/G14	47.00																	M.White
							G1.G11.G13.G14.G15/Existing	22.00																	M.White
12.09.12	G16	22433	329	28.00	4.95	M.White																			
12.09.12	G17	22433	329	27.00	4.95	M.White	G17/G16	27.00																	M.White
12.09.12	G18	22433	387	26.00	4.95	M.White	G18/G17	26.00																	M.White
12.09.12	G19	22433	387	25.00	4.95	M.White	G19/G18	25.00																	M.White
12.09.12	G20	22433	331	25.00	4.95	M.White	G20/G19	25.00																	M.White
							G16.G17.G18.G19.G20/Existing	25.00																	
13.09.12	G21	22433	329	26.00	4.95	M.White	G21/G16	26.00																	D. Durrans
13.09.12	G22	22433	332	16.00	4.95	M.White	G22/G21	16.00																	D. Durrans
13.09.12	G23	22433	329	14.00	4.95	M.White	G23/G22	4.95																	D. Durrans
							G23/G21	10.00																	D. Durrans
							G21.G23/Existing	15.00																	
13.09.12	G24	22433	332	29.00	4.95	M.White	G24/G22.G23	29.00																	D. Durrans
13.09.12	G25	22433	387	2.00	4.95	M.White	G25/G24	4.95																	D. Durrans
							G25/G22	2.00																	D. Durrans
13.09.12	G26	22433	332	24.00	4.95	M.White	G26/G25.G24	24.00																	D. Durrans
13.09.12	G27	22433	317	2.00	4.95	M.White	G27/G26	3.00																	D. Durrans
							G27/G24	2.00																	D. Durrans
13.09.12	G28	22433	332	24.00	4.95	M.White	G28/G26	24.00																	D. Durrans
13.09.12	G29	22433	332	7.00	4.95	M.White	G29/G28	7.00																	D. Durrans
13.09.12	G30	22433	362	12.00	4.95	M.White	G30/G29	4.95																	D. Durrans
							G30/G28	12.00																	D. Durrans
13.09.12	G31	22433	362	14.00	4.95	M.White	G31/G29.G30	14.00																	D. Durrans
13.09.12	G32	22433	362	5.00	4.95	M.White	G32/G31	5.00																	D. Durrans
13.09.12	G33	22433	362	5.00	4.95	M.White	G33/G32	4.95																	D. Durrans
							G33/G31	5.00																	D. Durrans
13.09.12	G34	22433	362	4.00	4.95	M.White	G34/G32.G33	4.00																	D. Durrans
							G15/G24.G27.G26.G28.G29.G31.G32.G34	40.00																	D. Durrans
13.09.12	G35	22433	362	24.00	4.95	M.White																			
13.09.12	G36	22433	362	25.00	4.95	M.White	G36/G35	25.00																	D. Durrans
13.09.12	G37	22433	313	11.50	4.95	M.White	G37/G36	11.50																	D. Durrans
13.09.12	G38	22433	313	14.50	4.95	M.White	G38/G37	4.95																	D. Durrans
							G38/G36	13.00																	
13.09.12	G39	22433	313	26.00	4.95	M.White	G39/G38.G37	26.00																	D. Durrans
13.09.12	G40	22433	313	4.00	2.50	M.White	G40.G39.G38.G36.G35/Existing	25.00																	D. Durrans
13.09.12	G41	22433	313	4.50	2.50	M.White	G41/G40	2.50																	D. Durrans
13.09.12	G42	22433	313	4.00	2.50	M.White	G42/G41	2.50																	D. Durrans
13.09.12	G43	22433	313	4.50	2.50	M.White	G43/G42	2.50																	D. Durrans
13.09.12	G44	22433	313	4.50	2.50	M.White	G44/G43	2.50																	

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Panel Repair Record

Geotextile Repair Record

Landfill Site: Llanddulas
 Project: Cell 3A Permanent capping
 Material: Terrex SNW 46

Repair Date	Repair Reference	Reason for Repair	Seam or Panel Reference	Approximate location	Technician	CQA S.I
12.09.12	GR1	Insufficient Overlap	G15/G26	Bottom G26/G28	M.Cullen	M.White
13.09.12	GR2	Pipeboot PB1	G18/G19	Top	M.Cullen	D. Durrans
13.09.12	GR3	Pipeboot PB2	G24/G25	Top	M.Cullen	D. Durrans
14.09.12	GR4	Pipeboot PB3	G23	Bottom	M.Cullen	M.White
14.09.12	GR5	Pipeboot PB4	G51/G52	Top	M.Cullen	M.White
15.09.12	GR6	Insufficient Overlap	G53/G54	Bottom	M.Cullen	M.White
15.09.12	GR7	Pipeboot PB5	G60	Bottom G60	M.Cullen	M.White

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

[CQA Inspectors Daily Report]

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 13 th August 2012	
Weather	Previous Night a.m p.m	Dry Cloudy Cloudy/rain
Site Hours:	07:00 – 19:30	
Contractors Arrival Time:	08:00	
CQA Arrival Time:	07:30	
Contractors Departure Time:	19:30	
CQA Departure Time:	19:30	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator 1 No. Labour 1 No. Site Forman	
Contract Works Undertaken	Jones Bros. commenced excavations along the southern edge of Cell 3A to locate the existing geomembrane in the area of the tie-in. The material was carefully excavated using the PC210 Excavator to just above the existing lining system. The remaining soils were removed by hand using a shovel so as not to damage the existing material.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	Site inductions carried out by FCC on all parties present.	
Visitors to Site	None.	
Comments	P. Taberner (FCC) pointed out that there were a lot of pipes hidden in the vegetation in the works area and that care must be taken when tracking machines around and excavating material.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 14 th August 2012
Weather	Previous Night a.m p.m Showers Cloudy Clear and sunny
Site Hours: Contractors Arrival Time: CQA Arrival Time: Contractors Departure Time: CQA Departure Time:	07:00 – 19:30 07:00 07:00 19:30 19:30
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator 1 No. Labour 1 No. Site Forman
Contract Works Undertaken	Jones Bros. continued excavations along the southern edge of Cell 3A to locate the existing geomembrane in the area of the tie-in. The material was carefully excavated using the PC210 Excavator to just above the existing lining system. The remaining soils were removed by hand using a shovel so as not to damage the existing material.
Testing Undertaken	None.
Meetings/ Correspondence	None.
Health and Safety	Site inductions carried out by FCC on all parties present.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 15 th August 2012	
Weather	Previous Night	Dry
	a.m	Cloudy
	p.m	Cloudy/Heavy rain
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator 1 No. Labour 1 No. Site Forman	
Contract Works Undertaken	Jones Bros. continued with the excavations along the southern edge of Cell 3A to locate the existing geomembrane in the area of the tie-in. The material was carefully excavated using the PC210 Excavator to just above the existing lining system. The remaining soils were removed by hand using a shovel so as not to damage the existing material.	
Testing Undertaken	None	
Meetings/ Correspondence	None	
Health and Safety	Site inductions carried out by FCC and Jones Bros on all parties present	
Visitors to Site	Tom Ashton (Egniol Environmental Ltd.)	
Comments	Pipes removed to allow access for excavator to remove waste to expose the existing material.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 16 th August 2012
Weather	Previous Night a.m p.m Dry Cloudy/Heavy rain Cloudy/Light rain
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator 1 No. Labour 1 No. Site Forman
Contract Works Undertaken	JSR. Moved and booted gas pipes to allow access of PC210 excavator to expose existing material. Jones Bros. continued with the excavations along the southern edge of Cell 3A to locate the existing geomembrane in the area of the tie-in. The material was carefully excavated using the PC210 Excavator to just above the existing lining system. The remaining soils were removed by hand using a shovel so as not to damage the existing material.
Testing Undertaken	None
Meetings/ Correspondence	None
Health and Safety	None
Visitors to Site	Tom Ashton (Egniol Environmental Ltd.)
Comments	Pipes removed to allow access for excavator to remove waste to expose the existing material.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date		Friday 17 th August 2012
Weather	Previous Night a.m p.m	Light rain Heavy rain Cloudy/Light rain
Site Hours:		07:00 – 18:00
Contractors Arrival Time:		07:00
CQA Arrival Time:		07:00
Contractors Departure Time:		18:00
CQA Departure Time:		18:00
Contractors Plant / Resources Utilised		Jones Bros. 1 No. PC210 Excavator 1 No. Labour 1 No. Site Forman
Contract Works Undertaken		Jones Bros. continued with the excavations along the southern edge of Cell 3A to locate the existing geomembrane in the area of the tie-in. The material was carefully excavated using the PC210 Excavator to just above the existing lining system. The remaining soils were removed by hand using a shovel so as not to damage the existing material.
Testing Undertaken		None
Meetings/ Correspondence		None
Health and Safety		None
Visitors to Site		None
Comments		FCC instructed Jones Bros to stop removing waste due to odour issues with local residents.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 20 th August 2012	
Weather	Previous Night a.m p.m	Dry. Dry / Bright. Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 1 No. Hydrema 922 Dump-Truck + Operator. 1 No. Labour 1 No. Site Forman	
Contract Works Undertaken	Cell 3A Capping Works: No works carried out today to Cell 3A Capping works. Jones Bros: Day Works: Construction of a haul road running along the southwest flank of Cell 3 as requested by FCC. Construction of a temporary retaining clay bund along the southern flank of Cell 3 as requested by FCC.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No Issues.	
Visitors to Site	None.	
Comments	None.	

For Egniol Environmental Ltd: Malachi White.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 21st August 2012	
Weather	Previous Night a.m p.m	Dry. Dry / Sunny spells. Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 1 No. Hydrema 922 Dump-Truck + Operator. 1 No. Labour 1 No. Site Forman	
Contract Works Undertaken	Cell 3A Capping Works: Construction of a temporary haul road from Cell 3A capping area to the active tipping area, loading stone with the 220 excavator transporting with the Hydrema 922 dump-truck & deploying with the 210 excavator. Commenced re-grading the surface of the waste / cover layer with the 210 excavator along the southern flank (permanent capping area) of cell 3, prior to the deployment of the 300mm regulating layer. Commenced with the deployment of the 300mm regulating layer along the southern tie-in of the permanent capping area. Loading soils from the stockpile situated on the crest of Cell 3A capping area transporting with the 922 dump-truck & deploying to a depth of approximately 350mm with the 210 excavator prior to compaction. Mobile deodorising unit in place & working during working hours.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No Issues.	
Visitors to Site	H. Weldon (Jones Bros.)	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 22 nd August 2012
Weather	Dry.
Previous Night	Dry / Sunny spells.
a.m	Dry / Bright.
p.m	
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 1 No. Hydrema 922 Dump-Truck + Operator. 1 No. Labour 1 No. Site Forman
Contract Works Undertaken	Cell 3A Capping Works: Continued re-grading the surface of the waste / cover layer with the 210 excavator along the southern flank (permanent capping area) of cell 3A prior to the deployment of the 300mm regulating layer. Awaiting Jones Bros engineer to continue with the survey of the top of the re-graded waste/cover layer before continuing with the deployment of the regulating layer. After surveying the top of waste levels over the western section of the permanent capping area, Jones Bros continued with the deployment of the 300mm regulating layer. Loading with the 220 excavator from the stockpiles situated on the crest of Cell 3A cap transporting with the 922 dump-truck & deploying with the 210 excavator to a depth of 350mm+ prior to compaction. Regulation soils tracked in & sealed at the end of shift with the 220 & 210 excavators. Mobile deodorising unit in place & working during working hours.
Testing Undertaken	Visual inspection & photographs taken.
Meetings/ Correspondence	None.
Health and Safety	No Issues.
Visitors to Site	R. Jones. (Jones Bros.) H.Weldon. (Jones Bros.)
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 23 rd August 2012	
Weather	Previous Night	Dry.
	a.m	Overcast / Dry.
	p.m	Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 1 No. Hydrema 922 Dump-Truck + Operator. 1 No. Labour 1 No. Site Forman 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros engineer surveying the existing waste levels over the eastern section of the permanent capping area prior to trimming back to a 1:3 slope. Commenced compaction & sealing of the regulating layer over the western section of the permanent capping area with the smooth drum roller. Ground-worker stone-picking & removing any unsuitable materials from the surface of the regulating layer which could damage the geomembrane. Continued with the excavation of waste along the central section of the permanent capping area to achieve a slope of 1:3. Cover material immediately placed over profiled waste to reduce odours. All excavated waste transported to the active tipping area & covered. Mobile deodorising unit in place & working during working hours.	
Testing Undertaken	Visual inspection & photographs taken. Shear vane Testing to regulating layer (SV1-SV3).	
Meetings/ Correspondence	None.	
Health and Safety	No Issues.	
Visitors to Site	R. Jones. (Jones Bros.) H.Weldon. (Jones Bros.)	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 24 th August 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright.
	p.m	Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 1 No. Hydrema 922 Dump-Truck + Operator. 1 No. Labour 1 No. Site Forman 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Continued with the excavation of waste along the central / eastern section of the permanent capping area to achieve a slope of 1:3. Cover material immediately placed over profiled waste to reduce odours. All excavated waste transported to the active tipping area & covered. Commenced grading & profiling the top of waste along the north facing flank of the temporary capping area with the 210 excavator. Mobile de-odourising unit in place & working during working hours. JSR: Extending gas wells D236 & D238 on the north flank of the temporary capping area, shortening to below waste level & sealing off redundant 160mm gas lines along the southern flank of the permanent capping area.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	Progress meeting & site walk-over: M.Lancaster, P. Taberner, M Songo & A.Kirk (FCC), M.Davies (JB.) T.Prosser (Infinis), M.White (EEL).	
Health and Safety	No Issues.	
Visitors to Site	H.Wheldon (Jones Bros.)	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 28 th August 2012
Weather	Rain. Dry / Bright. Dry / Bright.
Previous Night a.m p.m	
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Continued with the excavation of waste along the eastern section of the permanent capping area to achieve a slope of 1:3. Cover material immediately placed over profiled waste to reduce odours. Mobile deodorising unit in place & working during working hours. All excavated waste transported to the active tipping area & covered. Continued grading & profiling the top of waste along the north facing flank of the temporary capping area with the 210 excavator. After PM Surveys recorded the top of waste levels over the central & eastern sections of the permanent capping area, Jones Bros continued with the deployment of the 300mm regulating layer. Loading with the 220 excavator from the stockpiles situated on the crest of Cell 3A cap transporting with 2 x A30 dump-trucks & deploying with the 210 excavator to a depth of 350mm+ prior to compaction. The regulating layer was compacted with the smooth drum roller in order to achieve shear strength greater than 50kpa.
Testing Undertaken	Visual inspection & photographs taken. 2 x Shear Strength – Cell 3A Permanent Capping Area – (SV4-SV5).
Meetings/ Correspondence	None.
Health and Safety	No Issues.
Visitors to Site	A. Zachary (Environment Agency) PM Surveys UK
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 29 th August 2012	
Weather	Previous Night	Rain.
	a.m	Heavy showers / Sunny spells / Strong winds.
	p.m	Heavy showers / Sunny spells / Strong winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Continued with the excavation of waste along the eastern section of the permanent capping area to achieve a slope of 1:3. Cover material immediately placed over profiled waste to reduce odours. Mobile deodorising unit in place & working during working hours. All excavated waste transported to the active tipping area & covered. Continued with the deployment of the 300mm regulating layer. Loading with the 220 excavator from the stockpiles situated on the crest of Cell 3A cap transporting with 2 x A30 dump-trucks & deploying with the 210 excavator to a depth of 350mm+ prior to compaction. The regulating layer was tracked in & sealed with the 210 excavator due to heavy showers.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	Health & Safety Audit (Jones Bros).	
Visitors to Site	P.Taberner (FCC), H.Wheldon (Jones Bros.), T.Prosser (Infinis).	
Comments	Site walkover - T.Prosser, P.Taberner, H.Wheldon & M.White to discuss the repositioning of the main 250mm gas main to enable access into the eastern corner of Cell 3A capping area. Method / Risk assessments requested by Infinis / FCC from Jones Bros before works on the pipeline can commence.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 30 th August 2012
Weather	Rain. Overcast / Occasional sunny spells / Strong winds. Overcast / Occasional sunny spells / Strong winds.
Previous Night a.m p.m	
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Removing vegetation from the southeast corner of the capping area with 210 & 220 excavators. Removing vegetation & soils along the crest of the southeast corner to locate the permanent capping anchor trench. Removing existing temporary geomembrane from the southeast corner & transporting to the active tipping area. Commenced with the profiling of the southeast corner side slope with the 210 & 220 excavators. Continue to deploy & profile the regulating layer along the north facing flank of the temporary capping area with the 210 excavator. Infinis / Jones Bros. Re-positioning of the main 250mm gas pipeline running down the southeast flank of Cell 3 capping area. The pipeline was lifted & moved using Jones Bros 210 & 220 excavators, works were supervised by Infinis. Method statements & risk assessments in place prior to commencing works.
Testing Undertaken	Visual inspection & photographs taken.
Meetings/ Correspondence	None.
Health and Safety	None.
Visitors to Site	P.Taberner (FCC), H.Wheldon (Jones Bros.), T.Prosser (Infinis).
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 31 st August 2012	
Weather	Previous Night	Light rain.
	a.m	Dry / Bright.
	p.m	Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Removing vegetation from the lower section of the southeast corner of the capping area with 210 excavator. Continued to cut & fill the southeast corner side slope with the 210 & 220 excavators in order to achieve a 1:3 gradient. Exposing the clay sidewall seal anchor trench along the eastern perimeter of the permanent capping area.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	None.	
Visitors to Site	H.Wheldon (Jones Bros.)	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Saturday 1 st September 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright.
	p.m	Dry / Bright.
Site Hours:	07:00 – 13:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	13:00	
CQA Departure Time:	13:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros: Continued to profile the southeast corner side-slope with the 210 & 220 excavators, removing stones & smoothing with the back of excavator bucket. A30 dump-trucks transporting regulating soils to the permanent capping area. 210 excavator deploying the 300mm regulating layer over the eastern section of the permanent capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks man present checking levels & removing stones & any unsuitable materials. 210 & 220 excavators profiling the regulating layer & removing unsuitable material over the western section of the temporary capping area. Unsuitable materials loaded onto A30 dump-trucks & transported to the active tipping area.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	None.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 3 rd September 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright.
	p.m	Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros A30 dump-trucks transporting regulating soils to the permanent & temporary capping areas. 210 excavator deploying the 300mm regulating layer over the eastern section of the permanent capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks man present checking levels & removing stones & any unsuitable materials. 210 & 220 excavators profiling the regulating layer & removing unsuitable material over the crest & north facing flank of the temporary capping area. Unsuitable materials loaded onto A30 dump-trucks & transported to the active tipping area. PM Surveys: Surveying top of waste cover layer & top of placed regulating layer over the permanent capping area. Surveying top of waste cover layer over the western section of the temporary capping area.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	None.	
Visitors to Site	H. Wheldon (Jones Bros). PM Surveys UK	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 4 th September 2012
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros A30 dump-trucks transporting regulating soils from the stockpile situated between Phase 1C & Phase 2 to the permanent & temporary capping areas. 210 excavator continued deploying the 300mm regulating layer over the eastern section of the permanent capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks man present checking levels & removing stones & any unsuitable materials. 210 & 220 excavators deploying & profiling the regulating layer & removing unsuitable material over the crest & north facing flank of the temporary capping area. Unsuitable materials loaded onto A30 dump-trucks & transported to the active tipping area. Transporting the leachate tank situated on the western perimeter of the capping area to the active tipping area. Removing the temporary access road running from the temporary capping area to the active tipping area. Grading waste cover layer after removing access road & deploying regulating soils with the 220 excavator.
Testing Undertaken	Visual inspection & photographs taken.
Meetings/ Correspondence	None.
Health and Safety	None.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 5 th September 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright / Warm.
	p.m	Dry / Bright / Warm.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros 2 x A30 dump-trucks transporting regulating soils from the stockpile situated between Phase 1C & Phase 2 to the permanent & temporary capping areas. 210 excavator continued profiling waste cover layer & deploying regulating material over the north facing flank of the temporary capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks-man present checking levels & removing stones & any unsuitable materials. 220 excavator exposing the existing sidewall seal & digging the 500mm x 500mm anchor trench along the southern perimeter of the south east side-slope. 210 & 220 excavators digging through the 1m capping soils & exposing the existing GDL along the toe of the southeast side-slope. 210 & 220 excavators removing capping soils & profiling between the exposed GDL & the lower section of the southeast side- slope to form an even gradient from crest to toe.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	None.	
Visitors to Site	H. Wheldon (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 6 th September 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright / Warm.
	p.m	Dry / Bright / Warm.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros 2 x A30 dump-trucks transporting regulating soils from the stockpile situated between Phase 1C & Phase 2 to the permanent & temporary capping areas. 210 excavator continued profiling waste cover layer & deploying regulating material over the north facing flank of the temporary capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks man present checking levels & removing stones & any unsuitable materials. 220 excavator digging through the 1m capping soils & exposing the existing GDL along south flank tie-in. Removing waste & profiling waste cover over the southeast corner side-slope. Infinis / JSR: Re-positioning the main 250mm & 160mm gas pipelines to give Jones Bros access to place regulating soils.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	None.	
Visitors to Site	None.	
Comments	38 rolls of GSE 1mm geomembrane delivered to site, unloaded and placed onto prepared storage area with the 210 excavator & banks man.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date		Friday 7 th September 2012
Weather	Previous Night	Dry.
	a.m	Dry / Bright / Warm.
	p.m	Dry / Bright / Warm.
Site Hours:		07:00 – 18:00
Contractors Arrival Time:		07:00
CQA Arrival Time:		07:00
Contractors Departure Time:		18:00
CQA Departure Time:		18:00
Contractors Plant / Resources Utilised		Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.
Contract Works Undertaken		Cell 3A Capping Works: Jones Bros 2 x A30 dump-trucks transporting regulating soils from the stockpile situated between Phase 1C & Phase 2 to the permanent & temporary capping areas. 220 excavator continued profiling waste cover layer & deploying regulating material over the north facing flank of the temporary capping area, tracking in & smoothing with back of bucket prior to smooth rolling. Banks-man present checking levels & removing stones & any unsuitable materials. Commenced excavating the 500mm x 1000mm anchor trench with the 210 excavator along the crest of the permanent capping area. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Jones Bros labourer hand digging 7 x trial holes over the central section of the permanent capping area to check the depth of the regulating layer, the regulating soils were all found to be a minimum of 300mm, the trial holes were photographed & the results recorded/ Infinis / JSR: Re-positioning the main 250mm gas pipeline to give Dragon Lining access to place geomembrane. Dragon Lining : Deployment of 8 x panels of geomembrane over the southeast corner side-slope (P1-P8). Extrusion welding along the tie-in to the existing permanent geomembrane. 2 x geomembrane repairs (PR1 – PR2). 1 x panel of geotextile deployed (G1).
Testing Undertaken		Visual inspection & photographs taken. Trial Holes (TH1-TH7) – Regulating Layer. 2 x Trial Welds (TW1-TW2) 1 x Geomembrane Conformance Sample (GM1). 3 x Destructive Samples (DS1-DS3). 2 x Shear vane (SV6-SV7) – Regulating Layer.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Meetings/ Correspondence	None.
Health and Safety	N.Taylor (URS Health & Safety Audit).
Visitors to Site	N.Taylor (URS). M.Davies (Jones Bros).
Comments	13 rolls of geotextile delivered to site, unloaded and placed onto prepared storage area with the 210 excavator & banks man.

CQA Inspector's Daily Report

Site Name: Llanddulas Landfill
Project: Cell 3A Capping 2012

Date	Saturday 8 th September 2012	
Weather	Previous Night	Dry.
	a.m	Dry / Bright / Warm.
	p.m	Dry / Bright / Warm.
Site Hours:	07:00 – 13:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	13:00	
CQA Departure Time:	13:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros 210 excavator & banksman excavating the 500mm x 1000mm anchor trench running along the crest of the north flank capping area. A30 dumptruck transporting waste from the anchor trench to the active tipping area.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 10 th September 2012	
Weather	Previous Night	Light rain.
	a.m	Dry / Bright
	p.m	Overcast / Heavy intermittent rain.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Continued to excavate the 500mm x 1000mm anchor trench with the 210 excavator along the crest of the permanent capping area. A30 dump truck transporting waste material excavated from the anchor trench to the active tipping area. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Infinis / JSR: Re-positioning the main 250mm gas pipeline to give Dragon Lining access to place geomembrane. Dragon Lining : Deployment of 11 x panels of geomembrane over the southeast corner side-slope (P9-P19). PM Surveys: Surveying geomembrane panels over the southeast side-slope.	
Testing Undertaken	Visual inspection & photographs taken. 2 x Trial Welds (TW3-TW4) 1 x Geomembrane Conformance Sample (GM2). 1 x Destructive Samples (DS4-DS5). 1 x Shear vane (SV8) – Regulating Layer.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	H. Wheldon (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 11 th September 2012
Weather	Previous Night a.m. p.m.
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Continued to excavate the 500mm x 1000mm anchor trench with the 210 excavator along the crest of the permanent capping area. A30 dump truck transporting waste material excavated from the anchor trench to the active tipping area. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Infinis/JSR: Re-positioning the main 250mm gas pipeline to give Dragon Lining access to place geomembrane. Dragon Lining : Deployment of 4 x panels of geomembrane over the southeast corner side-slope (P20-P23). 4 x Geomembrane repairs (PR3-PR6). PM Surveys: Surveying geomembrane panels over the southeast side-slope.
Testing Undertaken	Visual inspection & photographs taken. 2 x Trial Welds (TW5-TW6). 1 x Destructive Samples (DS6-DS7). Apt'S TO Fusion welds. VB. Testing to Extrusion welds. 3 x Shear vane (SV9 – SV11) – Regulating Layer. 19 x trial Holes (TH8 – TH26) – Regulating Layer.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	210 excavator moving gas lines with JSR. 210 moving rock adjacent to the composting area.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 12 th September 2012
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller. 1 x Cat D6R Dozer + Operator.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Commenced with the deployment of 1000mm capping soils over the southeast side slope geomembrane / geotextile. 2 x A30 dump-trucks transporting capping soils from the Phase 1C valley stockpile to the crest of the southeast side slope. D6R pushing soils horizontally over the side slope so as not to put stress on the geomembrane / geotextile. Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Dragon Lining : Deployment of 2 x panels of geomembrane over the central area of the permanent capping side-slope (P24-P25). 19 x Geotextile panels deployed over the southeast side slope (G2-G20).
Testing Undertaken	Visual inspection & photographs taken. 1 x Trial Welds (TW7). 1 x Destructive Samples (DS8). APT'S to Fusion welds, VB Testing to Extrusion welds. 14 x trial Holes (TH27 – TH40) – Regulating Layer.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 13 th September 2012
Weather	Previous Night a.m p.m
	Overcast/Rain Dry / Overcast. Sunny Spells/Dry
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller. 1 x Cat D6R Dozer + Operator.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Commenced with the deployment of 1000mm capping soils over the southeast side slope geomembrane / geotextile. 2 x A30 dump-trucks transporting capping soils from the Phase 1C valley stockpile to the crest of the southeast side slope. D6R pushing soils horizontally over the side slope so as not to put stress on the geomembrane / geotextile. Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Infinis / JSR Disconnected Gas well D231/J480 and D222 for pipe boot installation and reconnected pipe work. Waited for JSR to disconnect Gas well RD 207/JN557. Dragon Lining : Commenced welding of pipe boots for Gas well D231/J480 and D222. Pipe boots taken from roll 463. JSR Disconnected Gas well D231/J480 to allow installation of pipe boot on P12 and carried out air pressure test (PR7, PR11 and PR12). Installed pipe boot for Gas well D222 and Air pressure test carried out (PR8, PR9, PR10). Whilst waiting for JSR to disconnect Gas well RD 207/JN557, 2no. pipe boot were made up ready to install. Due to a Gas Audit JSR were sorting other pipe work out. Liners decided to carry on with Geotextile placement (G21 – G45) whilst waiting for gas well disconnection.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Testing Undertaken	Visual inspection & photographs taken. 2 x Trial Welds (TW8-TW9). 1 x Destructive Samples (DS9). APT'S to Fusion welds, VB Testing to Extrusion welds.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date		Friday 14 th September 2012
Weather	Previous Night	Light rain.
	a.m	Sunny spells/ Heavy showers / Strong winds.
	p.m	Overcast / Light showers / Light winds.
Site Hours:		07:00 – 18:00
Contractors Arrival Time:		07:00
CQA Arrival Time:		07:00
Contractors Departure Time:		18:00
CQA Departure Time:		18:00
Contractors Plant / Resources Utilised		Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller. 1 x Cat D6R Dozer + Operator.
Contract Works Undertaken		Cell 3A Capping Works: Jones Bros Continued with the deployment of 1000mm capping soils over the southeast side slope geomembrane / geotextile. 2 x A30 dump-trucks transporting capping soils from the Phase 1C valley stockpile to the crest of the southeast side slope. D6R pushing soils horizontally over the side slope so as not to put stress on the geomembrane / geotextile. Commenced with the deployment of capping soils over the central section of the permanent capping area, placing with the 210 excavator & grading horizontally to a depth of 500mm with the D6R dozer. Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. Final smoothing of the southeast side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the southeast side-slope prior to deploying the geomembrane. Increasing the depth of regulating soils from 200mm to 300mm around Trial Hole 16. Infinis / JSR: Disconnecting & re-connecting well heads to allow pipe boot installation (PB3 & PB4). Infinis supervising the re-positioning of the 250mm main gas pipeline running down the southeast side slope, using Jones Bros 210 excavator & banks man. Dragon Lining : Deployment of 1 x panel of geomembrane over the central area of the permanent capping side-slope (P26). 3 x Geomembrane repairs (PR11-PR13). 2 x Pipe boots Installed to (PB3 – PB4). 2 x Geotextile repairs (GR4 – GR5).

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Testing Undertaken	Visual inspection & photographs taken. 3 x Trial Welds (TW10 – TW12)). 3 x Destructive Samples (DS11 - DS13). APT's to Fusion welds, VB. Testing to Extrusion welds.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	A. Zachary (Environment Agency).
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Saturday 15 th September 2012
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 1 No. PC210 Excavator + Operator. 1 No. JCB 220 Excavator + Operator. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 No. Hydrex 2012 Smooth Drum Roller. 1 x Cat D6R Dozer + Operator.
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros 2 x A30 dump-trucks transporting capping soils from the Phase 1C valley stockpile to the crest of the permanent capping side slope. Continued to deploy the 1000mm capping soils. D6R pushing soils horizontally so as not to put stress on the geomembrane / geotextile over the side slope to an initial depth of 500mm Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. Final smoothing of the central / western section of the permanent capping side-slope with the 210 excavator, final hand picking of any stones / unsuitable materials over the area prior to deploying the geomembrane. Dragon Lining : Deployment of 11 x panels of geomembrane over the central /western area of the permanent capping side-slope (P27 – P37). 3 x Geomembrane repairs (PR14-PR16). Deployment of 17 x panels of geotextile (G46-G62) over the central /western side slope. 1 x Geotextile repairs (GR6).
Testing Undertaken	Visual inspection & photographs taken. 2 x Trial Welds (TW13 – TW14)). 3 x Destructive Samples (DS14- DS16).) APT's to Fusion welds, VB. Testing to Extrusion welds. Geotextile deployment - Overlaps of 300mm minimum checked. 3 x Geotextile Conformance Samples (GT1 – GT3). Trial Holes Regulating layer (TH41-TH60).
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 17 th September 2012	
Weather	Previous Night	Rain.
	a.m	Dry / Bright / Light winds.
	p.m	Dry / Bright / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Commenced transporting composted soils with 2 x A30 dump trucks from the Cell 3A south flank stockpile to the crest of the permanent capping area for use as the upper 500mm of the capping soils. D6R pushing out material horizontally over the capping soils to a total depth of 1000mm. Continued transporting capping soils from the Phase 1C valley stockpile to the crest of the permanent capping side slope. Continued to deploy the capping soils over the central / western section to a depth of 500mm. D6R pushing soils horizontally so as not to put stress on the geomembrane / geotextile. Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Permanent Capping area) : Installation of 3 x pipe-boots (PB5-PB7). Geomembrane Repairs (PR17-PR18). 1 x Geotextile repairs (GR7). Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 7 x panels of geomembrane (P1-P7).	
Testing Undertaken	Visual inspection & photographs taken. 2 x Trial Welds (TW15 – TW16)). 2 x Destructive Samples (DS17- DS18). APT's to Fusion welds, VB. Testing to Extrusion welds.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 18 th September 2012	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Heavy showers / Light winds.
	p.m	Sunny spells / heavy showers / Strong winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Continued to transport composted soils with 2 x A30 dump trucks from the Cell 3A south flank stockpile to the crest of the permanent capping area for use as the upper 500mm of the capping soils. D6R pushing out material horizontally over the capping soils to a total depth of 1000mm. Continued transporting capping soils from the Phase 1C valley stockpile to the crest of the permanent capping side slope. Continued to deploy the capping soils over the western section to a depth of 500mm. D6R pushing soils horizontally so as not to put stress on the geomembrane / geotextile. Banks man present at all times, guiding dump trucks & removing any large stones / unsuitable materials as the soils are placed. No further capping soils can be placed on the western section of the permanent capping area, awaiting delivery of protection geotextile to complete the works. 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 8 x panels of geomembrane (P8-P15). Deploying temporary surcharge & sandbags along open edges at end of shift.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 19 th September 2012	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Light winds.
	p.m	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: Jones Bros Transporting regulating soils from the Phase 1C valley stockpile to the crest of the north flank temporary capping area. D6R & 210 excavator placing & grading regulating soils over the north flank of the temporary capping area. Banks man present at all times, guiding dump-trucks & removing any large stones / unsuitable materials as the soils are placed. D6R pushing composted material into the toe of the southeast side slope. 210 excavator placing composted material along the crest of the permanent capping area to bring the soils to 1000mm where the survey showed depths lower than 1000mm. 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 11 x panels of geomembrane (P16-P26). Pre-fabricating pipe boots for gas wells within the temporary capping area. Deploying temporary surcharge & sandbags along open edges at end of shift.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	Awaiting delivery of geotextile to complete 3A permanent capping area.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 20 th September 2012	
Weather	Previous Night a.m p.m	Rain. Sunny spells / Showers / Light winds. Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 12 x panels of geomembrane (P27-P38). Pre-fabricating pipe boots for gas wells within the temporary capping area. Deploying temporary surcharge & sandbags along open edges at end of shift.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	Awaiting delivery of geotextile to complete 3A permanent capping area.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 21 st September 2012	
Weather	Previous Night a.m p.m	Rain. Overcast / Dry / Light winds. Overcast / Intermittent rain / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 9 x panels of geomembrane (P39-P47). Pre-fabricating pipe boots for gas wells within the temporary capping area. Deploying temporary surcharge & sandbags along open edges at end of shift.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	Progress meeting & site walk-over: A.Zachary (Environment Agency), M.Lancaster, P. Taberner, M Songo & A.Kirk (FCC), M.Davies (Jones Bros.) T.Proctor (Infinis), M.White (Egniol).	
Health and Safety	Near miss: Dragon lining fusion welded 2 x panels together, the weld extended into the 2.2m DSEAR zone (Temporary 3A Capping Works).	
Visitors to Site	As at progress meeting.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Saturday 22 nd September 2012	
Weather	Previous Night	Rain.
	a.m	Bright / Dry / Light breeze.
	p.m	Bright / Dry / Light breeze.
Site Hours:	07:00 – 14:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Trucks + Operators. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	Cell 3A Capping Works: 210 excavator working with Dragon Lining, smoothing regulating layer, removing unsuitable materials & deploying geomembrane over the temporary capping area. Dragon Lining (Cell 3A Temporary Capping area) : Deployment of 23 x panels of geomembrane (P48-P70). Extrusion welding the temporary capping tie-in along the eastern section of the temporary capping area. Installing pipe boots (Temporary capping area). Deploying temporary surcharge & sandbags along open edges at end of shift.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase Capping 2012

Date	Monday 24 TH September 2012
Weather	Previous Night: a.m. p.m.
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.
Contract Works Undertaken	No works to Cell 3A capping works due to heavy & persistent rain.
Testing Undertaken	Visual inspection & photographs taken.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 25 th September 2012	
Weather	Previous Night	Heavy rain.
	a.m	Overcast / Heavy rain.
	p.m	Overcast / Heavy rain.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman. 1 x Cat D6R Dozer + Operator.	
Contract Works Undertaken	No works to Cell 3A capping works due to heavy & persistent rain.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 26 th September 2012	
Weather	Previous Night	Heavy rain.
	a.m	Overcast / Intermittent rain / Light winds.
	p.m	Overcast / Intermittent rain / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out due to weather conditions. <u>Dragon Lining:</u> Installation of 1 x pipe boot (Temporary capping area). Filling sandbags – no further works carried out due to adverse weather conditions.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	C. Enston (Jones Bros – Site Agent).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 27 th September 2012
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.
Contract Works Undertaken	<u>Jones Bros:</u> Commenced with the deployment of surcharge tyres over the temporary capping area. Tyres tied together with 12mm rope, placed along each panel of geomembrane & spaced 2m apart, ropes tied to steel pins & anchored into the temporary / permanent anchor trench. <u>Dragon Lining:</u> Installation of 3 x pipe boots (Temporary capping area).
Testing Undertaken	Visual inspection.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	H. Wheldon (Jones Bros).
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 28 th September 2012	
Weather	Previous Night	Heavy rain.
	a.m	Sunny spells / Showers.
	p.m	Sunny spells / Showers / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out – working on Cell 3. <u>Dragon Lining:</u> Repairing geomembrane along the north flank temporary capping tie-in. <u>PM Surveys:</u> Surveying geomembrane panels over the temporary capping area.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	C.Enston & H.Edwards (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 1 st October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Light winds
	p.m	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out – working on Cell 3. <u>Dragon Lining:</u> No works carried out – working on Cell 3.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	C. Enston (Jones Bros - Engineer).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 2 nd October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Moderate winds.
	p.m	Sunny spells / Heavy showers / Moderate winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> 2 x groundworkers deploying surcharge tyres over the temporary capping area. No further works carried out – working on Cell 3.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	C. Enston (Jones Bros - Engineer).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 3 rd October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Light winds.
	p.m	Sunny spells / Rain / Moderate winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros: 2 x groundworkers continue to deploy surcharge tyres over the temporary capping area. No further works carried out – working on Cell 3.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	H. Wheldon & C. Enston (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 4 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Dry / Light winds.
	p.m	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> 2 x ground-workers continue to deploy surcharge tyres over the temporary capping area. No further works carried out – working on Cell 3.	
Testing Undertaken	Visual inspection.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	H. Wheldon & C. Enston (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 5 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Dry / Light winds.
	p.m	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros: 2 x ground-workers continue to deploy surcharge tyres over the temporary capping area. <u>Geomembrane Panel 33 / Existing Extrusion Weld Repair.</u> Leachate was found to be seeping from a defect in the extrusion weld between panel 33 & the existing geomembrane. A 4m x 4m section of geomembrane was removed. The regulating layer was removed & the waste was excavated to 1m depth, the waste was transported to the active tipping area. Drainage aggregate was then placed into the void & the regulating layer replaced. Dragon Lining carried out a trial weld (TW17) & installed a 5m x 5m panel (PR19) which extended over the extrusion tie-in weld. A destructive sample (DS17) from the trial weld was taken for laboratory testing.	
Testing Undertaken	Visual inspection. 1 x Trial Weld (TW17). 1 x Destructive sample (DS17).	
Meetings/ Correspondence	Progress meeting & site walk-over: A. (Environment Agency), M.Lancaster, P. Taberner, M Songo & A.Kirk (FCC), M.Davies (Jones Bros.) T.Prosser (Infinis), M.Burrow & M.White (EEL).	
Health and Safety	No issues.	
Visitors to Site	As at progress meeting, also: H. Wheldon & C. Enston (Jones Bros).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 8 th October 2012.	
Weather	Previous Night	Rain.
	a.m.	Overcast / Dry / Light winds.
	p.m.	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros: Continued with the deployment of surcharge tyres over the temporary capping area, the tyres were secured with steel pins, tied together at 2.5m intervals & spaced 1 panel width apart. No further works carried out.	
Testing Undertaken	Visual inspection & photographs taken.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Tuesday 9 th October 2012.	
Weather	Previous Night	Dry.
	a.m	Overcast / Dry / Light winds.
	p.m	Sunny spells / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 No. Labourer / Banks man. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros Completed the deployment of 1000mm capping soils over the final section of the permanent capping area. The soils were transported from the Phase1C stockpile to the capping area. 210 excavator pre-loading soils over the geotextile, D61 dozer grading & profiling soils to depth. Banks man present at all times guiding dump-trucks & removing any oversize / unsuitable materials as the soils are placed. Dragon lining Deployment of 6 x panels of geotextile over the geomembrane (G63 – G68). Heat bonding seams with a minimum of 300mm down the slopes & a minimum of 500mm across the slope.	
Testing Undertaken	Visual inspection. Visual inspection of geotextile overlaps & heat bonding.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Wednesday 10 th October 2012.	
Weather	Previous Night	Dry.
	a.m	Overcast / Dry / Light winds.
	p.m	Overcast / Dry / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Yanmar C50R Tracked Mini-dumper. 1 x Komatsu D61 Dozer. 2 No. Labourers / Banks men. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out, all plant working on Cell 3 capping area.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 11 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Overcast / rain / Light winds.
	p.m	Overcast / Heavy rain / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Yanmar C50R Tracked Mini-dumper. 1 x Komatsu D61 Dozer. 2 No. Labourers / Banks men. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out, all plant working on Cell 3 capping area.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 12 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Overcast / Dry / Light winds.
	p.m	Sunny spells / Showers / Light winds.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Yanmar C50R Tracked Mini-dumper. 1 x Komatsu D61 Dozer. 2 No. Labourers / Banks men. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros: No works carried out, all plant working on Cell 3 capping area.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Saturday 13 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Light winds.
	p.m	Sunny spells / Showers / Light winds.
Site Hours:	07:00 – 13:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	13:00	
CQA Departure Time:	13:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 1 No. Volvo A30 Dump-Truck + Operator. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Yanmar C50R Tracked Mini-dumper. 1 x Komatsu D61 Dozer. 2 No. Labourers / Banks men. 1 No. Site Foreman.	
Contract Works Undertaken	<u>Jones Bros:</u> No works carried out, all plant working on Cell 3 capping area.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 15 th October 2012.	
Weather	Previous Night	Rain.
	a.m	Sunny spells / Showers / Light winds.
	p.m	Sunny spells / Showers / Light winds.
Site Hours:	07:00 – 13:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operator. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Yanmar C50R Tracked Mini-dumper. 1 x Komatsu D61 Dozer. 2 No. Labourers / Banks men. 1 No. Site Foreman.	
Contract Works Undertaken	Jones Bros: No works carried out, all plant working on Cell 3 capping area. No further works due to be carried out until the geomembrane lining crew return to site to complete the temporary capping area.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 19 th October 2012.	
Weather	Previous Night	Dry.
	a.m	Sunny spells / Dry / Light breeze.
	p.m	Sunny spells / Dry / Light breeze.
Site Hours:	07:00 – 13:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operators. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Komatsu D61 Dozer. 1 No. Labourer / Banks man. 1 No. Site Foreman. Jones Bros – 3 x Lining Crew.	
Contract Works Undertaken	<u>Jones Bros:</u> <u>Cell 3A temporary Capping works:</u> Jones Bros lining crew completed the deployment of geomembrane to the western flank of the temporary capping area. Completed the tie-in to existing geomembrane along the western flank.	
Testing Undertaken	None.	
Meetings/ Correspondence	Progress meeting & site walkover _ M.Lancaster, M.Songo & P.Taberner (FCC). M.Davies (Jones Bros). T.Ashton & M.White (EEL).	
Health and Safety	No issues.	
Visitors to Site	As at progress meeting.	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Monday 22 nd October 2012.
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 18:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	18:00
CQA Departure Time:	18:00
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operators. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Komatsu D61 Dozer. 1 No. Labourer / Banks man. 1 No. Site Foreman. Jones Bros – 3 x Lining Crew.
Contract Works Undertaken	Jones Bros: Cell 3A Temporary capping Works: Jones Bros lining crew carried out the installation of 2 x pipe boots situated on the eastern flank of the temporary capping area & 3 x geomembrane repairs situated on the western flank of the temporary capping area.
Testing Undertaken	None.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Thursday 25 th October 2012.	
Weather	Previous Night	Dry.
	a.m	Overcast / Damp / Light breeze.
	p.m	Overcast / Damp / Light breeze.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operators. 1 x 6 Tonne Komatsu Mini-excavator. 1 x Komatsu D61 Dozer. 1 No. Labourer / Banks man. 1 No. Site Foreman. Jones Bros – 3 x Lining Crew.	
Contract Works Undertaken	<u>Jones Bros:</u> Cell 3A Permanent Capping Works: D61 dozer pushing composted soils from the stockpile situated at the toe of Cell 3A to the toe of the west facing side slope. The soils were then pushed up-hill over the lower section of the slope to slacken the gradient to less than 1:3. The soils were tracked in & sealed at the end of the shift.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	None.	
Comments	No works carried out to Cell 3A area on Tuesday 23 rd & Wednesday 24 th October 2012.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Friday 26 th October 2012.	
Weather	Previous Night a.m. p.m.	Dry. Dry / Bright / Cold. Dry / Bright.
Site Hours:	07:00 – 18:00	
Contractors Arrival Time:	07:00	
CQA Arrival Time:	07:00	
Contractors Departure Time:	18:00	
CQA Departure Time:	18:00	
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operators. 1 x Komatsu D61 Dozer. 1 No. Labourer / Banks man. 1 No. Site Foreman. Dragon Lining – 3 x Lining Crew.	
Contract Works Undertaken	<u>Jones Bros:</u> <u>Cell 3A Permanent Capping Works:</u> Continue to push composted soils from the stockpile situated at the toe of Cell 3A to the toe of the west facing side slope. The soils were then pushed up-hill over the lower section of the slope to slacken the gradient to less than 1:3. The soils were tracked in & sealed at the end of the shift. <u>Temporary capping Works:</u> <u>Dragon Lining:</u> Completed 4 x geomembrane repairs along the south toe & along the base of the western flank temporary to permanent anchor trench. <u>Jones Bros:</u> Backfilling a 12m section of the western flank temporary to permanent anchor trench. 210 placing clay into the anchor trench & compacting.	
Testing Undertaken	None.	
Meetings/ Correspondence	None.	
Health and Safety	No issues.	
Visitors to Site	T.Ashton (Egniol).	
Comments	None.	

CQA Inspector's Daily Report

Site Name: Llanddulas

Project: Phase 3A Capping 2012

Date	Saturday 27 th October 2012.
Weather	Previous Night a.m p.m
Site Hours:	07:00 – 13:00
Contractors Arrival Time:	07:00
CQA Arrival Time:	07:00
Contractors Departure Time:	13:00
CQA Departure Time:	13:00
Contractors Plant / Resources Utilised	Jones Bros. 2 No. PC210 Excavators + Operators. 2 No. Volvo A30 Dump-Truck + Operators. 1 x Komatsu D61 Dozer. 2 No. Labourer / Banks man. 1 No. Site Foreman.
Contract Works Undertaken	<u>Jones Bros:</u> Cell 3A Permanent Capping Works: Continue to push composted soils from the stockpile situated at the toe of Cell 3A to the toe of the west facing side slope. The soils were then pushed up-hill over the lower section of the slope to slacken the gradient to less than 1:3. The soils were tracked in & sealed at the end of the shift. <u>Temporary capping Works:</u> <u>Jones Bros:</u> Completed the deployment of surcharge tyres over the western flank geomembrane.
Testing Undertaken	None.
Meetings/ Correspondence	None.
Health and Safety	No issues.
Visitors to Site	None.
Comments	None.

Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

Site Photographs

PHOTOGRAPHIC LOG

Plate No.	Description
1	Placement of regulating material layer.
2	Trimming and profiling of regulating layer material.
3	Trimming and profiling of regulating layer material.
4	Fusion welding of 1.0mm LLDPE geomembrane.
5	Fusion welding of 1.0mm LLDPE geomembrane.
6	Extrusion welding of 1.0mm LLDPE geomembrane at tie-in.
7	General view of deployed geomembrane layer.
8	General view of deployed geomembrane layer.
9	Deployment of geotextile layer.
10	Heat bonding of geotextile material.
11	General view of deployed geotextile layer.
12	Placement of restoration soils.

Plate 1



Plate 2



Plate 3



Plate 4



Plate 5



Plate 6



Plate 7



Plate 8



Plate 9



Plate 10



Plate 11



Plate 12



**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**

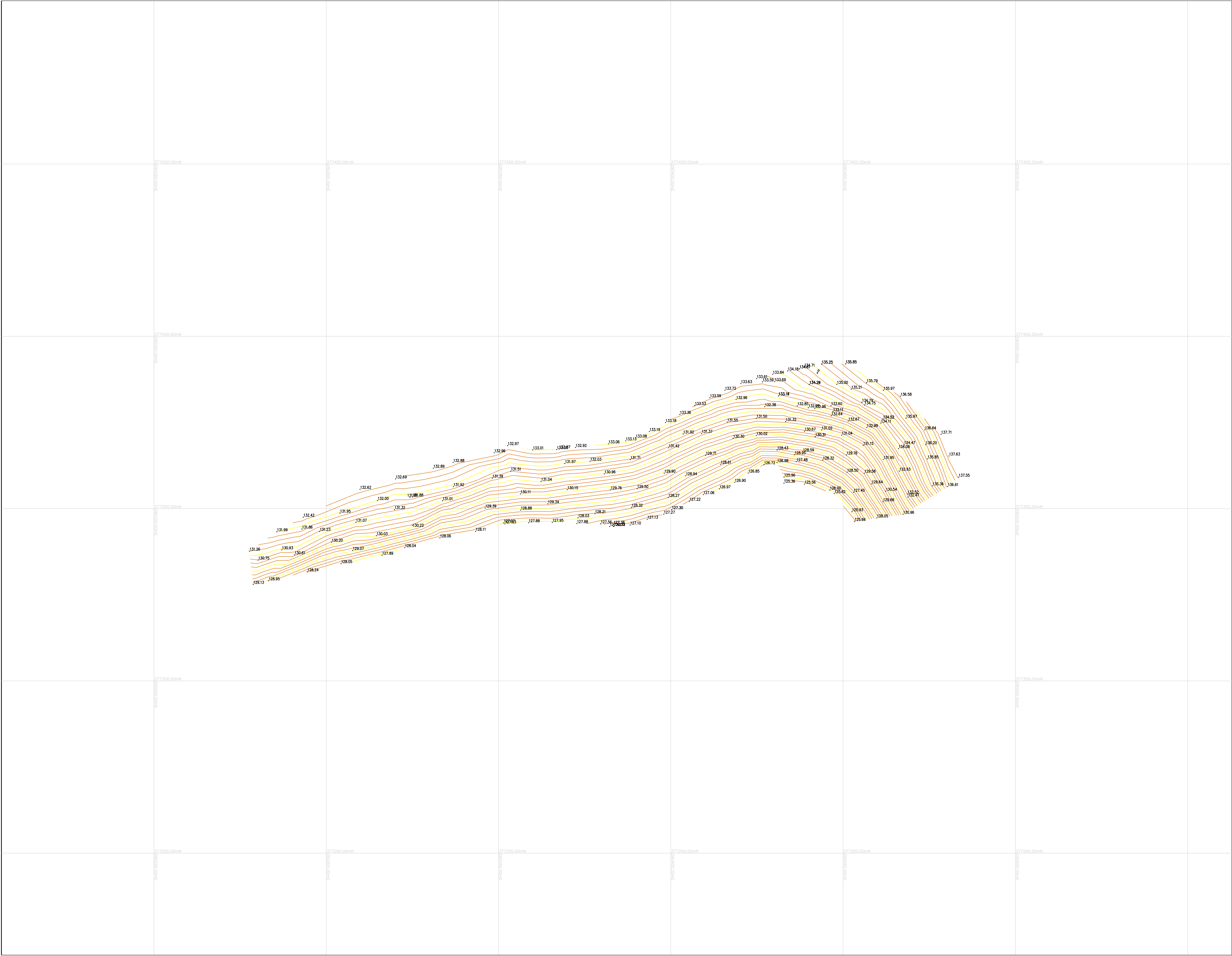


Llanddulas Landfill Site

Construction Quality Assurance Report

Phase 3A Capping Works 2012

As Built Survey Drawings



Site Grid North

Revision Information

Rev	Date	Description
1		
2		

DO NOT SCALE FROM THIS DRAWING.

NOTES

Co-ordinates and Levels related to Original site survey control provided by Jones Bros.

Distance Survey Bench Mark Used

Location	Type	Value
1		
2		

PM Surveys UK Ltd
Unit 4, Expressway Business Park
Station Road, Queensferry
Flinshire, CH5 2TF
Tel: 01244 821777 Fax: 01244 821002
Email: info@pmsurveys.co.uk

Client Info

Jones Brothers
Denbigh Road
Ruthin
Denbighshire. LL15 2TN

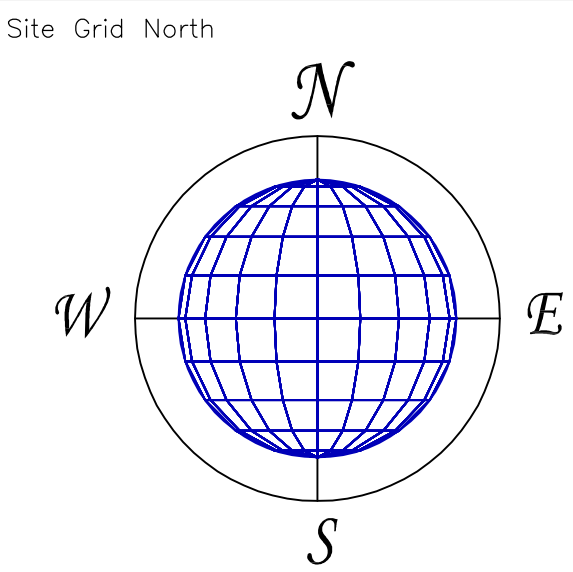
Tel: 01824 703661
Email: mike@jones-bros.com

Project

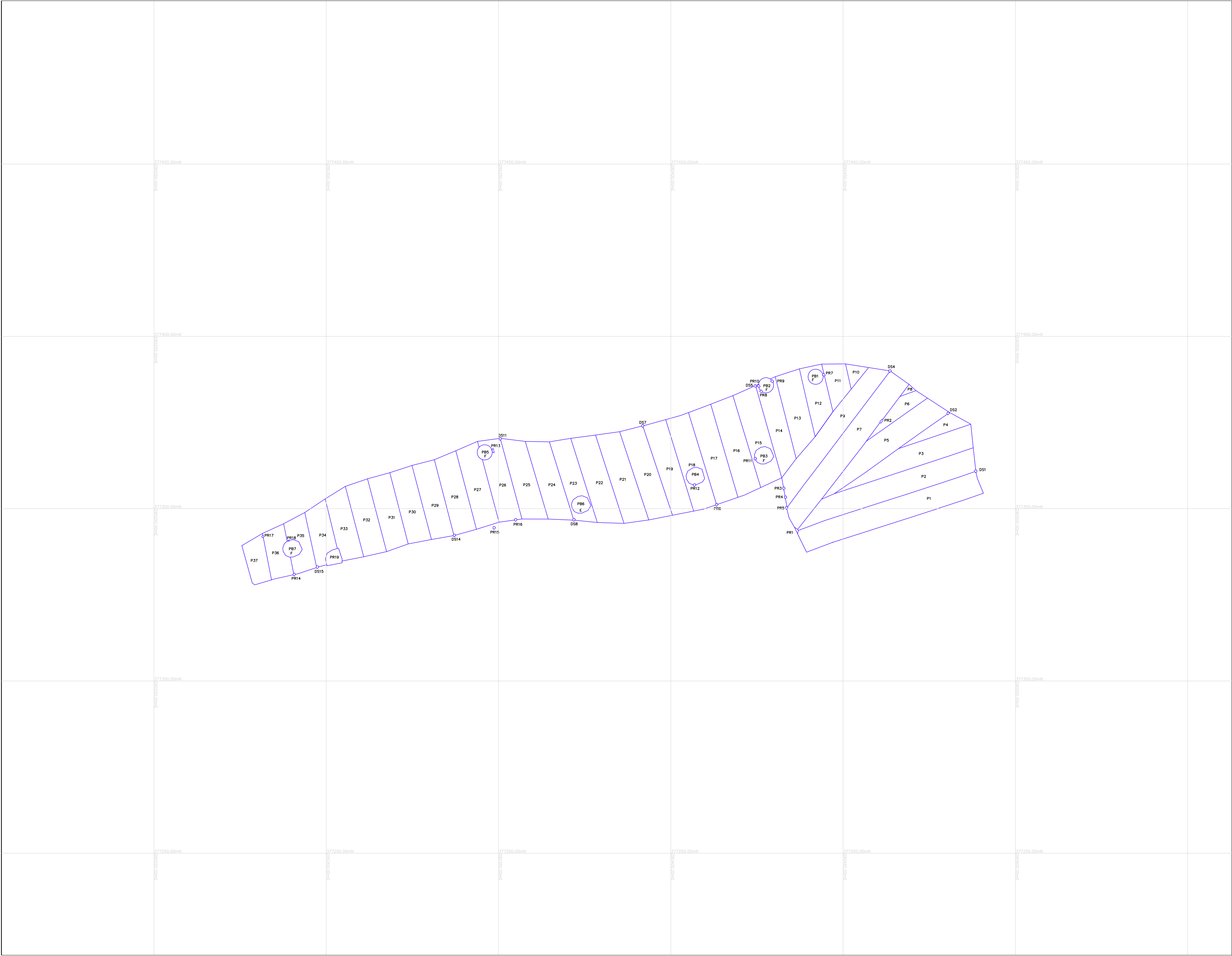
Cell 3A OGL Survey

LLandulas Landfill

Project No	Sheet	Surveyed By
PMS12168	A1	II
	Scale: 500	Drawn By: II
		Approved By: JMT
Dwg: PMS12168-06		Issued: 14/10/2012



Dwg PMS12168-03 Issued: 12/11/2012



Site Grid North

Revision Information

Rev	Date	Description
1		
2		

DO NOT SCALE FROM THIS DRAWING.

NOTES

Co-ordinates and Levels related to Original site survey control provided by Jones Bros.

Distances Surveyed From

Location	Type	Value
1		
2		

PM Surveys UK Ltd
Unit 4, Expressway Business Park
Station Road, Queensferry
Flinshire, CH5 2TF
Tel: 01244 821777 Fax: 01244 821002
Email: info@pmsurveys.co.uk

Client Info

Jones Brothers
Denbigh Road
Ruthin
Denbighshire, LL15 2TN

Tel: 01824 703661
Email: mike@jones-bros.com

Project

Cell 3A LDPE Geomembrane
Panel Layout
LLandulas Landfill

Project No

PMS12168

Sheet

A1

Scale

500

Surveyed By

II

Drawn By

II

Approved By

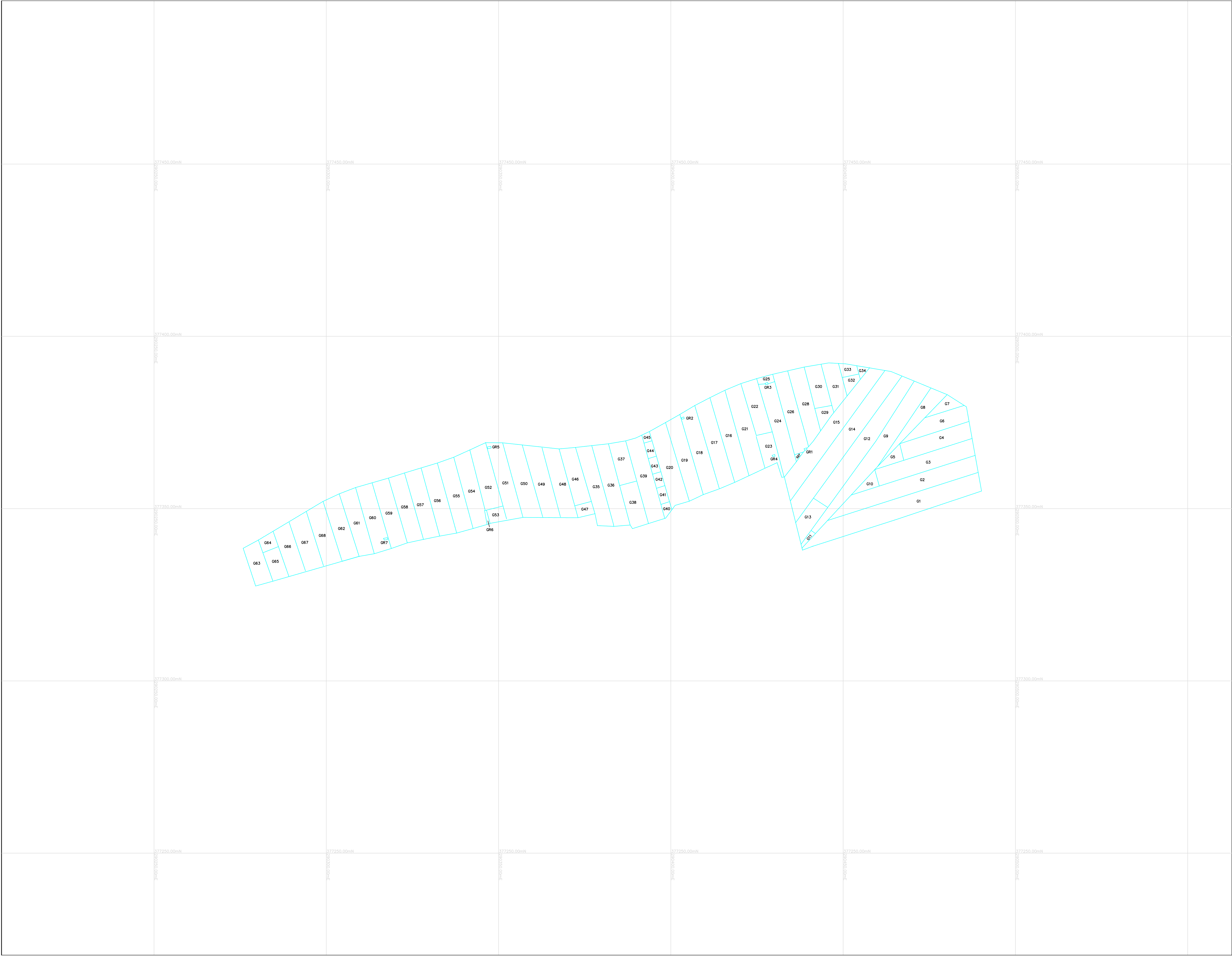
JMT

Dwg

PMS12168-01

Issued

16/10/2012



Site Grid North

Revision Information		
Rev	Date	Description
DO NOT SCALE FROM THIS DRAWING.		

NOTES

Co-ordinates and Levels related to Original site survey control provided by Jones Bros.

Distances Survey Bench Mark used		
Location	Type	Value
1		
2		

PM Surveys UK Ltd
Unit 4, Expressway Business Park
Station Road, Queensferry
Flinshire, CH5 2TF
Tel: 01244 821777 Fax: 01244 821002
Email: info@pmsurveys.co.uk

Client Info

Jones Brothers
Denbigh Road
Ruthin
Denbighshire, LL15 2TN

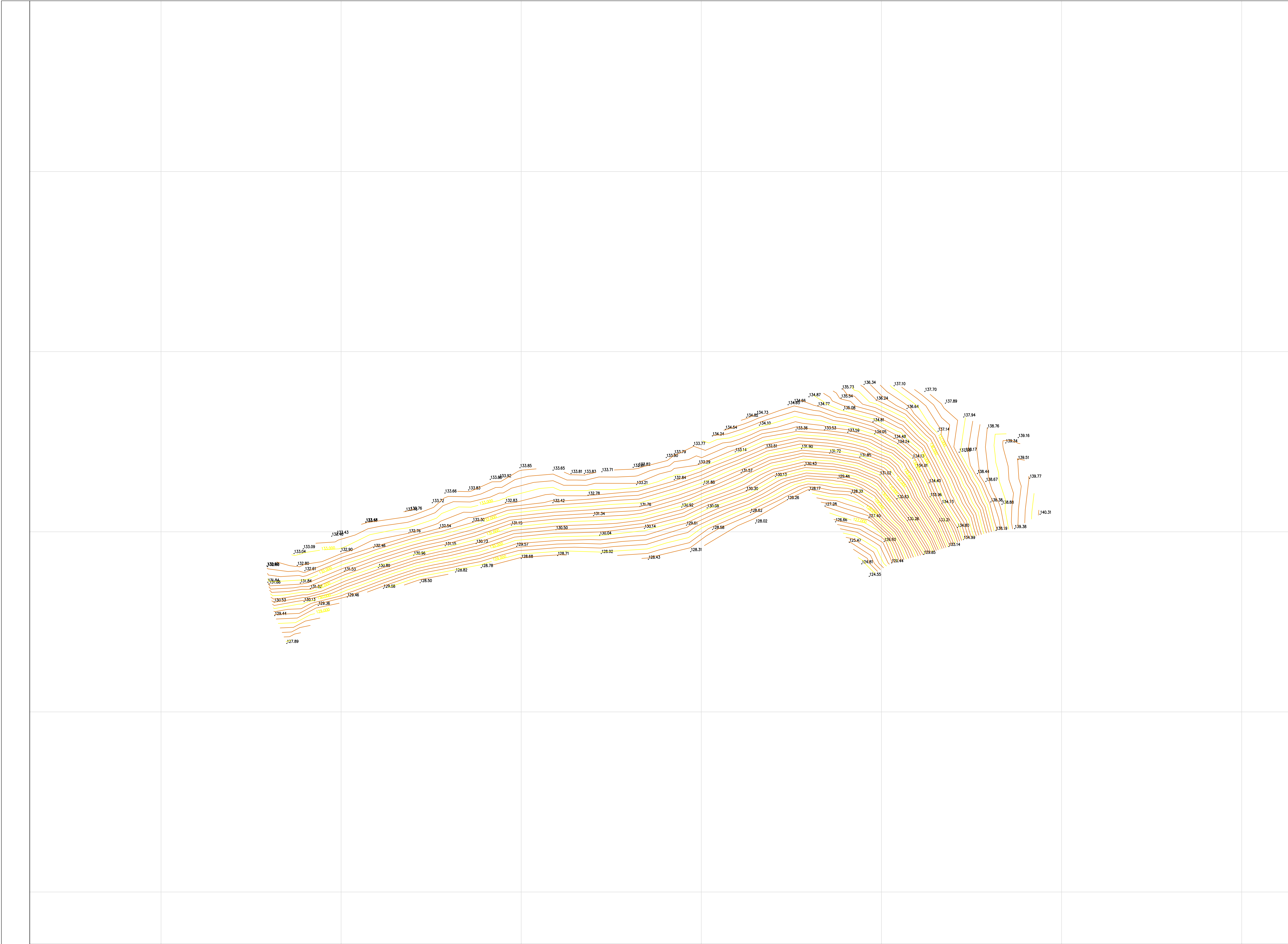
Tel: 01824 703661
Email: mike@jones-bros.com

Project

Cell 3A Geotextile Panel Layout

Llandulas Landfill

Project No	Sheet	Surveyed By
PMS12168	A1	II
Dwg	Scale	Drawn By
PMS12168-02	500	II
	Approved By	JMT
	Issued	16/10/2012



Site Grid North

Revision Information		
Rev	Date	Description

NOTES

Co-ordinates and Levels related to Original site survey control provided by Jones Bros.

Distance Survey Bench Mark used		
Location	Type	Value
1		
2		

PM Surveys UK Ltd
Unit 4, Expressway Business Park
Station Road, Queensferry
Flinshire, CH5 2TF
Tel: 01244 821777 Fax: 01244 821002
Email: info@pmsurveys.co.uk

2: \085_2012\PM012101 - 12200\PM012170a - Arpley Landfill\Visualised Data\Visp01.jpg

Client Info

Jones Brothers
Denbigh Road
Ruthin
Denbighshire. LL15 2TN

Tel: 01824 703661
Email: mike@jones-bros.com

Project

Cell 3A Capping Soil Levels

LLandulas Landfill

Project No	Sheet	Surveyed By
PMS12168	A1	II
	Scale: 500	Drawn By: II
		Approved By: JMT
Dwg: PMS12168-04		Issued: 12/11/2012

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



North Wales Office:

Tre Felin

Bangor

Gwynedd

LL57 4LH

T: 01248 355 996

F: 01248 371 996

Cheshire Office:

Mere View Farm Offices

Park Lane, Pickmere

Near Knutsford, Cheshire

WA16 0LG

T: 01565 732 930

F: 01565 732 931

www.egniol.com

APPENDIX 2

APPENDIX 3

CQA Inspector's Daily Report

Site Name:

Project:

Date	
Weather	Previous Night a.m p.m
Site Hours:	
Contractors Arrival Time:	
CQA Arrival Time:	
Contractors Departure Time:	
CQA Departure Time:	
Contractors Plant / Resources Utilised	
Contract Works Undertaken	
Testing Undertaken	
Meetings/ Correspondence	
Health and Safety	
Visitors to Site	
Comments	

For Egniol Environmental Ltd: _____

Site:
Project:
Material:

[illegible]

Geomembrane Destructive Testing and Sampling Record

Project:

[illegible]

Landfill Site:
Project:

[illegible]

Key for Defect Codes		
APT:	Air Pressure Test Hole	BT: Boot
BO:	Welder Burn Out	PT: Protrusion
DS:	Destructive Sample	
FS:	Failed Seam	
INT:	Panel Intersection	
IO:	Insufficient Overlap	
PD:	Panel Damage	
WR:	Wrinkle	
WS:	Welder Restart	

**ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY**



North Wales Office:

Tre Felin

Bangor

Gwynedd

LL57 4LH

T: 01248 355 996

F: 01248 371 996

Cheshire Office:

Mere View Farm Offices

Park Lane, Pickmere

Near Knutsford, Cheshire

WA16 0LG

T: 01565 732 930

F: 01565 732 931

www.egniol.com