
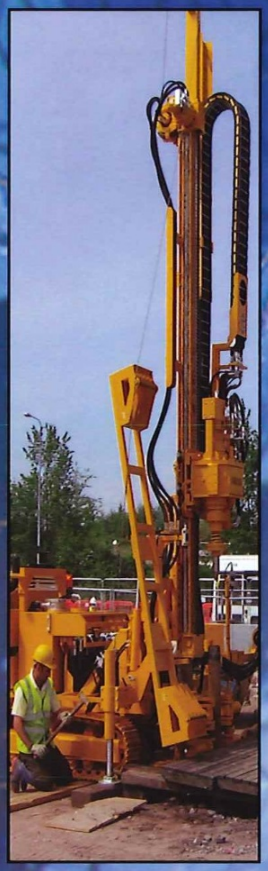


TerraConsult

February 2016
Report No 2651-R01-01 SRA

STANDARD ROAD LANDFILL SITE STABILITY RISK ASSESSMENT

Carried out for:

Sir y Fflint
Flintshire

STANDARD ROAD LANDFILL SITE

STABILITY RISK ASSESSMENT

Date: 12th February 2016

Carried Out For:

Sir y Fflint
Flintshire

Prepared By:

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DOCUMENT INFORMATION AND CONTROL SHEET

Document Status and Approval Schedule

Report No.	Title
2651/R/01-SRA	**Standard Road Landfill Site** **Stability Risk Assessment**

Issue History

Issue	Status	Date		Signature	Date
1	**Draft**	**12.02.2016**	**Prepared and Approved By** A. Binns BSc CEng FICE ice Fellow		
			Checked By: C Eccles BSc MSc C Geol		

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bsi. ISO 9001 Quality Management FS573193

bsi. ISO 14001 Environmental Management EMS573194

STANDARD ROAD LANDFILL SITE
STABILITY RISK ASSESSMENT

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STANDARD ROAD LANDFILL SITE

STABILITY RISK ASSESSMENT

INTRODUCTION

Preface

1. Two earlier reports by TerraConsult (0987/SRA001 dated June 2011 and 1588/R/001-2 SRA dated July 2012) have considered the stability of the Standard Road Landfill Site, Buckley, North Wales.

2. A stockpile of material (in excess of 5 m in height) had been placed on the finished cap of the landfill (adjacent to and to the north east of the site's car park area) by West Pennine Ltd (a previous tenant who has ceased trading). The stockpile materials comprise the rejected material from their former reclamation activities.

3. TerraConsult Limited produced a strategy for the removal of the stockpile of material which had been found to contain asbestos. The strategy (see Appendix A) was produced to allow the safe removal of the stockpile which was excavated, then large and deleterious material removed and the remaining stockpile material was spread on the top plateau of the landfill cap and covered with inert soil.

4. TerraConsult Limited carried out a further assessment (see Appendix B) to demonstrate that the spreading of the stockpile material at 1 m thickness over the "virgin" areas of the cap would not cause rupture of the capping.

5. TerraConsult Ltd (TCL) was instructed by Flintshire County Council to undertake this Stability Risk Assessment (SRA) to examine the stability of the steeper North West flank of the landfill immediately beneath the area of the former stockpile.

6. This SRA report addresses the stability of the North West flank of the landfill considering:

    a. Global stability of the waste mass and landfill side slope.
    b. Global stability of the capping ie the restoration layers and the geosynthetic capping layers.

7. The site description, geology and hydrogeology have been taken from the earlier SRA reports to which reference should be made for a more detailed treatment.

Site Location and Description

8. Standard Landfill is located 1.0 km northeast of Buckley town centre. The entrance to the site is from Standard Road, which lies to the west. Mount Pleasant Road follows the southern boundary of the site. The site is located in the Borough/District of Flintshire, in the county of Clwyd.

9. The site is centred on National Grid Reference 329035 364995 (short reference SJ 290 649); Latitude 53º10'38.31"N, Longitude 3º3'47.65"W. A site location plan is provided as Drawing 2651/1/001.

10. During its operational period the site was permitted to accept commercial, industrial and domestic wastes. The waste was disposed of into eight landfill cells, each of which was provided with a containment lining system formed from engineered clay.

11. Since the completion of landfilling in September 2005, the site has been restored to its planned final elevation (work completed in 2006). The restored landform is a broad dome with a maximum elevation of approximately 152 mOD in the centre of the site, falling to around 125-130 mOD on its northwest and northeast boundaries, around 130-137 mOD on the southeast side (towards Burntwood Road) and around 127-140 mOD on the southwest boundary (by the industrial estate).

12. As discussed in paragraph 2, a stockpile of material (in excess of 5 m in height) had been placed on the finished cap of the landfill (adjacent to and to the north east of the site's car park area) by West Pennine Ltd (a previous tenant who has ceased trading). A site plan indicating the current site topography in the area of the stockpile is included as Drawing No. 2651/1/002.

REMOVAL OF THE STOCKPILE

13. The stockpile was removed in accordance with the removal strategy in Appendix B. The final landform is shown on Drawing No: 2651/1/003.

14. The sideslope capping outside the area of the (removed) stockpile comprises:

    a. 650 mm restoration soils over
    b. Protection geotextile over
    c. LLDPE double textured over
    d. blinding material and waste

15. In the area beneath the stockpile (after restoration0 the capping comprises:

    a. 500 mm restoration soils over
    b. 1000 mm stockpile material
    c. Protection geotextile over
    d. LLDPE double textured over
    e. blinding material and waste

ANALYSIS APPROACH

16. This stability risk assessment (SRA) has been carried out in accordance with the principles of EuroCode 7, which uses a partial factor method (on actions and strength), to determine the Over Design Factor (ODF).

17. EuroCode 7 is based on the principles of limit state design, whereby a design must ensure that no limit state is exceeded. With respect to the analyses presented in this report, the limit state of relevance is limit state GEO defined as "*failure or excessive deformation of the ground, in which the strength of soil or rock is significant in providing resistance*", e.g. global stability of the landfill, bearing capacity of foundation soils.

18. Each limit state requires different partial factors to be used in the analysis. These are presented in the spreadsheet provided in Appendix B. It should be noted that the approach adopted in the UK for limit state GEO (Design Approach 1) requires two combinations of partial factors to be analysed as follows:

Combination 1 A1 + M1 + R1

Combination 2 A2 + M2 + R1

Where;

A = Partial factors on actions (applied forces and moments);
M = Partial factors on soil parameters; and
R = Partial factors on resistances.

19. The values of various sets of partial factors that are applied to characteristic actions (A1 and A2), characteristic material strengths (M1 and M2) and resistances (R1) vary depending upon whether they are favourable or unfavourable to the stability of the structure. Note: Only Combination 2 is considered in this assessment because any imposed loadings are negligible compared to the soil masses.

20. When considering a limit state of rupture or excessive deformation EuroCode 7 requires that $E_d \leq R_d$ where:

E_d = design value of effect of actions (forces) and
R_d = design value of the resistance to actions

The ratio R_d / E_d can be defined as the Over Design Factor and stability is demonstrated when the ODF $\geq$ 1.00. Hence, for each limit state considered, ODF's $\geq$ 1.00 are required for the construction to be considered stable (i.e. safe).

Computer Software

21. The analysis of global stability was undertaken using the computer programme *FLAC/Slope* (version 7), which utilises the finite difference method of analysis. *FLAC/Slope* offers many advantages over traditional limit equilibrium based programmes.

i. Limit equilibrium codes use an approximate scheme (typically based on the method of slices) in which a number of assumptions are made (eg the location and angle of the interslice forces). Several assumed failure surfaces are tested (often many hundreds), and the one giving the lowest factor of safety is chosen. Equilibrium is only satisfied on an idealised set of surfaces.

ii. In contrast, *FLAC/Slope* provides a full solution of the coupled stress/displacement, equilibrium and constitutive equations. Given a set of properties, the system is determined to be stable or unstable. By automatically performing a series of simulations while changing the strength properties (strength reduction technique), the factor of safety (= ODF in these analyses) can be found to correspond to the point of stability and the critical failure (slip) surface can be located. Hence:

1. Any failure mode develops naturally; there is no need to specify a range of trial surfaces in advance.
2. No artificial parameters (eg functions for interslice force angles) need to be given as input.
3. Multiple failure surfaces (or complex internal yielding) evolve naturally, if the conditions give rise to them.

The solution consists of mechanisms that are kinematically feasible whereas the limit equilibrium method considers only forces and not kinematics

MATERIAL PROPERTIES

Soil Shear Strength

22. Material properties used in the slope stability analysis (using FLAC computer software) and assessment are derived from the trial pit photographs (Appendix A), TCL experience and published values (EA Technical report P1-385/TR1, Ref 6). A summary of the characteristic densities and shear strength parameters for the material types is presented in Table 1.

23. Only long term (i.e. effective) strength parameters have been considered in the analyses as the slope has been in existence for some time.

24. The parameters listed in Table 1 represent the conservative characteristic values selected for the stability assessment.

25. In accordance with EuroCode 7 partial factors have then been applied to obtain the design values for Combination 2 used which are also presented in Table 1.

Note: Only Combination 2 is considered in this assessment of slope stability because any imposed loadings are negligible compared to the soil masses. No partial factors are applied to parameters in serviceability (settlement) analysis.

Table 1: EC7 Characteristic and Design Combination 2 material parameters

Material	EC7 Characteristic material parameters			EC7 Design Combination 2 material parameters			Unit weight (kN/m^3)		Source
	Undrained	Effective stress		Undrained	Effective stress				
	$c_{u\,k}$ kPa	c'_k kPa	ϕ'_k deg	$c_{u\,des}$ kPa	c'_{des} kPa	ϕ'_{des} deg	Moist γ_d kPa	Sat'd γ_{sat} kPa	
Waste - MSW		5 & 50	25 & 50		4 & 40	20.5 & 41	11	14	TCL Experience and EA TR1
Waste - Stockpile		2.5	33		2	27.5	18	20	Photos & TCL Experience
Restoration Soil/ Cohesionless capping		1.25	31.4		1	26	17	18	Specification & TCL Experience
Weathered Coal Measure Mudstone		50	25.9		40	21.3	22	23	Cripps & Taylor, Bell
Interface	$\alpha_{u\,k}$	α'_k	ϕ'_k	$\alpha_{u\,des}$	α'_{des}	ϕ'_{des}			
Protection Geotextile/ LLDPE FML		6.9	25.8		5.5	21.1			EA TR1
Cohesionless Restoration Soil/ Protection Geotextile		4.4	32.5		3.5	27			EA TR1

GLOBAL STABILITY OF THE WASTE MASS AND LANDFILL SIDE SLOPE

26. The Flac section analysed is shown below and is based on Drawing No 2651/1/003 (Topographical Survey and Section A-A'). Section A-A' has been selected because it has the steepest sideslope (1 in 2.04) over that area of the restored landfill.

27. The basal liner was assumed at 120 m OD from the previous reports.

28. Leachate levels in the cell were taken centrally at 20 m above the basal liner (extremely conservative) in run 01 with the leachate rising to the toe of the restored slope for analysis Run 02.

SECTION A-A'

Analyses - Global Stability (GEO Limit State)

29. The outputs/results of the analyses are presented in Appendix A. In Appendix A the following should be considered when looking at the graphical outputs:
    a. The X axis represents the distance along the section in m x 10.
    b. The Y axis represents the reduced level of the various points in m x 10 at each distance along the section.
    c. Unfortunately the units of strain contours cannot be plotted to a common scale as they are fixed by the software depending upon the range of strains produced. What the plot is used to show is where the critical failure (sliding) surface would be ie where the highest strains are concentrated.

30. The results of the analyses are summarised in Table 2.

Table 2 - ODFs for Global Stability of Waste Sideslope Section A-A'

Section Run	Over Design Factor	"Old BS" Factor of Safety (approx.)	Comment on analysis result
A-A' 01	1.30	1.63	Long term (Effective) analysis. High leachate level. Critical slip surface shallow through sideslope to toe **SAFE**
A-A' 02	1.08	1.35	Long term (Effective) analysis. Extremely high leachate level. Critical slip surface deep through waste below toe **SAFE**

Notes:

The factor of safety quoted on the FLAC/Slope output sheets is the EC7 ODF in these analyses.
To obtain the approximate Factor of Safety in effective stress analyses with no surcharge loadings the ODF is multiplied by 1.25.
To obtain the approximate Factor of Safety in undrained analyses in clay with no surcharge loadings the ODF is multiplied by 1.40.

Assessment and Recommendations

31. The Over Design Factors (ODFs) are greater than 1.00 even with a high leachate level. The restored landfill is considered, therefore, to be safe.

32. This is reinforced by the fact that the restored area of the landfill is showing no signs of distress some 5 months after restoration works were completed in (September 2015). Appendix E contains photographs of the restored area taken on 17th February 2016 after several months of above average rainfall.

GLOBAL STABILITY OF THE CAPPING

33. This section considers the stability of the restoration layers and the geosynthetic capping layers. In order to consider only slips in the restoration soils and capping veneers the shear strength of the waste materials was set at a high value ie c'_k = 50 kPa and $\phi'_k = 50^o$.

34. The Flac section analysed is shown below and is a truncated version of Section A-A' based on Drawing No 2651/1/003 (Topographical Survey and Section A-A').

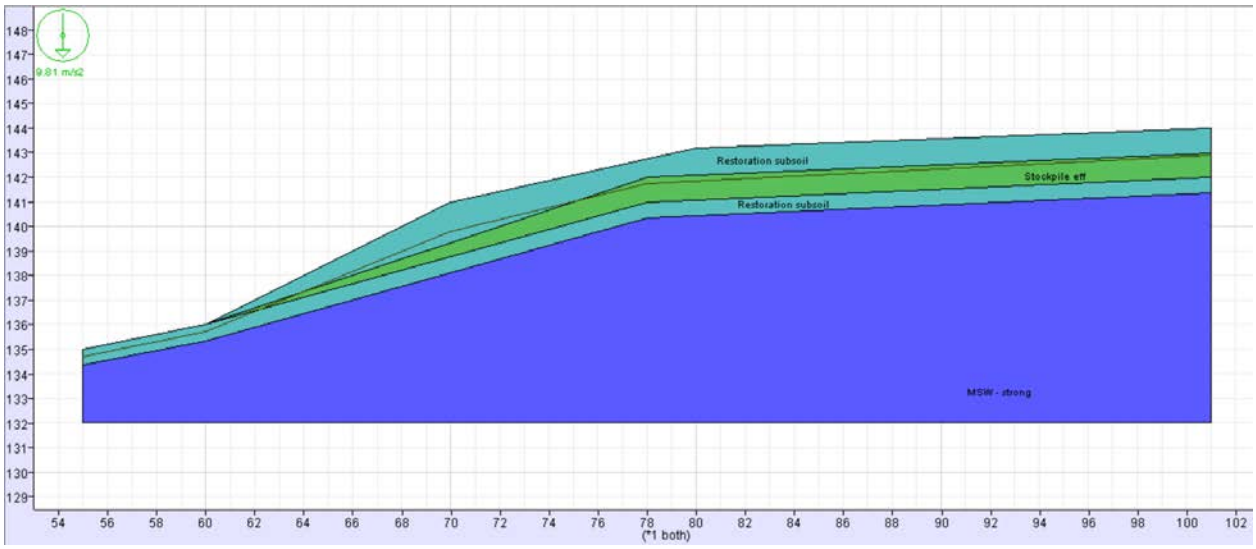
35. Water levels in the restoration soils were assumed as follows:

a. In Run 03 - No water
b. In Run 04 - Water in the cover soils above the FML equivalent to a PSR = 0.5
c. In Run 05 - Water in the cover soils above the FML equivalent to a PSR = 0.6
d. In Run 06 - Water in the cover soils above the FML equivalent to a PSR = 0.5
e. In Run 07 - Water in the cover soils above the FML equivalent to a PSR = 0.5

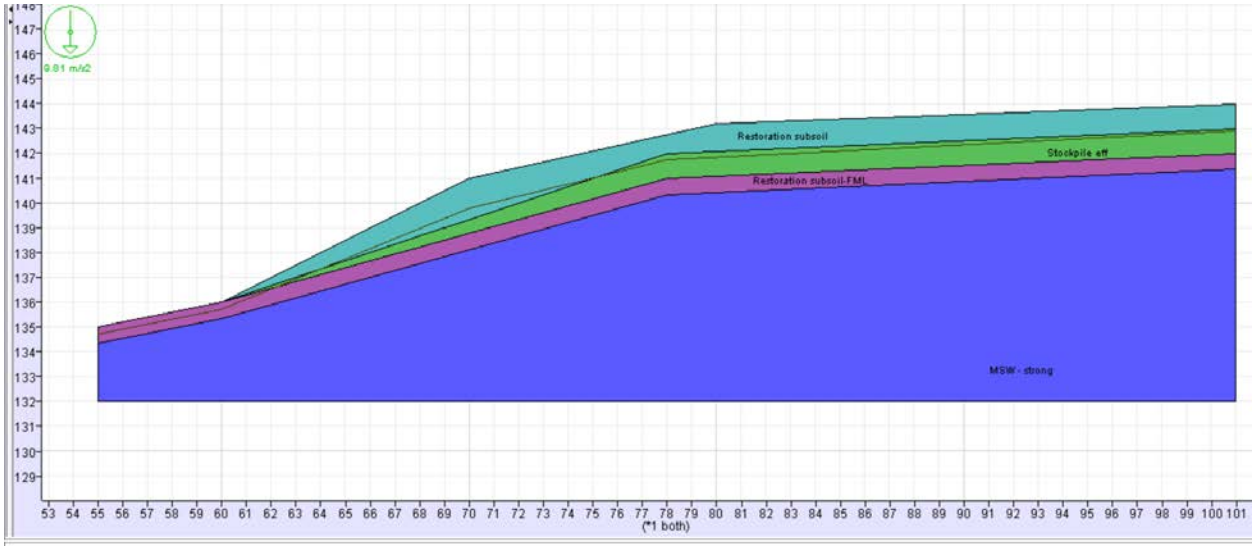
36. Runs 06 and 07 were used to investigate the veneer stability of the geosynthetics with the shear strength parameters of the Sandy– restoration subsoil being set to the interface

shear parameters of Protection Geotextile /FML and the Restoration Soil/ Protection Geotextile respectively.

Truncated Section A-A' with PSR = 0.5 Run 04



Truncated Section A-A' with PSR = 0.5 Runs 6 & 07



Analyses - Global Stability (GEO Limit State)

37. The outputs/results of the analyses are presented in Appendix A. In Appendix A the following should be considered when looking at the graphical outputs:
    d. The X axis represents the distance along the section in m x 10.
    e. The Y axis represents the reduced level of the various points in m x 10 at each distance along the section.
    f. Unfortunately the units of strain contours cannot be plotted to a common scale as they are fixed by the software depending upon the range of strains produced. What the plot is used to show is where the critical failure (sliding) surface would be ie where the highest strains are concentrated.

after several months of above average rainfall

38. The results of the analyses are summarised in Table 3.

Table 3 - ODFs for Global Stability of the Capping Section A-A'

Section Run	Over Design Factor	"Old BS" Factor of Safety (approx.)	Comment on analysis result
A-A' 03	1.27	1.59	Long term (Effective) analysis. No water in the capping Critical slip surface is shallow at surface of FML SAFE
A-A' 04	1.15	1.44	Long term (Effective) analysis. Water level in the capping equivalent to PSR = 0.5 Critical slip surface is shallow at surface of FML SAFE
A-A' 05	0.94	1.18	Long term (Effective) analysis. Water level in the capping equivalent to PSR = 0.6 Critical slip surface is shallow at surface of FML NOT SAFE
A-A' 06	1.22	1.53	Long term (Effective) analysis. Water level in the capping equivalent to PSR = 0.5 Critical slip surface is shallow at interface of Protection Geotextile /FML SAFE
A-A' 07	1.21	1.51	Long term (Effective) analysis. Water level in the capping equivalent to PSR = 0.5 Critical slip surface is shallow at interface of Restoration Soil/ Protection Geotextile SAFE

Notes:
The factor of safety quoted on the FLAC/Slope output sheets is the EC7 ODF in these analyses.
To obtain the approximate Factor of Safety in effective stress analyses with no surcharge loadings the ODF is multiplied by 1.25.
To obtain the approximate Factor of Safety in undrained analyses in clay with no surcharge loadings the ODF is multiplied by 1.40.

Assessment and Recommendations

39. The Over Design Factors (ODFs) are greater than 1.00 except when the equivalent PSR = 0.6 (high water level). This is not considered to be a major problem and the restored landfill is considered, therefore, to be safe.

40. This is reinforced by the fact that the restored area of the landfill is showing no signs of distress some 5 months after restoration works were completed in (September 2015). Appendix E contains photographs of the restored area taken on 17th February 2016 after several months of above average rainfall.

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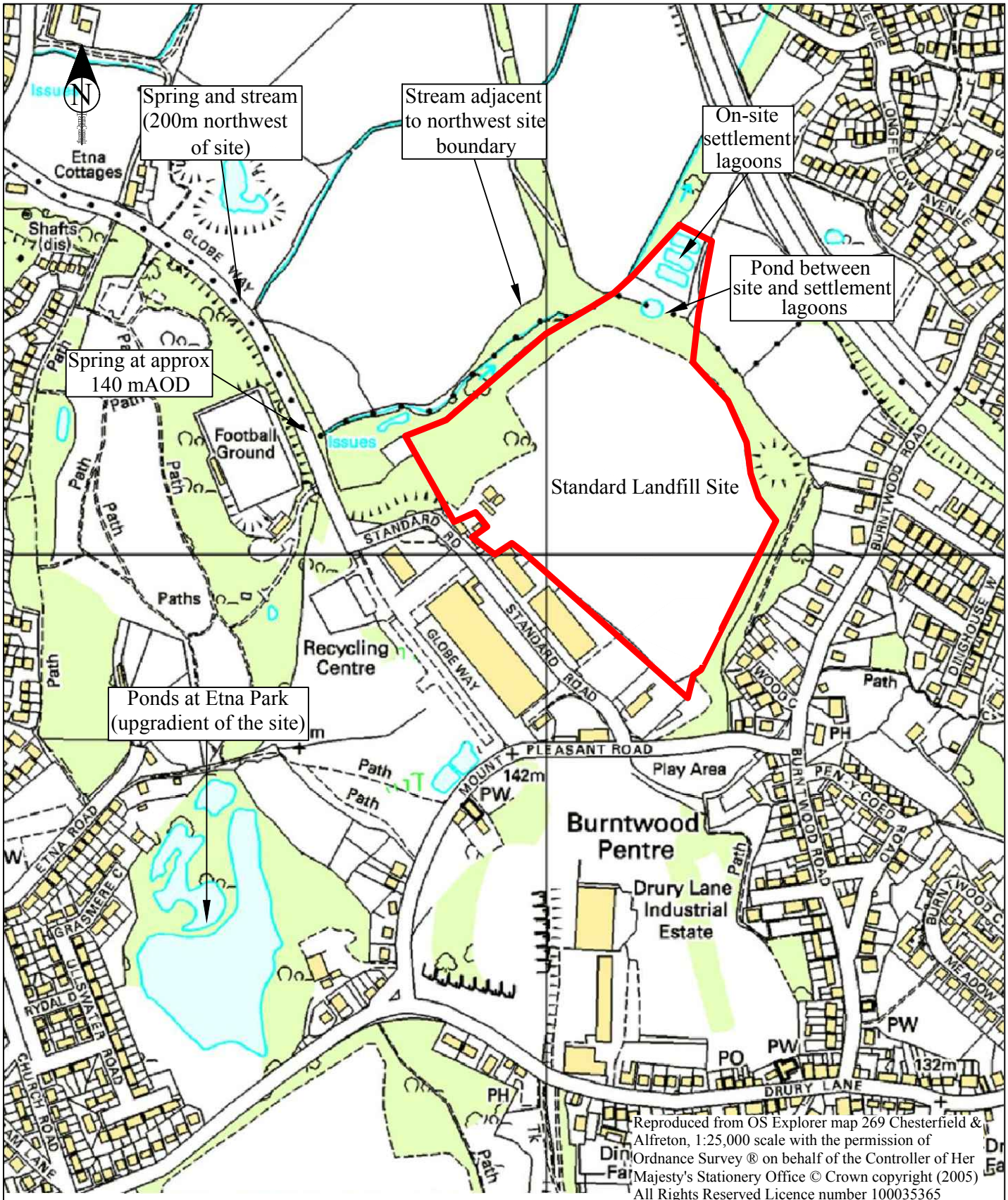
14. TerraConsult Limited Report No 1588/R/001-1 Stability Risk Assessment, July 2012

DRAWINGS

TERRACONSULT LIMITED DRAWINGS

2651/1/001	**Site Location**
2651/1/002	**Original survey**
2651/1/003	**Current Topographical Survey and Section A-A'**



TerraConsult

Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client: Sir y Fflint Flintshire

Site: **Standard Landfill**

Title: **Site Location Plan**

Scale	1:5,000	@ A4
Drawing No.	2651/1/001	
Rev / Date	Description	
File	26511001SiteLocPlan.dwg	
Date 02/16	Engineer AB	
Drawn JB	Checked AB	

Key

98 Existing Topography

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Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

Site

Standard Landfill

Title

Original Survey of Stockpile Area

Scale	1:500	@ A3
Drawing No.	2651/1/002	

Rev	Date	Description

File	26511002OriginalSurvey.dwg		
Date	02/16	Engineer	AB
Drawn	JB	Checked	AB

Section A-A'
(1:500)

Notes

1. Survey information provided by StafSurv. Drawing ref 8234A.dwg (Dated 12/11/2015)
2. Do not scale
3. Levels relate to site grid datum
4. Site grid shown

TerraConsult

Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client

Sir y Fflint Flintshire

Site

Standard Road Landfill Site

Title

Topographical Survey & Section A-A'

Scale	1:1,250 @ A2		
Drawing No.	2651/1/003		
Rev	Date	Description	
File	26511003TopSurvey&SectionAA.dwg		
Date	02/16	Engineer	AB
Drawn	JB	Checked	AB

Appendix A

TerraConsult Report 1936-R-01

Standard Landfill

Stockpile Removal Strategy dated May 2014

11th May 2014
Report No 1936R01-2

STANDARD LANDFILL

STOCKPILE REMOVAL STRATEGY

Carried out for: **Flintshire County Council**

STANDARD LANDFILL

STOCKPILE REMOVAL STRATEGY

Prepared for

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1936R01-2	STANDARD LANDFILL STOCKPILE REMOVAL STRATEGY

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1	Draft for Comment by Client	17/04/2014	**Prepared & Approved By:** A Binns BSc CEng FICE		18/04/2014
			Checked by: C S Eccles CGeol CSci, CEnv. RoGEP Adviser		18/04/2014
	Draft for Approval of EA	11/05/2014	**Prepared & Approved By:** A Binns BSc CEng FICE ice Fellow		12/05/2014
			Checked by: C S Eccles CGeol CSci, CEnv. RoGEP Adviser silc SPECIALIST IN LAND CONDITION Chris Eccles Reg. No 115s		12/05/2014

STANDARD LANDFILL
STOCKPILE REMOVAL STRATEGY

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STANDARD LANDFILL
STOCKPILE REMOVAL STRATEGY

INTRODUCTION

Background Information

1 TerraConsult Limited was commissioned by Flintshire County Council (FCC) to produce a strategy for the proposed removal of a stockpile of material at Standard Landfill Site, Buckley, North Wales. On completion of the removal a Verification Report will have to be completed and issued to the County Planning Authority.

2 The stockpile of material was placed on the finished cap of the landfill by West Pennine Ltd (a previous tenant who has ceased trading). The materials comprise the rejected material from their former reclamation activities.

3 All the stockpile material will be excavated, large and deleterious material removed and then spread on the top plateau of the landfill cap and covered with inert soil – see Section on Method sequence and Drawing No. 1936/1/004. Coarse fractions (e.g. concrete and brickwork) may be segregated, crushed and screened to provide suitable fill materials with a particle size of less than 150 mm.

4 This report has been designed to meet the requirements of DEFRA/Environment Agency Report CLR11 “Model Procedures for the Management of Land Contamination” together with other relevant guidance.

Aims and Objectives

5 Free fibres of asbestos have been identified within samples from the stockpile, although the quantities have been at or below the laboratory limit of detection. No discrete fragments of Asbestos Containing Materials (ACMs) were observed during site investigation works or detected in the laboratory analysis.

6 This Strategy will clarify the conditions and restraints on the re-use of the excavated materials containing asbestos, whilst ensuring that safe systems of work are implemented by the principal contractor in line with the Control of Asbestos Regulations 2012 (CAR) and the HSE’s Asbestos ACoP published in December 2013.

7 In addition, this Strategy also presents mitigation measures that must be implemented to protect future site users, and also outlines the records that should be maintained within the CDM Health and Safety File to inform future land owners of the locations of the re-engineered materials.

PREVIOUS SITE INVESTIGATIONS

8 An intrusive investigation has been carried out of the stockpile. Ten trial pits were excavated by FCC at the locations shown on the FCC Drawing No 6706a (Sample Location Layout). A representative selection of photographs of the trial pit spoil heaps is included in Appendix A to this report.

9 23 samples were sent to the laboratory for contamination testing and the test certificates are included as Appendix B to this report. The results indicated that there are relatively low concentrations of metallic and organic contaminants within the stockpile.

10 Four samples were tested for asbestos as some loose fibres were seen in the soil:

- 2 samples had traces of Amosite (brown) Asbestos fibres
- 1 sample had Amosite fibres detected
- 1 sample had Chrysotile (white) asbestos detected

The percentage of asbestos was not quantified in any of the samples.

HEALTH AND SAFETY

General

12 The Principal Contractor shall obtain the necessary permits and undertake the appropriate notifications and assessments prior to works commencement. All statutory records shall be kept in the site manager's office and these may include (not an exhaustive list):

- HSE Notification F10;
- Separate notification to HSE that asbestos is present in the soil.

13 It is anticipated that the following tasks will involve, or potentially involve, working with asbestos containing materials (ACMs). These tasks are included in the preparation of the Risk Assessment and Plan of Work in accordance with CAR as detailed below.

- Site mobilisation;
- Handling, movement and storage on site of excavation arisings from the stockpile
- Any processing of excavation arisings containing ACMs (if encountered)
- Off-site disposal of ACMs.

Risk Assessment - Compliance with Regulation 6 of CAR

14 The test results indicate that:

- there is no significant source of contaminants present in the stockpile;
- there is a negligible risk to humans or ecology from potential contaminants in the stockpile soils, with the exception of asbestos (amosite and chrysotile);
- discrete asbestos fibres were identified in the stockpile soil in laboratory analysis, (note that the amount present was very low but was not quantified);
- potential risks exist to both on-site construction staff and off-site human receptors in relation to release of asbestos fibres during disturbance of soils and earthworks in the construction phase ;
- there is no significant risk to controlled waters at the site;

14 Prior to the commencement of any works where there is a potential for ACMs to be disturbed an assessment of risk is required. The Risk Assessment shall be carried out by the Principal Contractor and confirm that these proposals are sufficient to control the risks from ACMs. The Risk Assessment shall also be reviewed by the Principal Contractor for sufficiency at regular stages during the works. The person undertaking the Risk Assessment and reviews must be competent to do so in line with Regulation 10 of CAR and Risk Assessment review shall ensure that it is in line with Regulation 6 of CAR.

15 The only significant risks relate to potential release of asbestos fibres during the construction phase. Potential risks exist to construction staff and off-site human receptors from fibres being transported off-site by prevailing winds. These risks would be present during soil excavation and placement.

16 During the excavation of the stockpile, unexpected contamination may be encountered. Appropriate measures shall be put into place so that, if such contamination is encountered, the extent, nature and magnitude of the contaminants shall be assessed appropriately, and corrective action taken as necessary.

Quantity of Asbestos

17 The only asbestos encountered in the investigations was free fibres of amosite and chrysotile at concentrations below the laboratory limit of detection (0.001%). It should be noted that free fibres of asbestos present a higher risk to workers and the environment. The total quantity of asbestos present in stockpile is difficult to assess but is expected to be very low unless ACMs are encountered.

Information, Instruction and Training - Compliance with Regulation 10 of CAR

18 The following information, instruction and training shall be provided to all persons involved in the excavation and re-placement of material containing, or potentially containing ACMs:

- Significant findings of risk assessment;
- The risks to health from asbestos;
- Precautions that should be observed;
- Method of work; and,
- The relevant control limit.

19 All personnel who will be involved with working on the stockpile removal will have attended a suitable Asbestos Awareness training course. Personnel involved in handling asbestos will have received training in the removal of asbestos. If handling fibrous asbestos (which is notifiable) is required once site works commence then personnel undertaking these activities will only be from a specialist subcontractor and these personnel will have a higher level of training appropriate for this notifiable work.

20 All personnel working in the ACZ (see paragraph 21) and not in a machine shall wear the following PPE:

- hard hat;
- disposable hooded overalls suitable for use with asbestos i.e. resistant to penetration by dust and fibres such as a Type 5 coverall;
- washable safety boots (Wellingtons) – suit legs must be over the outside of the Wellingtons and taped down to the boots);
- inner (Nitrile type) and outer gloves;
- safety goggles;
- Hi Vi long sleeve jacket/vest;
- If required by the Principal Contractor's Health and Safety Adviser, Respiratory Protective Equipment (RPE) during work with ACMs (FF P3 high efficiency particulate filtered masks in accordance with HSE guidance note HS(G)53). These will have been face fit tested and required to be worn by the operatives who are not operating plant at the face and handling asbestos.

REMOVAL STRATEGY

Preliminaries

21 Prior to commencement of works the Principal Contractor will fence off the area of the stockpile plus the areas of filling as shown on Drawing No 1936/1/001 (Area of Works). This fenced off area is to act as an Asbestos Control Zone (ACZ) for the duration of the works.

22 Prior to commencing any works within the fenced off area a suitable decontamination unit will be established outside the perimeter of the ACZ, if required by the Principal Contractor's Health and Safety Adviser. This decontamination unit will have separate clean and dirty entrances and exits. Personnel will enter via the clean entrance, get changed into their PPE and then exit by the dirty door into the ACZ. At the end of each period of work they will enter via the dirty door and exit by the clean door. An external boot wash will also be provided adjacent to the dirty door.

23 Excavators shall only be operated with all doors and windows closed and will have a suitable dust filter on the air conditioning unit. The excavator operator will track to the edge of fenced area (near the decontamination unit if present) to leave or enter the cab so as to avoid taking ACMs into the cab.

24 As a minimum it is anticipated the works will be undertaken in accordance with the Building Research Establishment (BRE) Best Practice guidance and that the following measures will be introduced to assist with control of dust generation:

- access roads and stockpile will be regularly damped down with water;
- vehicle speeds and general vehicle movements will be kept to a minimum within the site;
- dust generating equipment (e.g. mobile crushing and screening equipment) will be equipped with a dust suppression system to minimise potential nuisance as far as practicable;
- minimising drop heights of all loading and unloading activities that involve the transfer of soils;

Earthworks

25 The earthworks shall be carried out in accordance with BS 6031: 2009.

26 The Principal Contractor shall have a system for spraying the ground to dampen it down in order to reduce dust transmission.

27 The material excavated from the stockpile shall be picked over by the excavator and any concrete or masonry greater than 150 mm shall be removed and crushed for reuse as fill. Any timber, vegetation or re-bar shall be removed.

28 Any open faces of the stockpile shall be inspected at the end of each day to ensure that no asbestos is left exposed in the face where it could release fibres. The face will be sealed up by the excavator and if asbestos is present in the face then it shall be covered with 2000 gauge Visqueen sheeting to prevent release of fibres.

Sequence of Removal and Replacement of Stockpile

29 Materials from the stockpile shall be placed and recompacted on the site areas shown on Drawing No Drawing Nos 1936/1/003, 4 and 5 as follows:

Step	Activity	Drawing ref
1	From CQA surveys it is apparent that stockpile material has been tipped on top of the landfill and has cascaded down the original 1 in 3 side slopes. Remove all stockpile material from the top and side slopes of the landfill down to the original subsoil/grass surface. Process to remove deleterious material.	1936/1/003 1936/1/004
2	Place all acceptable old stockpile material in a new stockpile	1936/1/004
3	Inspect the original surface for signs of intrusive damage from the stockpile material.	1936/1/004
4	Excavate the top 500 mm of subsoil/topsoil from the footprint of the old stockpile on the top plateau of the landfill. Place in a new stockpile. Inspect base of the excavation for signs of intrusive damage from the stockpile material.	1936/1/004
5	Excavate the top 500 mm of subsoil/topsoil from the area on the top plateau of the landfill outside the old stockpile as shown on Drawing No. 1936/1/005. Place in a new stockpile.	1936/1/004 1936/1/005
6	Place 1000 mm of old stockpile material from the new stockpile over the total area shown on Drawing No. 1936/1/005. Note that this area is only on the top Plateau of the landfill and does not include the 1 in 3 side slopes. The material shall be placed in two 500 mm thick layers and receive nominal compaction by tracking in by the dozer.	1936/1/004 1936/1/005
7	Place 500 mm of subsoil/topsoil from the new stockpile over the total area shown on Drawing No. 1936/1/005. Note that this area is only on the top Plateau of the landfill and does not include the 1 in 3 side slopes. The material shall be placed in one 500 mm thick layers and receive nominal compaction by tracking in by the dozer.	1936/1/004 1936/1/005

30 During the above activities the methodology and risk assessments shall be reviewed by the Principal Contractor's Health and Safety Adviser to assess the nature of the risk(s) based on work activities. This review will be carried out pre-commencement and one week after commencing earthworks.

Verification

31 A brief verification report shall be produced including as a minimum:

(i) Description of the works;

(ii) Photographic Records;

(iii) As-built Drawings:

- Survey of the finished ground level
- Appropriate site plan showing extent of any excavations and earthworks

(iv) Details of any unexpected contamination encountered and how it was dealt with;

(v) Copies of signed Declaration(s) by Qualified Person(s);

32 On completion a copy of the Verification Report should be presented to the Environment Agency.

REFERENCES

BS 6031: 2009: Code of practice for Earthworks. British Standards Institution.

BS 8485: 2007: Code of Practice for the characterization and remediation from ground gas in affected developments. British Standards Institution.

Building Research Establishment: 1991: Report No BR212, Construction of New Buildings on Gas-Contaminated Land.

Building Research Establishment & Environment Agency: 2001: Report No BR414, Protective Measures for Housing on Gas Contaminated Land. Author Johnson, R.

DEFRA/Environment Agency 2004: Report CLR11 "Model Procedures for the Management of Land Contamination".

Department for Communities and Local Government: 2012: National Planning Policy Framework, 27th March 2012.

Environment Agency: 2013: Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste. WM2, May 2013 including October 2013 errata, Third Edition.

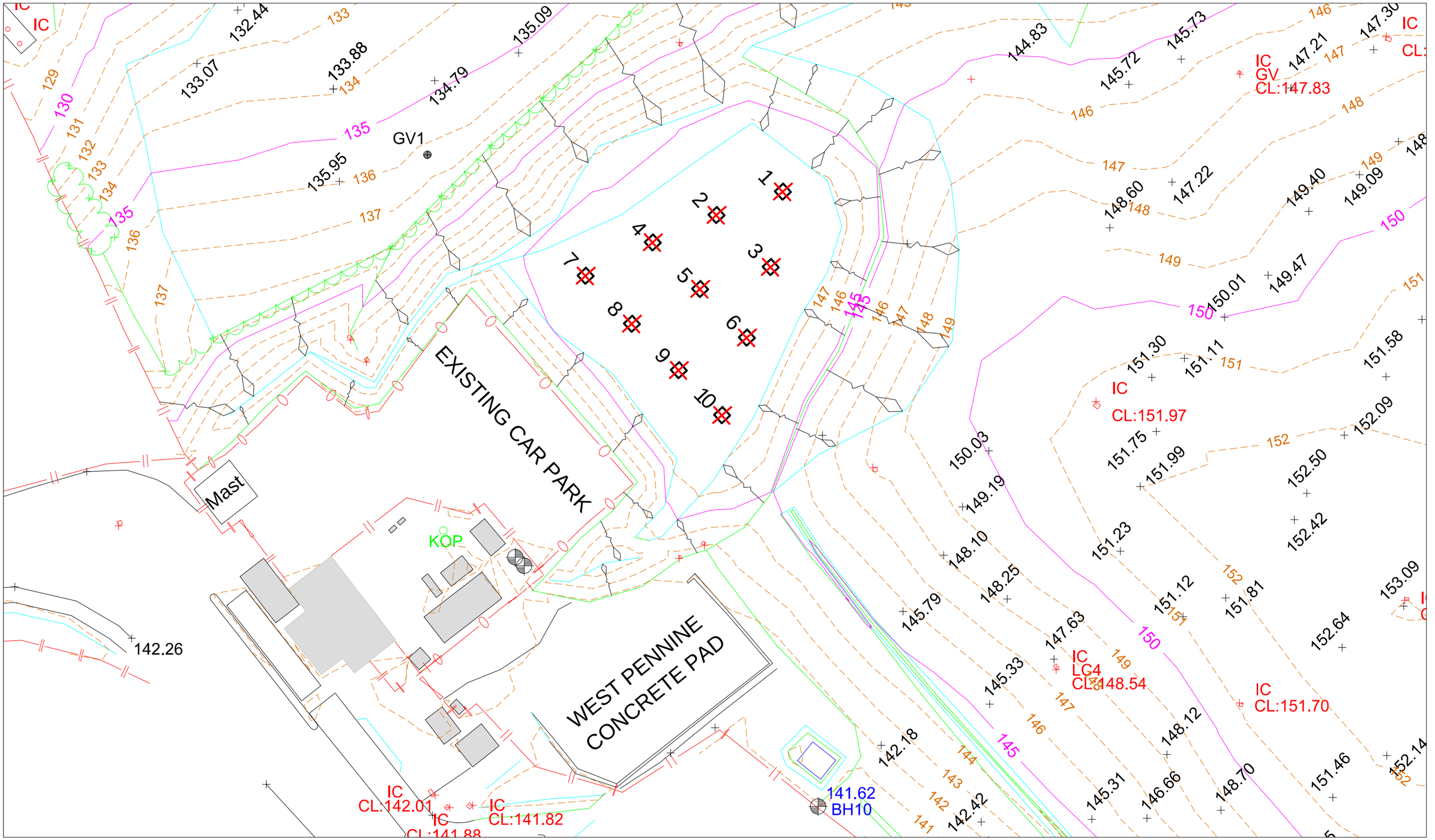
Health and Safety Executive: 2004: HSE Guidance "The selection and use of flammable gas detectors" November 2004.

Health & Safety Executive: 2013: Approved Code of Practice: Managing & working with asbestos. Control of Asbestos Regulations 2012.

Statutory Instruments: 2012: Health and Safety. The Control of Asbestos Regulations 2012. No. 262 coming into force 6th April 2012.

DRAWINGS

FCC Drawing No 6706a	**Sample Location Layout**
1936/1/001	**Not used**
1936/1/002	**Original survey and section locations**
1936/1/003	**Existing Stockpile Sections**
1936/1/004	**Sequenced Removal and Replacement of Stockpile**
1936/1/005	**Area of Excavation**



DRAWING NUMBER 6706a 01 A

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

CHRISTOPHER T. KAY
B.Sc.C.Eng.,M.I.C.E.,F.I.H.T.
Cyfarwyddwr Cludiant a Chynllunio. Director of Transportation and Planning.
Neuadd y Sir, Yr Wyddgrug. CH7 6NF. County Hall, Mold, CH7 6NF.

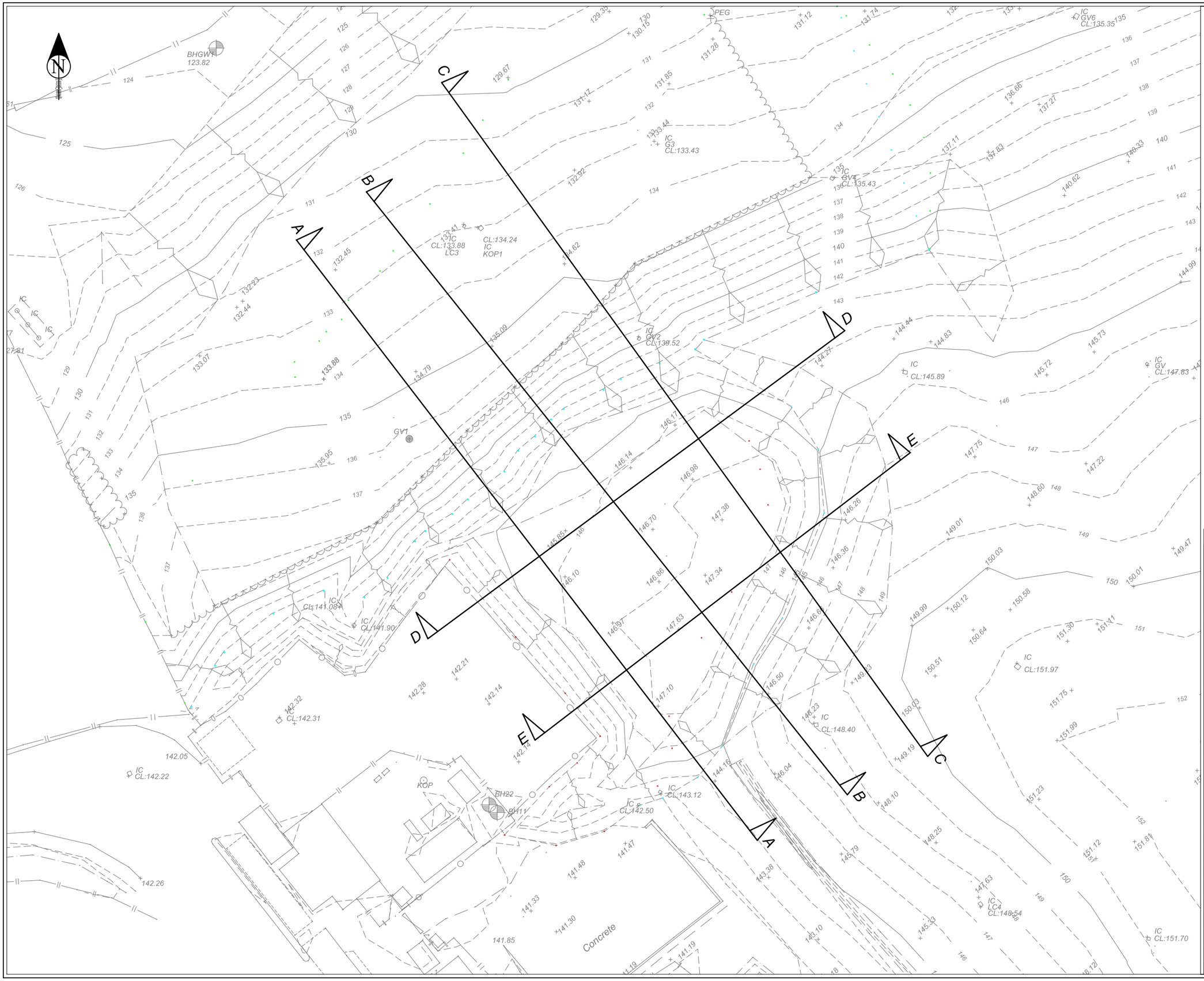
MAINTENANCE

JOB NUMBER:	SCALES:	AMENDMENTS:	DATE
6706a	NTS	A Original Drawing	19/11/12
DACDIV GROUP: Maintenance			
DRAWN BY: I.B	NAT. GRID REF: SJ 2865		
CHECKED BY: P.M	STATUS:	LAST EDIT DATE: 19 / 11 / 12	

STANDARD LANDFILL SITE

SAMPLE LOCATION LAYOUT PLAN

DRAWING NUMBER 6706a 01 A



Key

Cross section location

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

Site

Standard Landfill

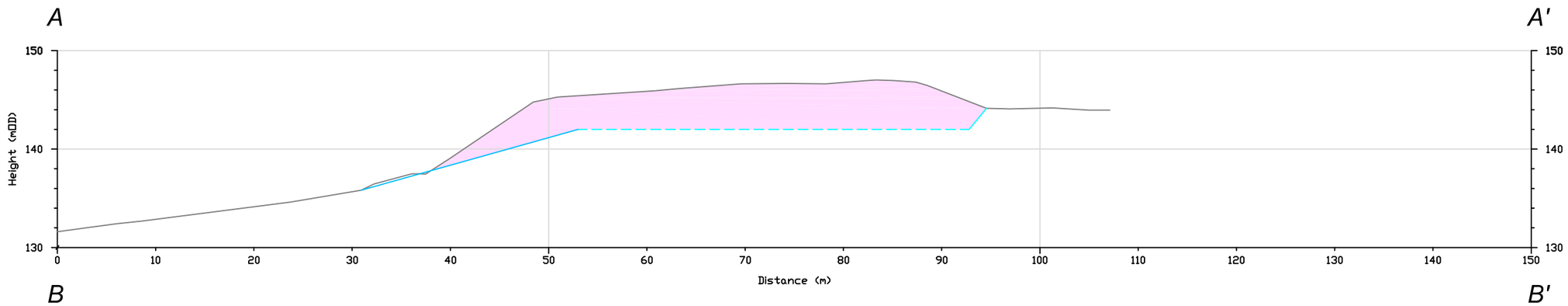
Title

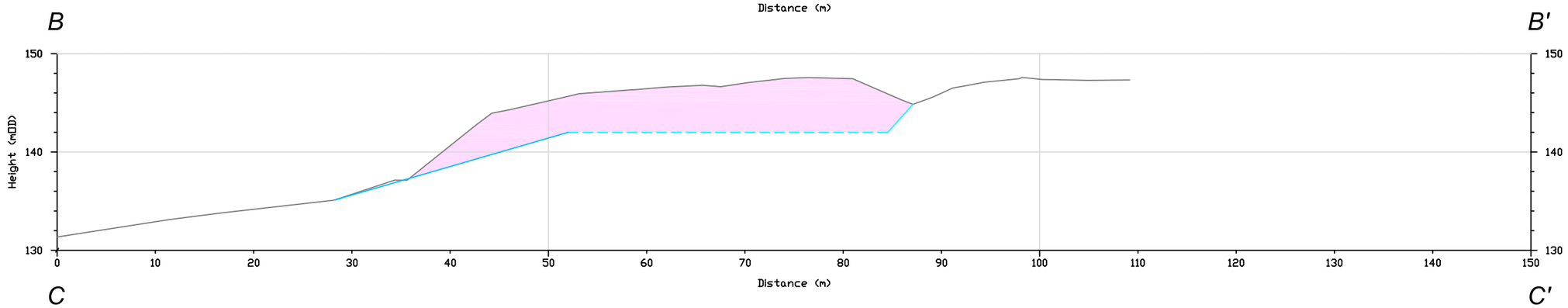
Original Survey and Section Locations

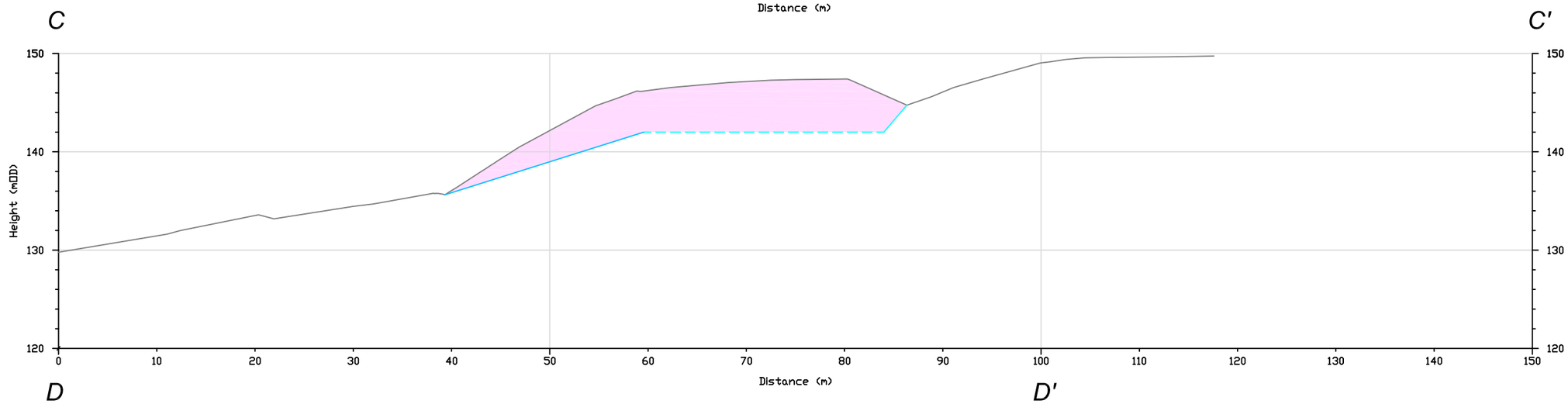
Scale	1:500	@ A3
Drawing No.	1936/1/002	

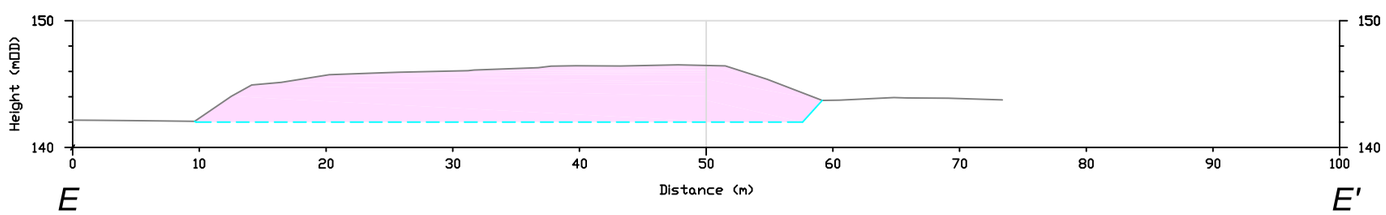
Rev	Date	Description

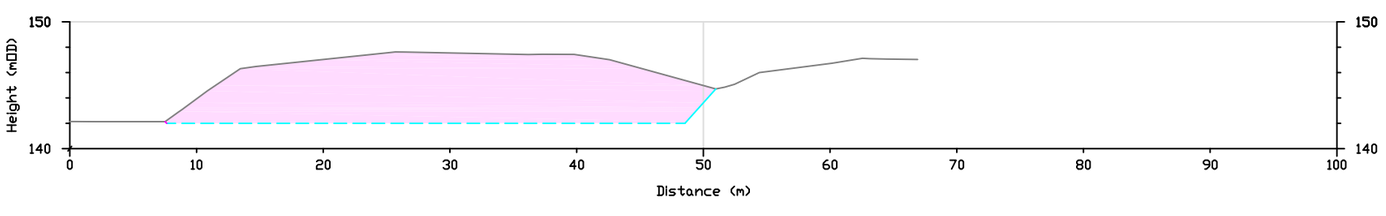
File	19361002existing.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	DRAFT











Key - Sections

- Topographical survey 17/09/12
- Assumed base of stockpile (142mOD)
- Assumed original landfill sideslope beneath slipped stockpile material
- Stockpile material

TerraConsult

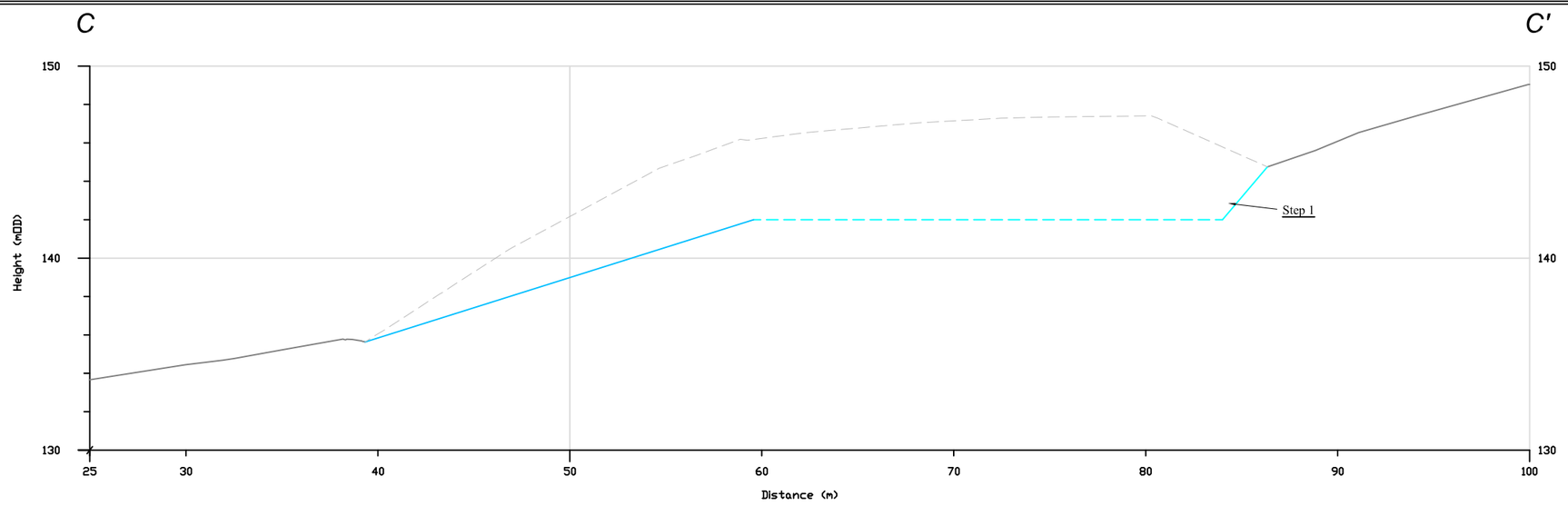
Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client: Cyngor Sir y Fflint Flintshire County Council

Site: **Standard Landfill**

Title: **Existing Stockpile Sections**

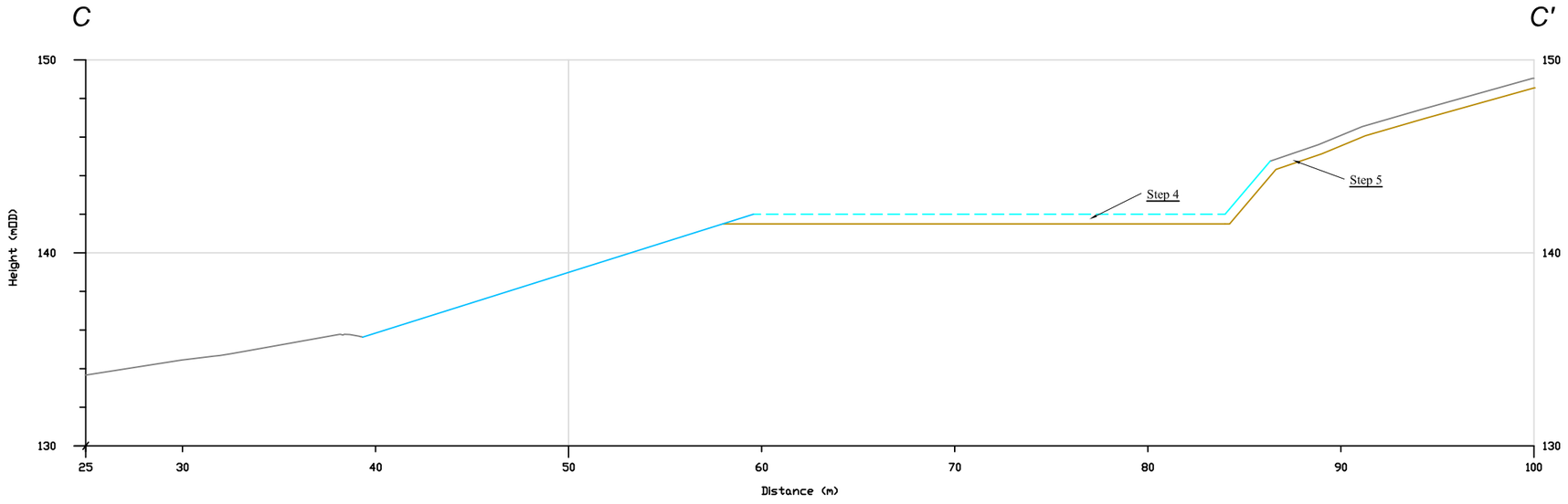
Scale	1:250 @ A1		
Drawing No.	1936/1/003		
Rev	Date	Description	
File	19361003stockpilesections.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	AB



Step 1
Remove all stockpile material down to original subsoil/grass surface and process to remove all deleterious material (concrete, brickwork, timber, rebar) particle size greater than 150mm dia.

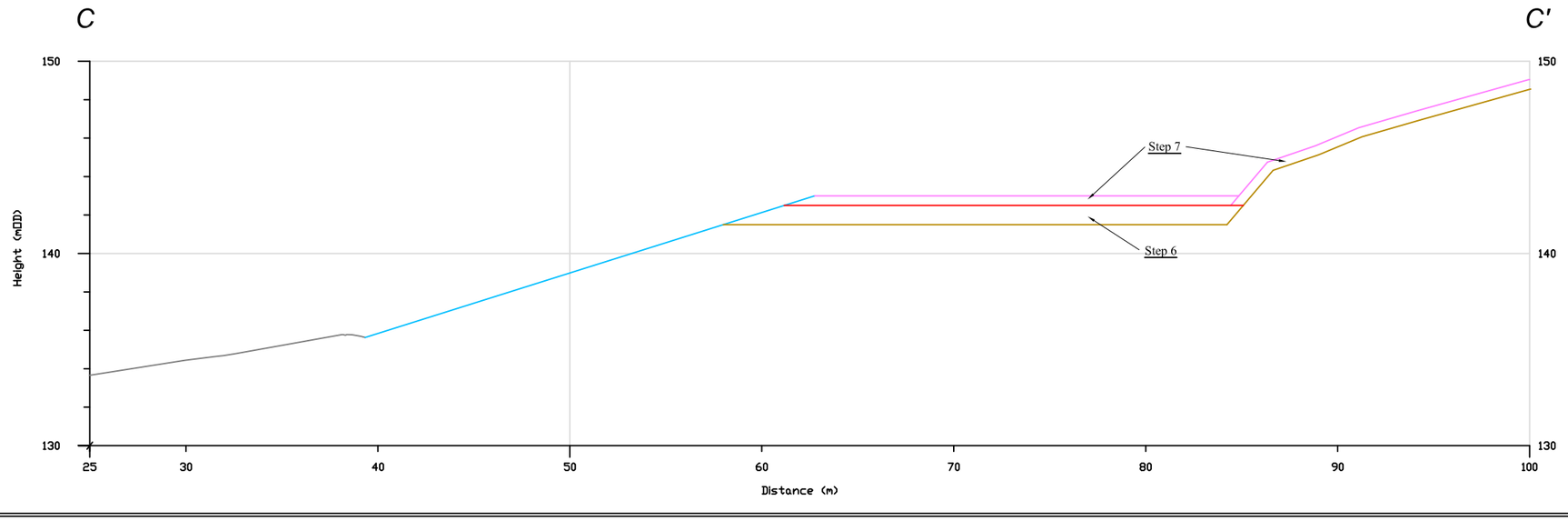
Step 2
Place all acceptable old stockpile material in a new stockpile.

Step 3
Inspect the original surface for intrusive damage from the stockpile material.



Step 4
Excavate top plateau 500mm of subsoil/topsoil from the footprint of the old stockpile and place in a new stockpile. Inspect the base of the extraction for intrusive damage from the stockpile material.

Step 5
Excavate 500mm of subsoil/topsoil over the area of the landfill's top plateau outside stockpile shown on TCL Drawing No. 1936/1/005.



Step 6
Place 1000mm of old stockpile material over the total area of the earthworks as shown on TCL Drawing No. 1936/1/005. This material to be feathered in to the existing at the perimeter. The material should be spread in 2 x 500mm thick layers compacted nominally by tracking in by the dozer.

Step 7
Place with nominal compaction 500mm of subsoil/topsoil material over the total area of the earthworks from the new stockpile.

Key

- Topographical survey 17/09/12
- Assumed base of stockpile (142mOD)
- Assumed original landfill sideslope beneath slipped stockpile material
- Base of dig
- Top of replaced soils

Notes

1. Indicative sequence shown using section C-C' only - other sections are similar.
2. These steps should be read in conjunction with the stockpile removal strategy (TCL Report No. 1936R01-1).

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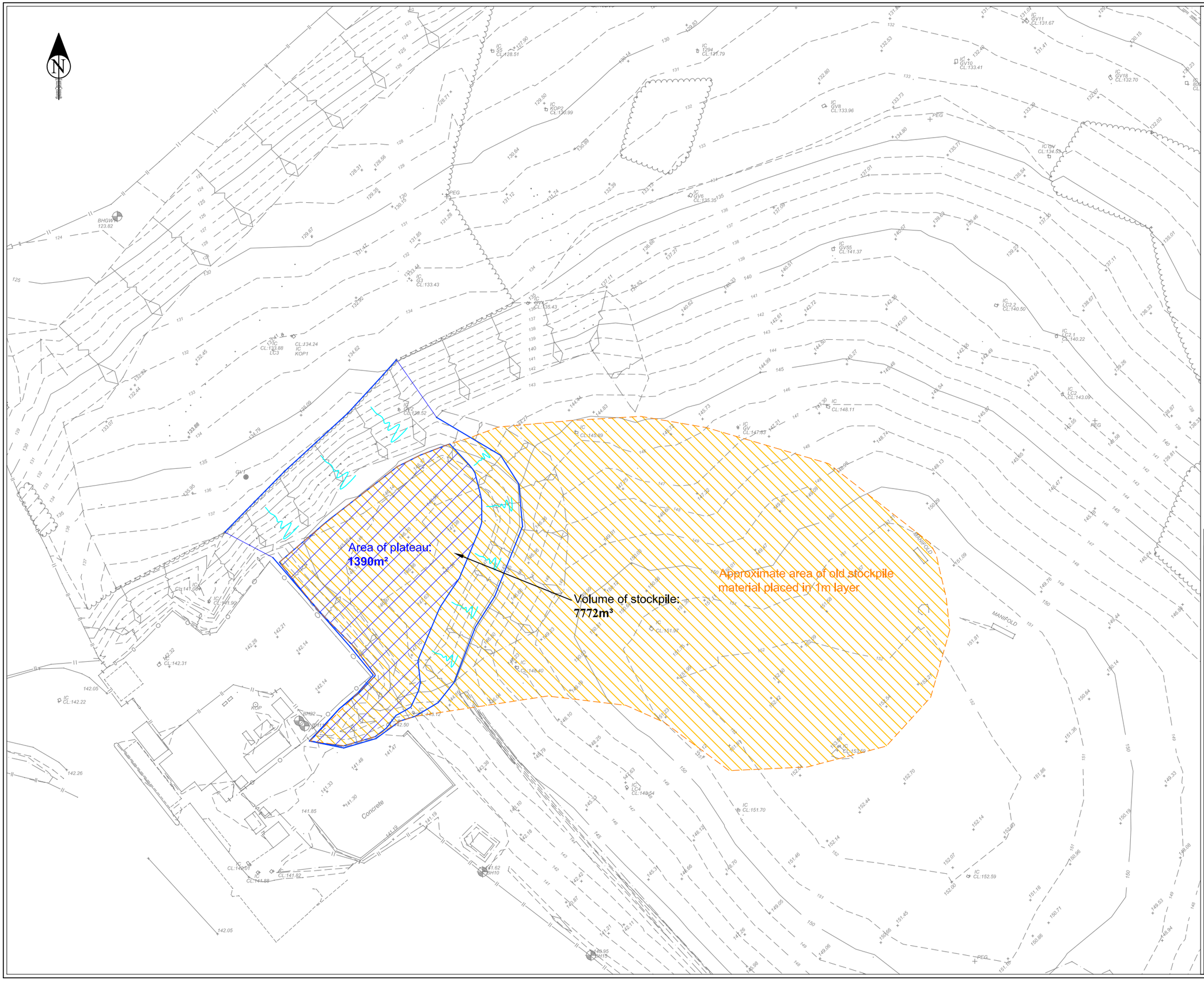
Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client: Cyngor Sir y Fflint Flintshire County Council

Site
Standard Landfill

Title
Sequenced Removal and Replacement of Stockpile

Scale	1:150	@ A1
Drawing No.	1936/1/004	
Rev	Date	Description
File	19361004stockpilesteps.dwg	
Date	05/14	Engineer AB
Drawn	SK	Checked DRAFT



Key

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

Site

Standard Landfill

Title

Area of Excavation

Scale	1:750	@ A3
Drawing No.	1936/1/005	

Rev	Date	Description

File	19361005areaofexcavation.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	DRAFT

Appendix A

Selection of photographs of the trial pit spoil heaps

Photographic Album
WPR Trial Pits
Standard Landfill Site

Natural Resources Wales

Photographs taken by
Mandy Langstaff
Date taken
19/08/13

Taken on WPR stockpile on edge of Standard Landfill site, shows burnt waste from trial pit 10.

Taken on WPR stockpile on edge of Standard Landfill site, waste from trial pit 9 at 2m deep.

Taken on WPR stockpile on edge of Standard Landfill site, sampling waste from trial pit 9.

Taken on WPR stockpile on edge of Standard Landfill site, waste from trial pit 8

Waste from trial pit 4 at 2m deep

Waste from Trial pit 4 at 4m deep

Waste from Trial pit 4 at 6m deep

Waste from Trial pit 5

Sampling waste from Trial pit 5 at 6m deep

Waste from trial pit 7 at 4m deep?

Trial pit 8 or 7?

Trial pit 7 or 8?

Waste from trial pit 6 at 3m deep

Waste from trial pit 2 at 3m deep?

Waste from trial pit 1

Appendix B

Chemical test certificates

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Flintshire County Council
Waste Management Services
Standard Landfill Site
Spencers Industrial Estate
Buckley
Flintshire
CH7 3LY

Attention: Phil Mulhall

CERTIFICATE OF ANALYSIS

Date:	16 September 2013
Customer:	H_FLINTCCO_BUC
Sample Delivery Group (SDG):	130820-49
Your Reference:	
Location:	WPS
Report No:	242047

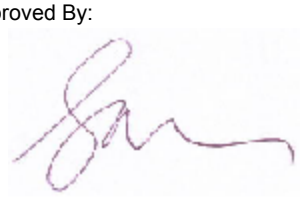
This report has been revised and directly supersedes 240721 in its entirety.

We received 23 samples on Monday August 19, 2013 and 23 of these samples were scheduled for analysis which was completed on Monday September 16, 2013. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
7965270	WPS1		2.00	19/08/2013
7965267	WPS2		3.00	19/08/2013
7965269	WPS2		6.00	19/08/2013
7965264	WPS3		3.00	19/08/2013
7965253	WPS4		2.00	19/08/2013
7965256	WPS4		4.00	19/08/2013
7965257	WPS4		6.00	19/08/2013
7965259	WPS5		2.00	19/08/2013
7965260	WPS5		4.00	19/08/2013
7965262	WPS5		6.00	19/08/2013
7965263	WPS6		3.00	19/08/2013
7965245	WPS7		2.00	19/08/2013
7965246	WPS7		4.00	19/08/2013
7965249	WPS7		6.00	19/08/2013
7965236	WPS8		2.00	19/08/2013
7965240	WPS8		4.00	19/08/2013
7965242	WPS8		6.00	19/08/2013
7965228	WPS9		2.00	19/08/2013
7965233	WPS9		4.00	19/08/2013
7965235	WPS9		6.00	19/08/2013
7965221	WPS10		2.00	19/08/2013
7965223	WPS10		4.00	19/08/2013
7965225	WPS10		6.00	19/08/2013

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

SOLID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			7965270	WPS1		2.00	250g Amber Jar (AL
			7965267	WPS2		3.00	60g VOC (ALE215)
			7965269	WPS2		6.00	250g Amber Jar (AL
			7965264	WPS3		3.00	60g VOC (ALE215)
			7965253	WPS4		2.00	250g Amber Jar (AL
			7965256	WPS4		4.00	400g Tub (ALE214)
			7965257	WPS4		6.00	60g VOC (ALE215)
			7965259	WPS5		2.00	250g Amber Jar (AL
			7965260	WPS5		4.00	60g VOC (ALE215)
			7965262	WPS5		6.00	250g Amber Jar (AL
			7965263	WPS6		3.00	60g VOC (ALE215)
			7965245	WPS7		2.00	250g Amber Jar (AL
			7965246	WPS7		4.00	60g VOC (ALE215)
			7965249	WPS7		6.00	250g Amber Jar (AL
			7965236	WPS8		2.00	60g VOC (ALE215)
			7965240	WPS8		4.00	250g Amber Jar (AL
			7965242	WPS8		6.00	400g Tub (ALE214)
			7965228	WPS9		2.00	60g VOC (ALE215)
			7965233	WPS9		4.00	250g Amber Jar (AL
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4					60g VOC (ALE215)
Asbestos Quantification - Full	All	NDPs: 0 Tests: 4					250g Amber Jar (AL
EPH by FID	All	NDPs: 0 Tests: 23					60g VOC (ALE215)
GRO by GC-FID (S)	All	NDPs: 0 Tests: 23					250g Amber Jar (AL
Metals in solid samples by OES	All	NDPs: 0 Tests: 23					60g VOC (ALE215)
PAH by GCMS	All	NDPs: 0 Tests: 23					250g Amber Jar (AL
Sample description	All	NDPs: 0 Tests: 14					60g VOC (ALE215)

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

SOLID

Results Legend

X **Test**

N **No Determination Possible**

		Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
		7965235	WPS9		6.00	250g Amber Jar (AL)
						400g Tub (ALE214)
						60g VOC (ALE215)
		7965221	WPS10		2.00	250g Amber Jar (AL)
						60g VOC (ALE215)
		7965223	WPS10		4.00	250g Amber Jar (AL)
						60g VOC (ALE215)
		7965225	WPS10		6.00	250g Amber Jar (AL)
						400g Tub (ALE214)
						60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4				
						X
						X
Asbestos Quantification - Full	All	NDPs: 0 Tests: 4				
						X
						X
EPH by FID	All	NDPs: 0 Tests: 23				X
						X
						X
						X
GRO by GC-FID (S)	All	NDPs: 0 Tests: 23				
						X
						X
						X
						X
Metals in solid samples by OES	All	NDPs: 0 Tests: 23				X
						X
						X
						X
PAH by GCMS	All	NDPs: 0 Tests: 23				X
						X
						X
						X
Sample description	All	NDPs: 0 Tests: 14				
						X

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
7965270	WPS1	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Tile	Brick
7965267	WPS2	3.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Glass	Brick
7965269	WPS2	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Tile	Brick
7965264	WPS3	3.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Glass	Brick
7965253	WPS4	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Tile	Brick
7965256	WPS4	4.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Fibres	Tile
7965257	WPS4	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	None
7965259	WPS5	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Glass & Stones	Tile
7965260	WPS5	4.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Tile	Brick
7965262	WPS5	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Glass & Stones	None
7965263	WPS6	3.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Brick
7965245	WPS7	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
7965246	WPS7	4.00	Dark Brown	Sandy Clay	0.1 - 2 mm	Stones	Brick
7965249	WPS7	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Fibres
7965236	WPS8	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
7965240	WPS8	4.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Fibres	Vegetation
7965242	WPS8	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Concrete/Aggregate	Stones
7965228	WPS9	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Concrete/Aggregate
7965233	WPS9	4.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Plastic
7965235	WPS9	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Fibres	Glass & Stones
7965221	WPS10	2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Concrete/Aggregate
7965223	WPS10	4.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Concrete/Aggregate	Stones
7965225	WPS10	6.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Fibres	Brick

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS1	WPS2	WPS2	WPS3	WPS4	WPS4
			Depth (m)	2.00	3.00	6.00	3.00	2.00	4.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965270	7965267	7965269	7965264	7965253	7965256
			AGS Reference						
EPH Surrogate % recovery**	%	TM061		119 M	118 M	117 M	118 M	114 M	113 M
EPH Range >C10 - C40	<35 mg/kg	TM061		993 M	429 M	677 M	1040 M	479 M	987 M
Arsenic	<0.6 mg/kg	TM181		6.9 M	7.3 M	6.5 M	7.76 M	6.74 M	5.91 M
Cadmium	<0.02 mg/kg	TM181		0.372 M	0.441 M	0.724 M	0.531 M	0.722 M	0.619 M
Chromium	<0.9 mg/kg	TM181		38.6 M	63.6 M	51.5 M	45.9 M	35.2 M	291 M
Copper	<1.4 mg/kg	TM181		27.2 M	344 M	31.7 M	43.3 M	28.9 M	79.7 M
Lead	<0.7 mg/kg	TM181		102 M	165 M	112 M	117 M	226 M	194 M
Mercury	<0.14 mg/kg	TM181		0.267 M	0.502 M	0.384 M	0.209 M	1.03 M	0.335 M
Nickel	<0.2 mg/kg	TM181		21.5 M	50.5 M	45.9 M	19.5 M	19.1 M	289 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		219 M	285 M	278 M	388 M	565 M	488 M

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS4	WPS5	WPS5	WPS5	WPS6	WPS7
			Depth (m)	6.00	2.00	4.00	6.00	3.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965257	7965259	7965260	7965262	7965263	7965245
			AGS Reference						
EPH Surrogate % recovery**	%	TM061		117 M	117 M	117 M	122 M	115 M	112 M
EPH Range >C10 - C40	<35 mg/kg	TM061		346 M	420 M	413 M	416 M	844 M	418 M
Arsenic	<0.6 mg/kg	TM181		8.05 M	5.28 M	6.65 M	5.03 M	7.75 M	5.64 M
Cadmium	<0.02 mg/kg	TM181		0.43 M	0.242 M	0.724 M	0.426 M	1.98 M	2.26 M
Chromium	<0.9 mg/kg	TM181		78.4 M	26.2 M	151 M	34.9 M	28.4 M	27.9 M
Copper	<1.4 mg/kg	TM181		44.9 M	16.6 M	30.5 M	43.5 M	32.4 M	22.7 M
Lead	<0.7 mg/kg	TM181		135 M	167 M	153 M	93.9 M	1340 M	94.9 M
Mercury	<0.14 mg/kg	TM181		0.592 M	0.255 M	0.199 M	0.277 M	0.203 M	0.898 M
Nickel	<0.2 mg/kg	TM181		56.7 M	14.7 M	25.3 M	47 M	20 M	12.3 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	1.4 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		277 M	174 M	353 M	243 M	517 M	427 M

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS7	WPS7	WPS8	WPS8	WPS8	WPS9
			Depth (m)	4.00	6.00	2.00	4.00	6.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965246	7965249	7965236	7965240	7965242	7965228
			AGS Reference						
EPH Surrogate % recovery**	%	TM061		118 M	123 M	122 M	123 M	112 M	117 M
EPH Range >C10 - C40	<35 mg/kg	TM061		461 M	333 M	375 M	350 M	449 M	385 M
Arsenic	<0.6 mg/kg	TM181		6.99 M	6.1 M	6.69 M	5.9 M	7.88 M	5.88 M
Cadmium	<0.02 mg/kg	TM181		1.93 M	0.954 M	0.805 M	0.479 M	0.686 M	0.515 M
Chromium	<0.9 mg/kg	TM181		37.6 M	27.6 M	38.3 M	40.7 M	41 M	29.8 M
Copper	<1.4 mg/kg	TM181		33.5 M	26.8 M	26.9 M	30.1 M	35.3 M	33.3 M
Lead	<0.7 mg/kg	TM181		168 M	116 M	169 M	128 M	167 M	133 M
Mercury	<0.14 mg/kg	TM181		1.23 M	1.62 M	1.38 M	0.379 M	0.546 M	0.408 M
Nickel	<0.2 mg/kg	TM181		19.6 M	12.6 M	14.4 M	23.1 M	84.1 M	16.4 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		526 M	342 M	315 M	298 M	403 M	263 M

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS9	WPS9	WPS10	WPS10	WPS10
			Depth (m)	4.00	6.00	2.00	4.00	6.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965233	7965235	7965221	7965223	7965225
			AGS Reference					
EPH Surrogate % recovery**	%	TM061		112 M	115 M	114 M	111 M	109 M
EPH Range >C10 - C40	<35 mg/kg	TM061		385 M	311 M	478 M	437 M	1210 M
Arsenic	<0.6 mg/kg	TM181		7.41 M	6.71 M	5.84 M	7.68 M	6.09 M
Cadmium	<0.02 mg/kg	TM181		0.6 M	0.419 M	0.729 M	17.3 M	0.789 M
Chromium	<0.9 mg/kg	TM181		36.7 M	76 M	36.8 M	54 M	44.3 M
Copper	<1.4 mg/kg	TM181		31.9 M	45.6 M	27.4 M	39.6 M	32.4 M
Lead	<0.7 mg/kg	TM181		255 M	168 M	145 M	617 M	231 M
Mercury	<0.14 mg/kg	TM181		1.77 M	1.06 M	0.52 M	0.376 M	0.225 M
Nickel	<0.2 mg/kg	TM181		16.8 M	20 M	17.6 M	18.9 M	19.9 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		350 M	295 M	203 M	2890 M	365 M

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

GRO by GC-FID (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS1	WPS2	WPS2	WPS3	WPS4	WPS4
			Depth (m)	2.00	3.00	6.00	3.00	2.00	4.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965270	7965267	7965269	7965264	7965253	7965256
			AGS Reference						
GRO TOT (Moisture Corrected)	<0.044 mg/kg	TM089		<0.044 M	<0.044 M	<0.044 M	<0.044 M	0.107 M	<0.044 M
Methyl tertiary butyl ether (MTBE)	<0.005 mg/kg	TM089		<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M
Benzene	<0.01 mg/kg	TM089		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Toluene	<0.002 mg/kg	TM089		<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M
Ethylbenzene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
m,p-Xylene	<0.006 mg/kg	TM089		<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M
o-Xylene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
sum of detected mpo xylene by GC	<0.009 mg/kg	TM089		<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	<0.024 mg/kg	TM089		<0.024	<0.024	<0.024	<0.024	<0.024	<0.024

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

GRO by GC-FID (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS4	WPS5	WPS5	WPS5	WPS6	WPS7
			Depth (m)	6.00	2.00	4.00	6.00	3.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965257	7965259	7965260	7965262	7965263	7965245
			AGS Reference						
GRO TOT (Moisture Corrected)	<0.044 mg/kg	TM089		<0.044 M	0.0848 M	0.0866 M	<0.044 M	0.288 M	0.0739 M
Methyl tertiary butyl ether (MTBE)	<0.005 mg/kg	TM089		<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M
Benzene	<0.01 mg/kg	TM089		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Toluene	<0.002 mg/kg	TM089		<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M
Ethylbenzene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
m,p-Xylene	<0.006 mg/kg	TM089		<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M
o-Xylene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
sum of detected mpo xylene by GC	<0.009 mg/kg	TM089		<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	<0.024 mg/kg	TM089		<0.024	<0.024	<0.024	<0.024	<0.024	<0.024

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

GRO by GC-FID (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS7	WPS7	WPS8	WPS8	WPS8	WPS9
			Depth (m)	4.00	6.00	2.00	4.00	6.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965246	7965249	7965236	7965240	7965242	7965228
			AGS Reference						
GRO TOT (Moisture Corrected)	<0.044 mg/kg	TM089		0.1 M	<0.044 M	0.276 M	0.204 M	<0.044 M	<0.044 M
Methyl tertiary butyl ether (MTBE)	<0.005 mg/kg	TM089		<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M
Benzene	<0.01 mg/kg	TM089		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Toluene	<0.002 mg/kg	TM089		<0.002 M	0.00236 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M
Ethylbenzene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
m,p-Xylene	<0.006 mg/kg	TM089		<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M
o-Xylene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
sum of detected mpo xylene by GC	<0.009 mg/kg	TM089		<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	<0.024 mg/kg	TM089		<0.024	<0.024	<0.024	<0.024	<0.024	<0.024

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

GRO by GC-FID (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS9	WPS9	WPS10	WPS10	WPS10
			Depth (m)	4.00	6.00	2.00	4.00	6.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965233	7965235	7965221	7965223	7965225
			AGS Reference					
GRO TOT (Moisture Corrected)	<0.044 mg/kg	TM089		<0.044 M	0.478 M	0.247 M	0.317 M	0.307 M
Methyl tertiary butyl ether (MTBE)	<0.005 mg/kg	TM089		<0.005 M	<0.005 M	<0.005 M	<0.005 M	<0.005 M
Benzene	<0.01 mg/kg	TM089		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Toluene	<0.002 mg/kg	TM089		<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M
Ethylbenzene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	0.00342 M	<0.003 M	<0.003 M
m,p-Xylene	<0.006 mg/kg	TM089		<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M
o-Xylene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
sum of detected mpo xylene by GC	<0.009 mg/kg	TM089		<0.009	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	<0.024 mg/kg	TM089		<0.024	<0.024	<0.024	<0.024	<0.024

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS1	WPS2	WPS2	WPS3	WPS4	WPS4
			Depth (m)	2.00	3.00	6.00	3.00	2.00	4.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965270	7965267	7965269	7965264	7965253	7965256
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		100	99.3	107	108	105	91.6
Acenaphthene-d10 % recovery**	%	TM218		101	99.5	107	108	106	92
Phenanthrene-d10 % recovery**	%	TM218		102	99.6	105	106	104	92.4
Chrysene-d12 % recovery**	%	TM218		105	102	98.3	100	97.4	101
Perylene-d12 % recovery**	%	TM218		115	106	101	103	99.4	102
Naphthalene	<0.009 mg/kg	TM218		0.765 M	0.22 M	0.201 M	0.402 M	0.687 M	0.222 M
Acenaphthylene	<0.012 mg/kg	TM218		0.0281 M	0.0146 M	0.0184 M	0.0186 M	0.0153 M	<0.012 M
Acenaphthene	<0.008 mg/kg	TM218		<0.008 M	<0.008 M	<0.008 M	0.0123 M	0.0102 M	<0.008 M
Fluorene	<0.01 mg/kg	TM218		<0.01 M	<0.01 M	<0.01 M	0.0155 M	0.0142 M	<0.01 M
Phenanthrene	<0.015 mg/kg	TM218		0.123 M	0.103 M	0.153 M	0.175 M	0.14 M	0.057 M
Anthracene	<0.016 mg/kg	TM218		0.0417 M	0.0318 M	0.0421 M	0.0473 M	0.0428 M	0.0192 M
Fluoranthene	<0.017 mg/kg	TM218		0.198 M	0.16 M	0.231 M	0.198 M	0.238 M	0.137 M
Pyrene	<0.015 mg/kg	TM218		0.192 M	0.168 M	0.222 M	0.168 M	0.209 M	0.131 M
Benz(a)anthracene	<0.014 mg/kg	TM218		0.207 M	0.145 M	0.167 M	0.147 M	0.149 M	0.131 M
Chrysene	<0.01 mg/kg	TM218		0.152 M	0.129 M	0.176 M	0.161 M	0.134 M	0.105 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		0.275 M	0.185 M	0.245 M	0.214 M	0.184 M	0.171 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.121 M	0.085 M	0.111 M	0.0932 M	0.0787 M	0.0792 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		0.272 M	0.209 M	0.227 M	0.183 M	0.176 M	0.173 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.186 M	0.133 M	0.165 M	0.129 M	0.112 M	0.125 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.0494 M	0.0377 M	0.041 M	0.0338 M	0.0278 M	0.0448 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		0.233 M	0.184 M	0.234 M	0.171 M	0.15 M	0.174 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		2.84	1.81	2.23	2.17	2.37	1.57

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS4	WPS5	WPS5	WPS5	WPS6	WPS7
			Depth (m)	6.00	2.00	4.00	6.00	3.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965257	7965259	7965260	7965262	7965263	7965245
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		99.1	90.3	95.7	94.2	101	106
Acenaphthene-d10 % recovery**	%	TM218		103	90.6	94.4	92.5	103	105
Phenanthrene-d10 % recovery**	%	TM218		102	91.3	95.6	93.1	101	105
Chrysene-d12 % recovery**	%	TM218		97.2	96.7	99.3	96.7	97.4	98.4
Perylene-d12 % recovery**	%	TM218		105	98.5	105	98.5	106	100
Naphthalene	<0.009 mg/kg	TM218		0.118 M	0.259 M	0.183 M	0.178 M	0.835 M	0.766 M
Acenaphthylene	<0.012 mg/kg	TM218		<0.012 M	0.0159 M	0.0151 M	0.0191 M	0.0227 M	0.0342 M
Acenaphthene	<0.008 mg/kg	TM218		<0.008 M	0.00925 M	<0.008 M	0.00959 M	0.084 M	0.0237 M
Fluorene	<0.01 mg/kg	TM218		<0.01 M	<0.01 M	<0.01 M	0.0119 M	0.0893 M	0.025 M
Phenanthrene	<0.015 mg/kg	TM218		0.0939 M	0.11 M	0.131 M	0.124 M	0.409 M	0.461 M
Anthracene	<0.016 mg/kg	TM218		0.0294 M	0.0365 M	0.0369 M	0.0404 M	0.106 M	0.159 M
Fluoranthene	<0.017 mg/kg	TM218		0.189 M	0.223 M	0.243 M	0.325 M	0.61 M	1.02 M
Pyrene	<0.015 mg/kg	TM218		0.176 M	0.213 M	0.22 M	0.284 M	0.55 M	0.987 M
Benz(a)anthracene	<0.014 mg/kg	TM218		0.111 M	0.164 M	0.153 M	0.251 M	0.308 M	0.549 M
Chrysene	<0.01 mg/kg	TM218		0.11 M	0.169 M	0.158 M	0.225 M	0.288 M	0.52 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		0.162 M	0.201 M	0.192 M	0.222 M	0.378 M	0.67 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.0905 M	0.0834 M	0.0994 M	0.125 M	0.15 M	0.3 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		0.175 M	0.203 M	0.219 M	0.289 M	0.352 M	0.748 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.127 M	0.134 M	0.165 M	0.178 M	0.205 M	0.428 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.0373 M	0.0496 M	0.0621 M	0.0611 M	0.0528 M	0.0923 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		0.184 M	0.173 M	0.213 M	0.219 M	0.27 M	0.552 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		1.6	2.04	2.09	2.56	4.71	7.33

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS7	WPS7	WPS8	WPS8	WPS8	WPS9
			Depth (m)	4.00	6.00	2.00	4.00	6.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965246	7965249	7965236	7965240	7965242	7965228
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		100	108	102	95.4	99.3	117
Acenaphthene-d10 % recovery**	%	TM218		102	108	102	96.1	104	105
Phenanthrene-d10 % recovery**	%	TM218		99.6	106	102	96.1	102	99.5
Chrysene-d12 % recovery**	%	TM218		94	98.7	97.4	104	97.2	84.1
Perylene-d12 % recovery**	%	TM218		99	102	104	107	103	87.1
Naphthalene	<0.009 mg/kg	TM218		0.767 M	0.616 M	0.875 M	2.46 M	0.444 M	0.211 M
Acenaphthylene	<0.012 mg/kg	TM218		0.0204 M	0.025 M	0.0267 M	0.0303 M	<0.012 M	<0.024 M
Acenaphthene	<0.008 mg/kg	TM218		0.0181 M	<0.008 M	0.0162 M	0.903 M	<0.008 M	<0.016 M
Fluorene	<0.01 mg/kg	TM218		0.021 M	0.0176 M	0.0306 M	0.547 M	<0.01 M	<0.02 M
Phenanthrene	<0.015 mg/kg	TM218		0.193 M	0.24 M	0.248 M	3.88 M	0.111 M	0.0679 M
Anthracene	<0.016 mg/kg	TM218		0.0646 M	0.0684 M	0.0834 M	0.833 M	0.032 M	<0.032 M
Fluoranthene	<0.017 mg/kg	TM218		0.34 M	0.351 M	0.895 M	3.43 M	0.182 M	0.0861 M
Pyrene	<0.015 mg/kg	TM218		0.327 M	0.297 M	1.21 M	3.25 M	0.169 M	0.0985 M
Benz(a)anthracene	<0.014 mg/kg	TM218		0.258 M	0.208 M	0.725 M	2.03 M	0.123 M	0.051 M
Chrysene	<0.01 mg/kg	TM218		0.228 M	0.173 M	0.616 M	1.66 M	0.101 M	0.0584 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		0.346 M	0.207 M	0.714 M	1.37 M	0.124 M	0.0909 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.126 M	0.0841 M	0.3 M	0.706 M	0.0776 M	0.0494 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		0.335 M	0.197 M	0.838 M	1.76 M	0.136 M	0.084 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.204 M	0.111 M	0.344 M	0.71 M	0.093 M	0.0583 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.067 M	0.0304 M	0.107 M	0.245 M	0.0312 M	<0.046 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		0.271 M	0.151 M	0.416 M	0.785 M	0.137 M	0.116 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		3.59	2.78	7.45	24.6	1.76	0.971

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	WPS9	WPS9	WPS10	WPS10	WPS10
			Depth (m)	4.00	6.00	2.00	4.00	6.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			Sample Time	.	.	.	.	.
			Date Received	19/08/2013	19/08/2013	19/08/2013	19/08/2013	19/08/2013
			SDG Ref	130820-49	130820-49	130820-49	130820-49	130820-49
			Lab Sample No.(s)	7965233	7965235	7965221	7965223	7965225
			AGS Reference					
Naphthalene-d8 % recovery**	%	TM218		113	112	107	106	108
Acenaphthene-d10 % recovery**	%	TM218		113	112	106	107	107
Phenanthrene-d10 % recovery**	%	TM218		112	111	105	104	106
Chrysene-d12 % recovery**	%	TM218		104	104	98.9	107	101
Perylene-d12 % recovery**	%	TM218		106	106	101	126	105
Naphthalene	<0.009 mg/kg	TM218		0.892 M	0.492 M	0.829 M	1.39 M	0.861 M
Acenaphthylene	<0.012 mg/kg	TM218		0.0192 M	0.0155 M	0.0278 M	0.0255 M	0.0261 M
Acenaphthene	<0.008 mg/kg	TM218		0.0118 M	0.0129 M	0.0274 M	0.0787 M	0.0727 M
Fluorene	<0.01 mg/kg	TM218		0.0186 M	0.0205 M	0.034 M	0.0788 M	0.0705 M
Phenanthrene	<0.015 mg/kg	TM218		0.175 M	0.164 M	0.324 M	0.284 M	0.534 M
Anthracene	<0.016 mg/kg	TM218		0.0506 M	0.045 M	0.102 M	0.0778 M	0.144 M
Fluoranthene	<0.017 mg/kg	TM218		0.258 M	0.214 M	0.805 M	0.459 M	0.75 M
Pyrene	<0.015 mg/kg	TM218		0.239 M	0.188 M	0.752 M	0.474 M	0.71 M
Benz(a)anthracene	<0.014 mg/kg	TM218		0.167 M	0.141 M	0.398 M	0.306 M	0.379 M
Chrysene	<0.01 mg/kg	TM218		0.158 M	0.153 M	0.405 M	0.241 M	0.376 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		0.214 M	0.206 M	0.464 M	0.346 M	0.41 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.091 M	0.083 M	0.205 M	0.194 M	0.201 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		0.202 M	0.168 M	0.428 M	0.429 M	0.404 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.123 M	0.116 M	0.22 M	0.182 M	0.205 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.0325 M	0.0318 M	0.0558 M	<0.023 M	0.0557 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		0.17 M	0.158 M	0.279 M	0.237 M	0.265 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		2.82	2.21	5.36	4.8	5.46

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Extractable Petroleum Hydrocarbons (EPH) By GC-FID

EPH (DRO) (C10-C40)

Sample No	Customer Sample Ref.	Depth	Matrix (mg/kg)	EPH	Interpretation
7998678	WPS10	2.00	SOLID	478	biodegraded diesel/bitumen/tar
7998725	WPS10	4.00	SOLID	437	bitumen/tar
7998502	WPS10	6.00	SOLID	1210	biodegraded diesel/bitumen/tar
7998647	WPS9	2.00	SOLID	385	bitumen/tar
7998209	WPS9	4.00	SOLID	385	bitumen/tar
7998520	WPS9	6.00	SOLID	311	bitumen/tar
7998539	WPS8	2.00	SOLID	375	biodegraded diesel/bitumen/tar
7998232	WPS8	6.00	SOLID	449	bitumen/tar
7998173	WPS7	2.00	SOLID	418	biodegraded diesel/bitumen/tar
8005482	WPS7	4.00	SOLID	461	bitumen/tar
8002524	WPS7	6.00	SOLID	333	bitumen/tar
7998759	WPS4	4.00	SOLID	987	bitumen/tar
8007184	WPS5	2.00	SOLID	420	bitumen/tar
8007217	WPS5	4.00	SOLID	413	bitumen/tar
8007159	WPS5	6.00	SOLID	416	bitumen/tar
8007161	WPS3	3.00	SOLID	1040	bitumen/tar
8007290	WPS2	3.00	SOLID	429	bitumen/tar
8007169	WPS2	6.00	SOLID	677	bitumen/tar
8007545	WPS1	2.00	SOLID	993	bitumen/tar
8001665	WPS8	4.00	SOLID	350	bitumen/tar
8007228	WPS4	2.00	SOLID	479	bitumen/tar
8005500	WPS4	6.00	SOLID	346	bitumen/tar
8005446	WPS6	3.00	SOLID	844	bitumen/tar

Extractable Petroleum Hydrocarbons (formally Diesel Range Organics) :- Any compound extractable in n-hexane within the carbon range C10-C40, includes Aliphatic (Min Oil), Aromatic (PAHs) and naturally occurring compounds.

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS4 4.00 SOLID 19/08/2013 00:00:00 130820-49 7965256 TM048	02/09/13	Simon Postlewhite	Loose fibres in soil	Trace (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS8 4.00 SOLID 19/08/2013 00:00:00 130820-49 7965240 TM048	02/09/13	Martin Cotterell	Loose fibres in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS9 6.00 SOLID 19/08/2013 00:00:00 130820-49 7965235 TM048	02/09/13	Martin Cotterell	Loose fibres in soil	Trace (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS10 6.00 SOLID 19/08/2013 00:00:00 130820-49 7965225 TM048	02/09/13	Martin Cotterell	Loose fibres in soil	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS4 4.00 SOLID 19/08/2013 00:00:00 130820-49 7965256 TM 304	Chrysotile (#)	Loose fibres	<0.001 (#)	<0.001 (#)	<0.001 (#)
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS8 4.00 SOLID 19/08/2013 00:00:00 130820-49 7965240 TM 304	Amosite (#)	Loose fibres and ACM debris	0.0037 (#)	<0.001 (#)	0.0039 (#)
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS9 6.00 SOLID 19/08/2013 00:00:00 130820-49 7965235 TM 304	Chrysotile (#)	Loose fibres	0.0045 (#)	<0.001 (#)	0.0048 (#)
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WPS10 6.00 SOLID 19/08/2013 00:00:00 130820-49 7965225 TM 304	Chrysotile (#)	Loose fibres	0.0016 (#)	<0.001 (#)	0.0019 (#)

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Test Completion Dates

Lab Sample No(s)	7965270	7965267	7965269	7965264	7965253	7965256	7965257	7965259	7965260	7965262
Customer Sample Ref.	WPS1	WPS2	WPS2	WPS3	WPS4	WPS4	WPS4	WPS5	WPS5	WPS5
AGS Ref.										
Depth	2.00	3.00	6.00	3.00	2.00	4.00	6.00	2.00	4.00	6.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples						02-Sep-2013				
Asbestos Quantification - Full						16-Sep-2013				
EPH by FID	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013
GRO by GC-FID (S)	29-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	29-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	29-Aug-2013
Metals in solid samples by OES	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	29-Aug-2013	29-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013
PAH by GCMS	27-Aug-2013	27-Aug-2013	28-Aug-2013	28-Aug-2013	28-Aug-2013	29-Aug-2013	28-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013
Sample description	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013

Lab Sample No(s)	7965263	7965245	7965246	7965249	7965236	7965240	7965242	7965228	7965233	7965235
Customer Sample Ref.	WPS6	WPS7	WPS7	WPS7	WPS8	WPS8	WPS8	WPS9	WPS9	WPS9
AGS Ref.										
Depth	3.00	2.00	4.00	6.00	2.00	4.00	6.00	2.00	4.00	6.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples						02-Sep-2013				02-Sep-2013
Asbestos Quantification - Full						16-Sep-2013				16-Sep-2013
EPH by FID	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013
GRO by GC-FID (S)	29-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013	30-Aug-2013
Metals in solid samples by OES	30-Aug-2013	29-Aug-2013	30-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013	29-Aug-2013
PAH by GCMS	28-Aug-2013	28-Aug-2013	28-Aug-2013	28-Aug-2013	28-Aug-2013	27-Aug-2013	28-Aug-2013	31-Aug-2013	28-Aug-2013	28-Aug-2013
Sample description	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013	22-Aug-2013

Lab Sample No(s)	7965221	7965223	7965225
Customer Sample Ref.	WPS10	WPS10	WPS10
AGS Ref.			
Depth	2.00	4.00	6.00
Type	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples			02-Sep-2013
Asbestos Quantification - Full			16-Sep-2013
EPH by FID	30-Aug-2013	30-Aug-2013	30-Aug-2013
GRO by GC-FID (S)	30-Aug-2013	30-Aug-2013	30-Aug-2013
Metals in solid samples by OES	29-Aug-2013	29-Aug-2013	29-Aug-2013
PAH by GCMS	28-Aug-2013	28-Aug-2013	28-Aug-2013
Sample description	22-Aug-2013	22-Aug-2013	22-Aug-2013

SDG:	130820-49	**Location:**	WPS	**Order Number:**	
Job:	H_FLINTCCO_BUC-33	**Customer:**	Flintshire County Council	**Report Number:**	242047
Client Reference:		**Attention:**	Phil Mulhall	**Superseded Report:**	240721

Appendix
General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Holding time exceeded before sample received**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to sampled on date**
&	**Sample Holding Time exceeded - Late arrival of instructions.**

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix B

TerraConsult Report 1936-R-03

Standard Landfill

Stockpile Removal Analysis dated May 2014

12th May 2014
Report No 1936R03-1

STANDARD LANDFILL

STOCKPILE REMOVAL ANALYSIS

Carried out for: **Flintshire County Council**

STANDARD LANDFILL

STOCKPILE REMOVAL ANALYSIS

Prepared for

Flintshire County Council

By

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DOCUMENT INFORMATION AND CONTROL SHEET

Document Status and Approval Schedule

Report No.	Title
1936R03-1	STANDARD LANDFILL STOCKPILE REMOVAL ANALYSIS

Issue History

Issue	Status	Date		Signature	Date
1	Draft for Comment	11/05/2014	**Prepared & Approved By:** A Binns BSc CEng FICE Fellow		12/05/2014
			Checked by: C S Eccles CGeol CSci, CEnv. RoGEP Adviser SPECIALIST IN LAND CONDITION Chris Eccles Reg. No 115s		12/05/2014

DISCLAIMER

This consultancy contract was completed by TerraConsult Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, the degree of manpower and resources allocated to the project as agreed. TerraConsult Ltd cannot accept responsibility to any parties whatsoever, following the issue f this report, for any matters arising which may be considered out with the agreed scope of works. This report is issued solely to the client and TerraConsult cannot accept any responsibility to any third parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents at their own risk.

bsi. ISO 9001 Quality Management FS573193

bsi. ISO 14001 Environmental Management EMS573194

STANDARD LANDFILL
STOCKPILE REMOVAL STRATEGY

CONTENTS

Page

STANDARD LANDFILL
STOCKPILE REMOVAL ANALYSIS

INTRODUCTION

1 TerraConsult Limited (TCL) was commissioned by Flintshire County Council (FCC) to produce a strategy for the proposed removal of a stockpile of material at Standard Landfill Site, Buckley, North Wales.

2 The stockpile of material was placed on the finished cap of the landfill by West Pennine Ltd (a previous tenant who has ceased trading). The materials comprise the rejected material from their former reclamation activities.

3 This report should be read in conjunction with TCL Report No 1936/R/002-2 (Stockpile Removal Strategy).

4 From CQA surveys it is apparent that stockpile material has been tipped on top of the landfill and has cascaded down the original 1 in 3 side slopes (Drawing No 1936/1/003). The proposed sequence is as follows:

Step	Activity	Drawing ref
1	Remove all stockpile material from the top and side slopes of the landfill down to the original subsoil/grass surface. Process to remove deleterious material.	1936/1/003 1936/1/004
2	Place all acceptable old stockpile material in a new stockpile	1936/1/004
3	Inspect the original surface for signs of intrusive damage from the stockpile material.	1936/1/004
4	Excavate the top 500 mm of subsoil/topsoil from the footprint of the old stockpile on the top plateau of the landfill. Place in a new stockpile. Inspect base of the excavation for signs of intrusive damage from the stockpile material.	1936/1/004
5	Excavate the top 500 mm of subsoil/topsoil from the area on the top plateau of the landfill outside the old stockpile as shown on Drawing No. 1936/1/005. Place in a new stockpile.	1936/1/004 1936/1/005
6	Place 1000 mm of old stockpile material from the new stockpile over the total area shown on Drawing No. 1936/1/005. Note that this area is only on the top Plateau of the landfill and does not include the 1 in 3 side slopes. The material shall be placed in two 500 mm thick layers and receive nominal compaction by tracking in by the dozer.	1936/1/004 1936/1/005
7	Place 500 mm of subsoil/topsoil from the new stockpile over the total area shown on Drawing No. 1936/1/005. Note that this area is only on the top Plateau of the landfill and does not include the 1 in 3 side slopes. The material shall be placed in one 500 mm thick layer and receive nominal compaction by tracking in by the dozer.	1936/1/004 1936/1/005

Objective

5 The objective of this report is to demonstrate that the spreading of 1 m thickness of fill over the old capping will not induce excessive strains in the capping materials

COMPRESSION OF THE WASTE

6 The waste (MSW) outside the footprint of the old stockpile will receive a net loading from 1 m thickness of inert processed material from the old stockpile.

7 The compression behaviour of the waste was examined using FLAC 7 software. The surface of the model was loaded with a 20kPa surcharge from Chainage 0m to halfway across the model (at Chainage 25 m) and the resulting distorting surface deflections were examined to determine the tensile strains induced in the capping.

8 The capping over this part of the landfill comprises:

650mm Subsoil increased to 1000 mm where saplings are planted on the lower flanks
over Protection Geotextile
over 1 mm double textured LLDPE Capping
over Blinding Material
over Waste

The initial waste thickness was taken as 15m.

9 The finite difference software requires deformation parameters to be input. These were not available from site specific testing and therefore conservative values of deflection modulus and Poisson's ratio were assumed that lead to over estimates of the differential strains in the capping to allow assessment of the integrity of the system when the waste was allowed to settle and decompose.

10 The parameters chosen for the analysis were:

Table 1 – Waste parameters for settlement calculations

Elastic modulus (E)	0.05 MPa	The literature quotes values between 0.2 and 4.5 MPa. This low value was chosen to allow for long term compressibility and decomposition of the waste and to give higher values of compression/distortion.
Poisson's ratio (μ)	0.49	
Effective cohesion	4 kPa	
Effective friction	20.5º	

11 The FLAC outputs and strain calculations spreadsheet are presented in Appendix A and the movements at 5 points on the surface (see model in Appendix A for locations of points) are summarised in Table 2.

Table 2 –Surface settlements

Point on the surface	Settlement m	Horizontal movement m	Tensile strain % (-ve = Compression)	
4 & 15	2.28	0.66		
			2.8	
5 & 16	2.25	0.80		
			2.0	
6 & 17	1.63	0.86		Midpoint of the top surface
			-0.5	
7 & 18	1.03	0.80		
			-2.8	
8 & 19	1.00	0.66		

a. Vertical settlements were calculated in the order of about 7 to 15% which is within the normal range for MSW landfills.
b. Horizontal movements of 2.3 m were also calculated but it must be remembered that low moduli were used to give exaggerated displacements in order to check the capping integrity with large movements.
c. The spreadsheet in Appendix A gives the calculation of the strains in the capping based on the original and final lengths of the surface. The maximum tensile strain in the constructed cap is therefore about 2.8% which is below the allowable tensile strain of LLDPE and Geotextile protector, remembering that low moduli were used in the analysis.

17. Analysis of the settlement on the waste mass has showed the tensile strain in the capping system to be low, the design is therefore considered acceptable.

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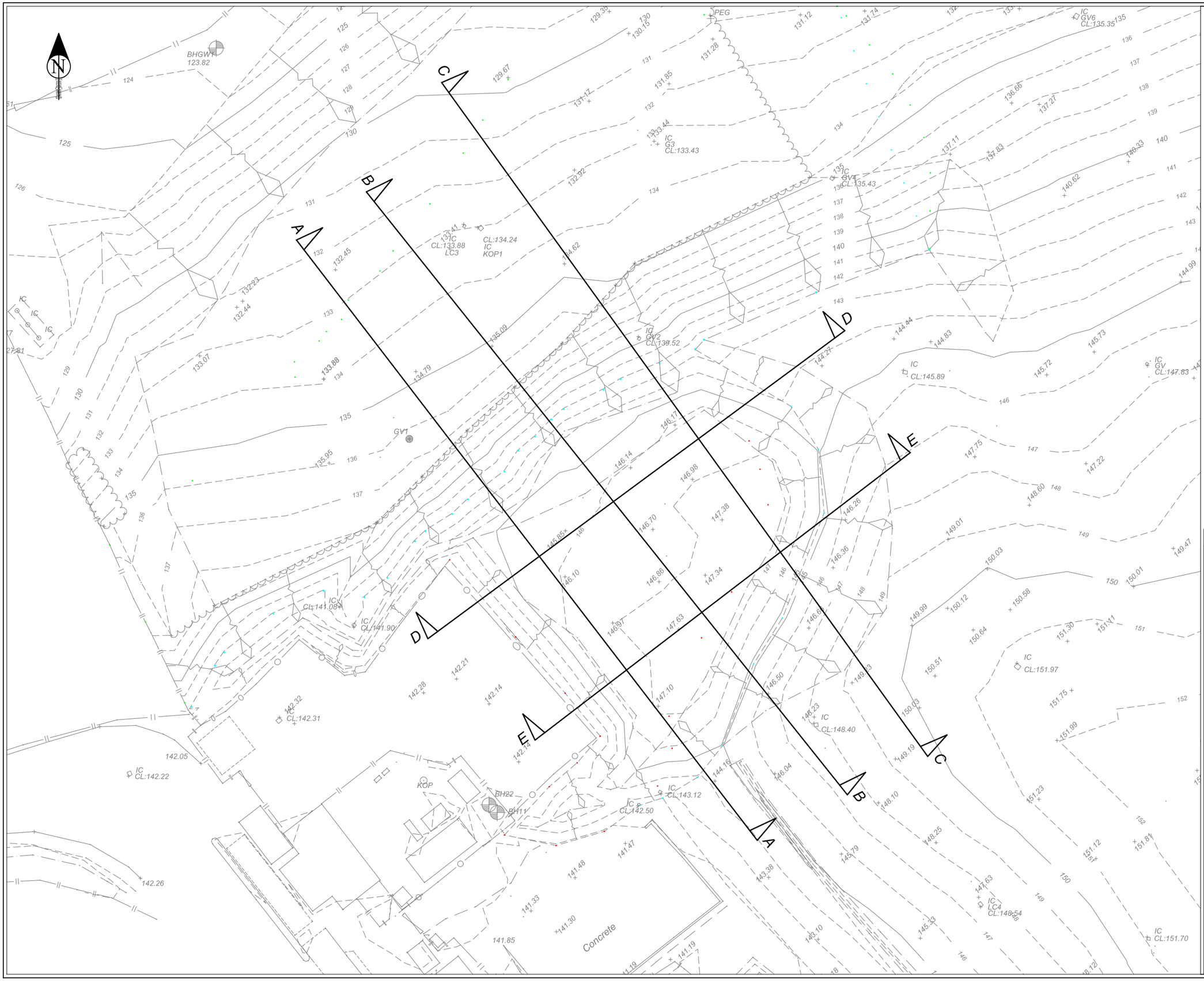
DRAWINGS

1936/1/002	**Original survey and section locations**
1936/1/003	**Existing Stockpile Sections**
1936/1/004	**Sequenced Removal and Replacement of Stockpile**
1936/1/005	**Area of Excavation**



Key

Cross section location

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

Site

Standard Landfill

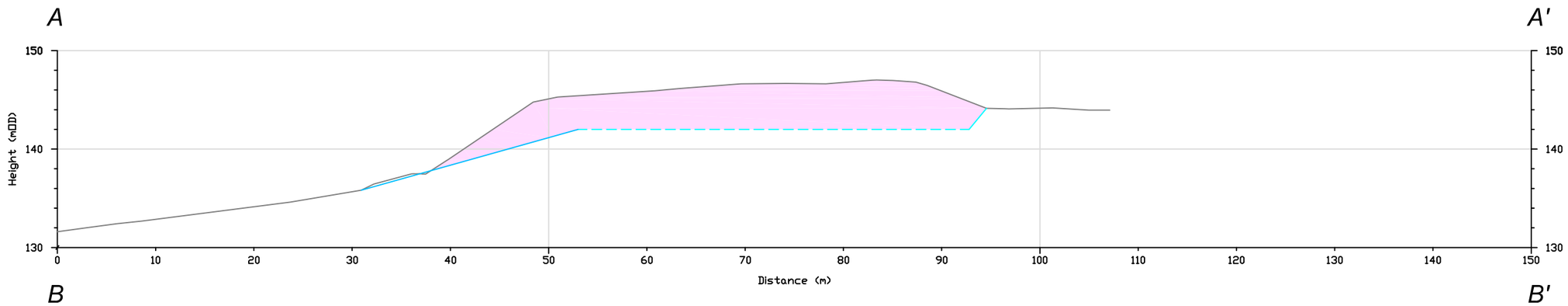
Title

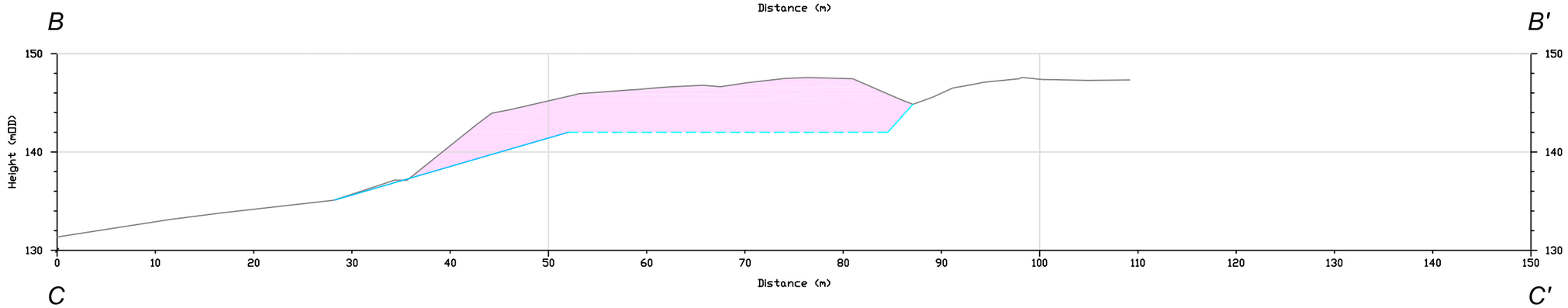
Original Survey and Section Locations

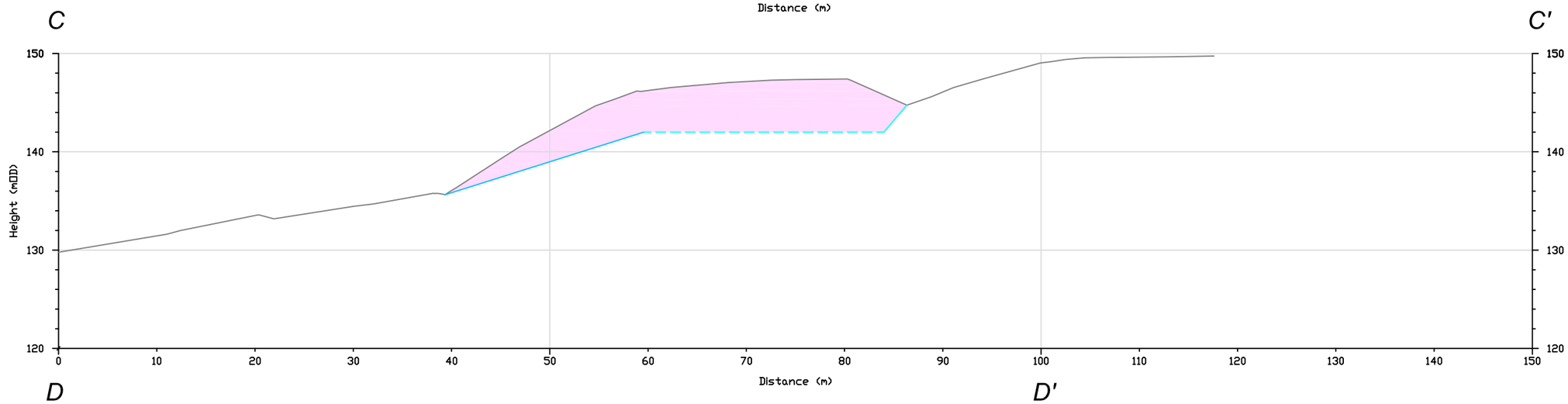
Scale	1:500	@ A3
Drawing No.	1936/1/002	

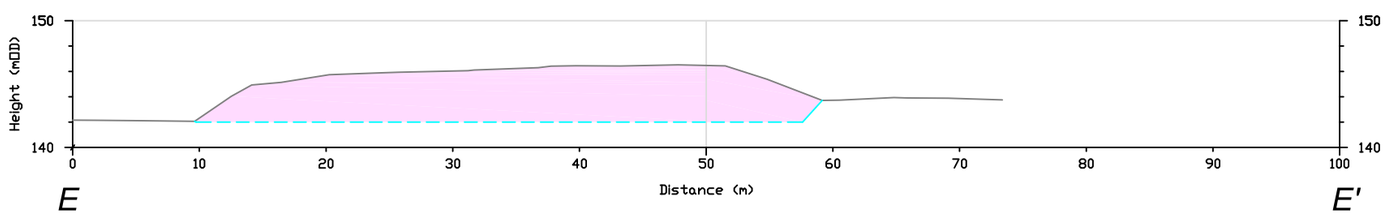
Rev	Date	Description

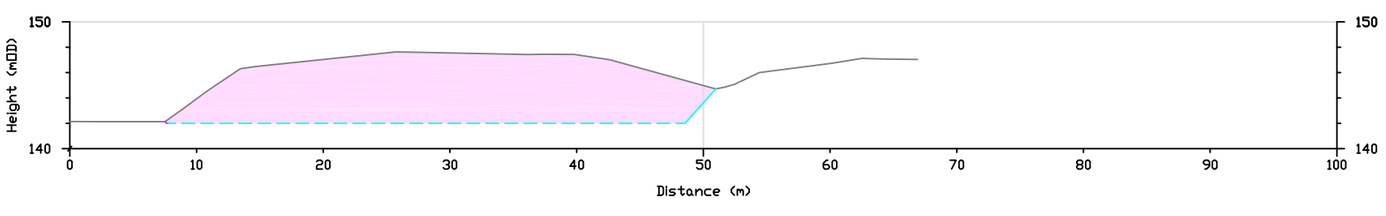
File	19361002existing.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	DRAFT











Key - Sections

- Topographical survey 17/09/12
- Assumed base of stockpile (142mOD)
- Assumed original landfill sideslope beneath slipped stockpile material
- Stockpile material

TerraConsult

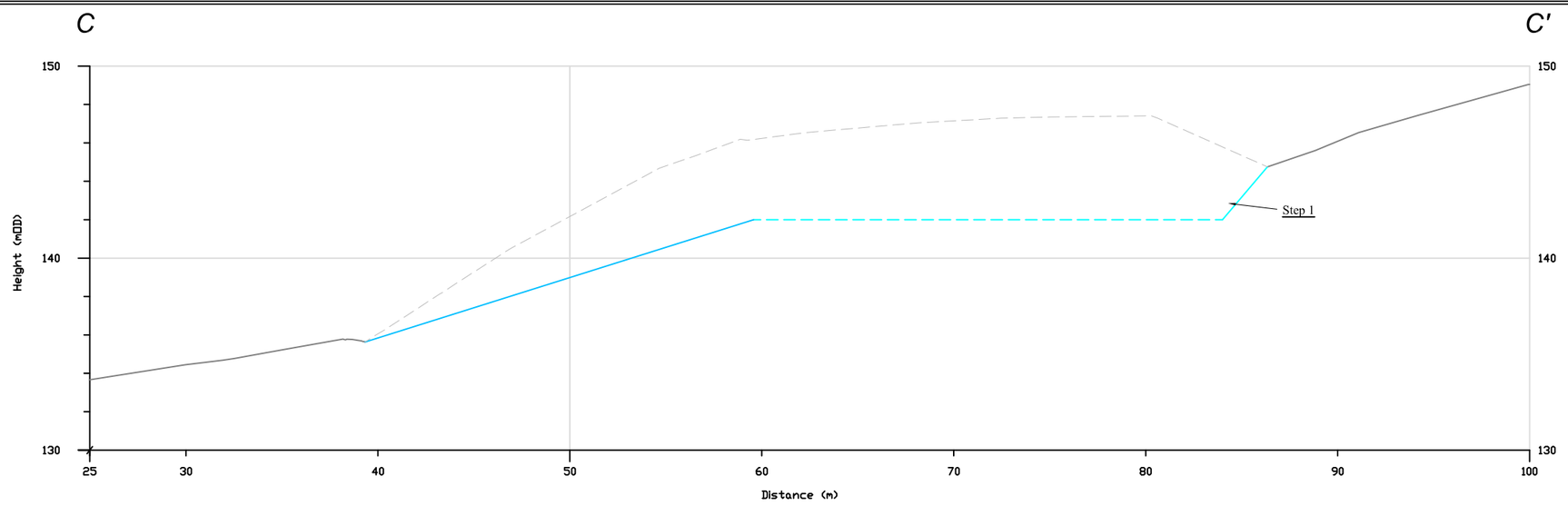
Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client: Cyngor Sir y Fflint Flintshire County Council

Site: **Standard Landfill**

Title: **Existing Stockpile Sections**

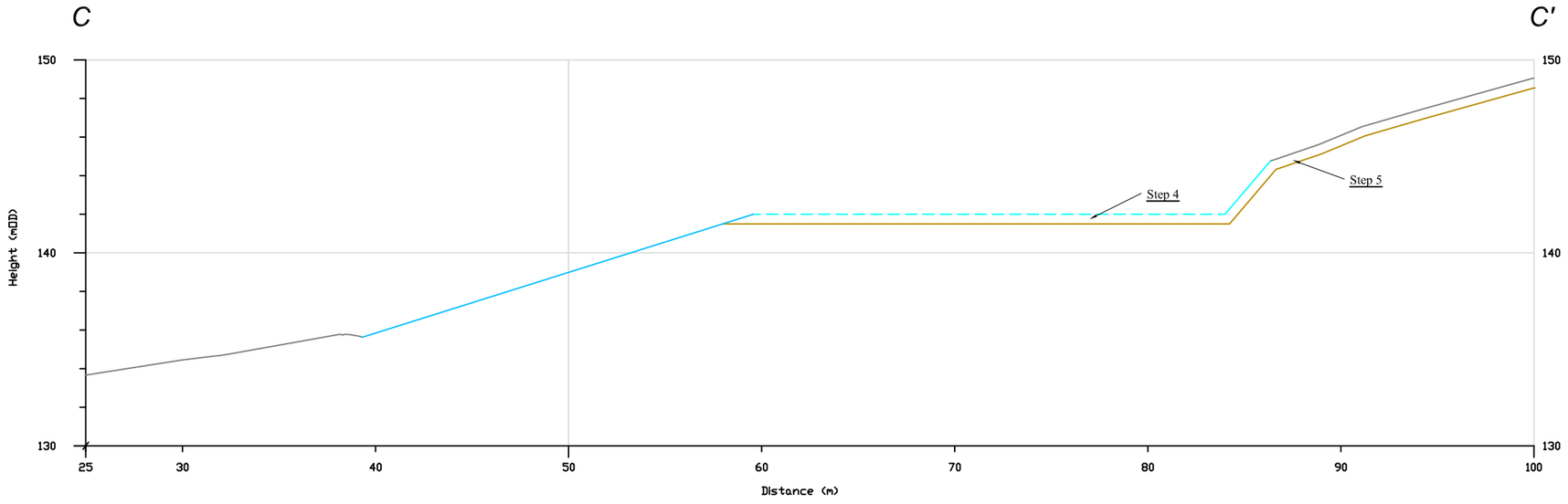
Scale	1:250 @ A1		
Drawing No.	1936/1/003		
Rev	Date	Description	
File	19361003stockpilesections.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	AB



Step 1
Remove all stockpile material down to original subsoil/grass surface and process to remove all deleterious material (concrete, brickwork, timber, rebar) particle size greater than 150mm dia.

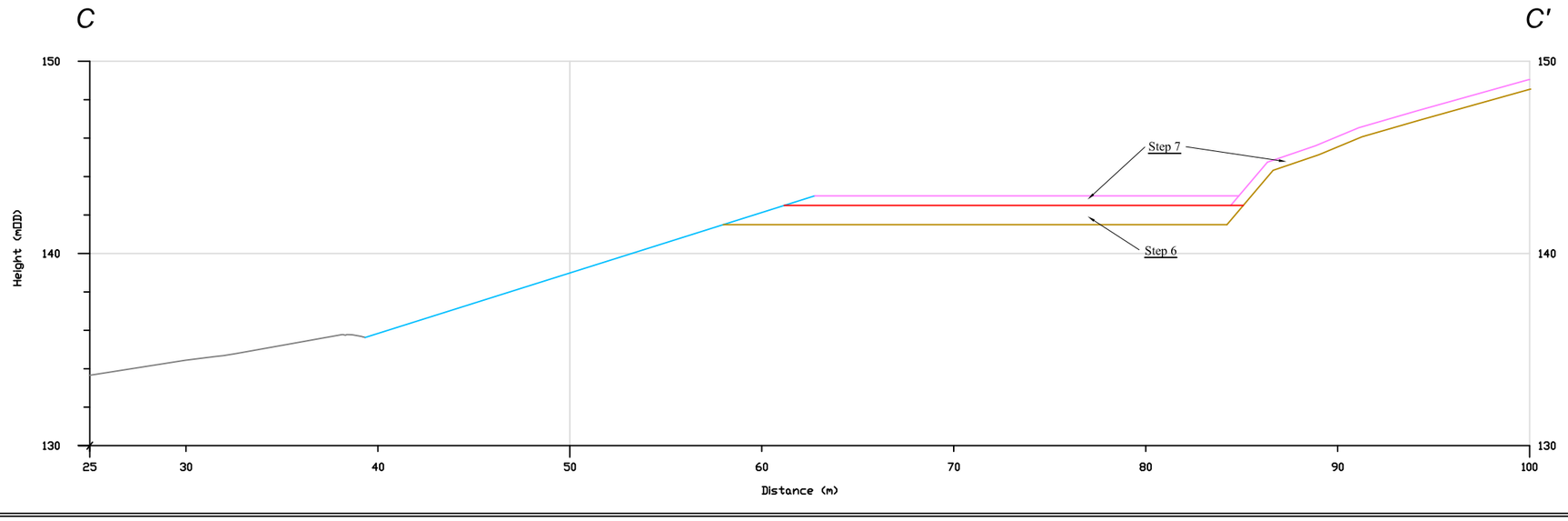
Step 2
Place all acceptable old stockpile material in a new stockpile.

Step 3
Inspect the original surface for intrusive damage from the stockpile material.



Step 4
Excavate top plateau 500mm of subsoil/topsoil from the footprint of the old stockpile and place in a new stockpile. Inspect the base of the extraction for intrusive damage from the stockpile material.

Step 5
Excavate 500mm of subsoil/topsoil over the area of the landfill's top plateau outside stockpile shown on TCL Drawing No. 1936/1/005.



Step 6
Place 1000mm of old stockpile material over the total area of the earthworks as shown on TCL Drawing No. 1936/1/005. This material to be feathered in to the existing at the perimeter. The material should be spread in 2 x 500mm thick layers compacted nominally by tracking in by the dozer.

Step 7
Place with nominal compaction 500mm of subsoil/topsoil material over the total area of the earthworks from the new stockpile.

Key

- Topographical survey 17/09/12
- Assumed base of stockpile (142mOD)
- Assumed original landfill sideslope beneath slipped stockpile material
- Base of dig
- Top of replaced soils

Notes

1. Indicative sequence shown using section C-C' only - other sections are similar.
2. These steps should be read in conjunction with the stockpile removal strategy (TCL Report No. 1936R01-1).

TerraConsult

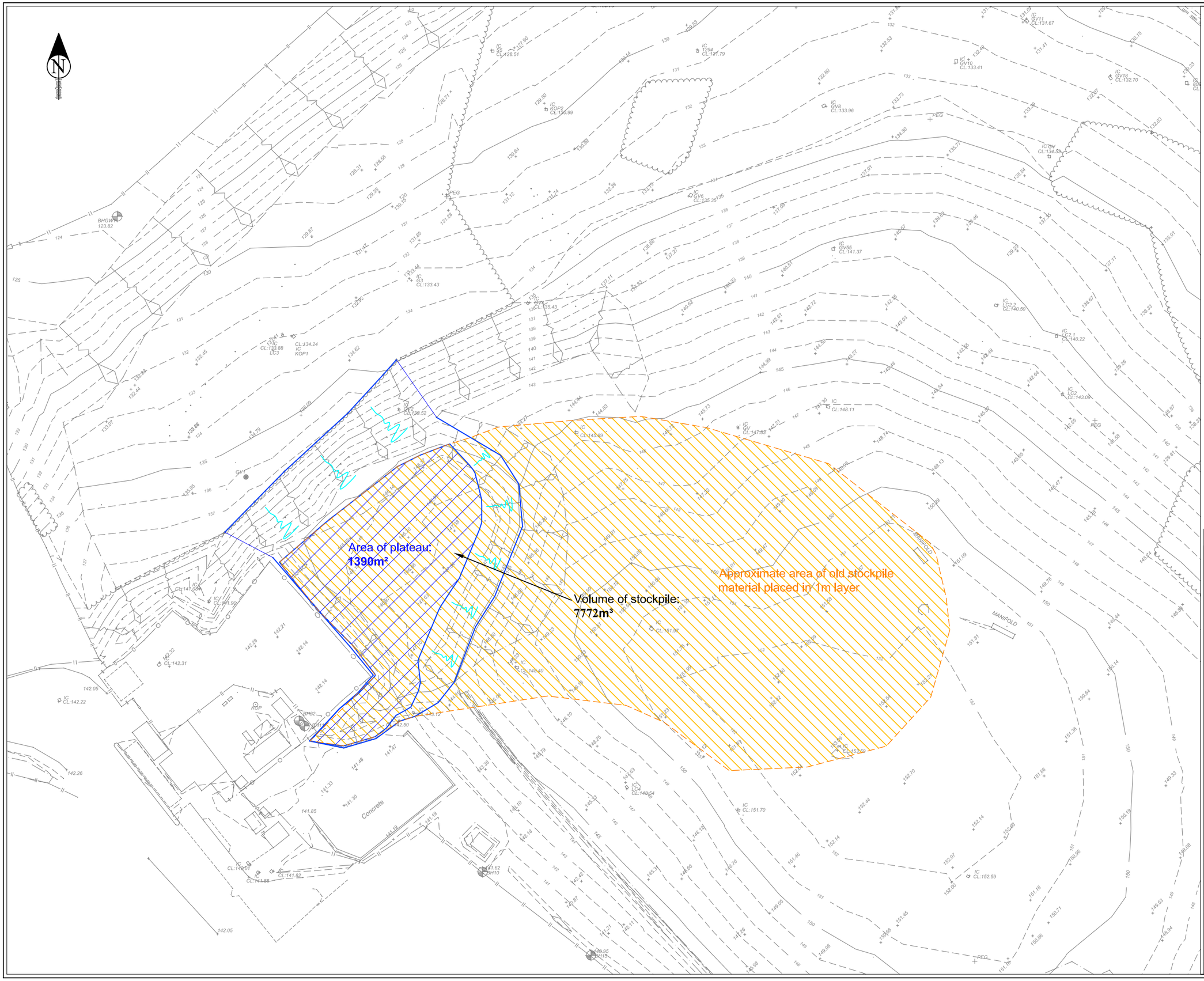
Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client: Cyngor Sir y Fflint Flintshire County Council

Site
Standard Landfill

Title
Sequenced Removal and Replacement of Stockpile

Scale	1:150	@ A1
Drawing No.	1936/1/004	
Rev	Date	Description
File	19361004stockpilesteps.dwg	
Date	05/14	Engineer AB
Drawn	SK	Checked DRAFT



Key

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL

Site

Standard Landfill

Title

Area of Excavation

Scale	1:750	@ A3
Drawing No.	1936/1/005	

Rev	Date	Description

File	19361005areaofexcavation.dwg		
Date	05/14	Engineer	AB
Drawn	SK	Checked	DRAFT

Appendix A

FLAC 7 Outputs

JOB TITLE : 1963 Standard Road Settlement under 1 m of fill

FLAC (Version 7.00)

LEGEND

9-May-14 13:03
step 3708
-2.778E+00 <x< 5.278E+01
1.047E+02 <y< 1.603E+02

Boundary plot

0 1E 1

Grid plot

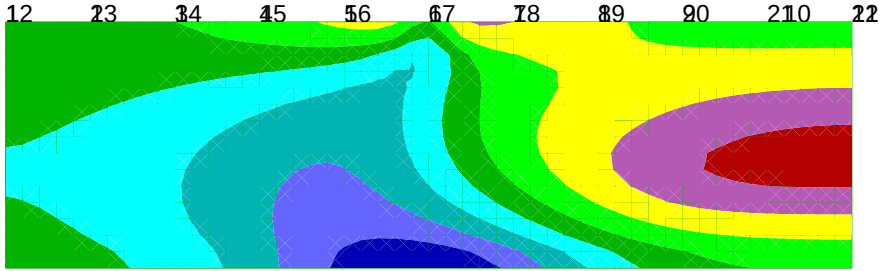
0 1E 1

History Locations

Max. shear strain increment

- 0.00E+00
- 2.50E-02
- 5.00E-02
- 7.50E-02
- 1.00E-01
- 1.25E-01
- 1.50E-01
- 1.75E-01
- 2.00E-01

TerraConsult
Max shear strain increment



JOB TITLE : 1963 Standard Road Settlement under 1 m of fill

FLAC (Version 7.00)

LEGEND

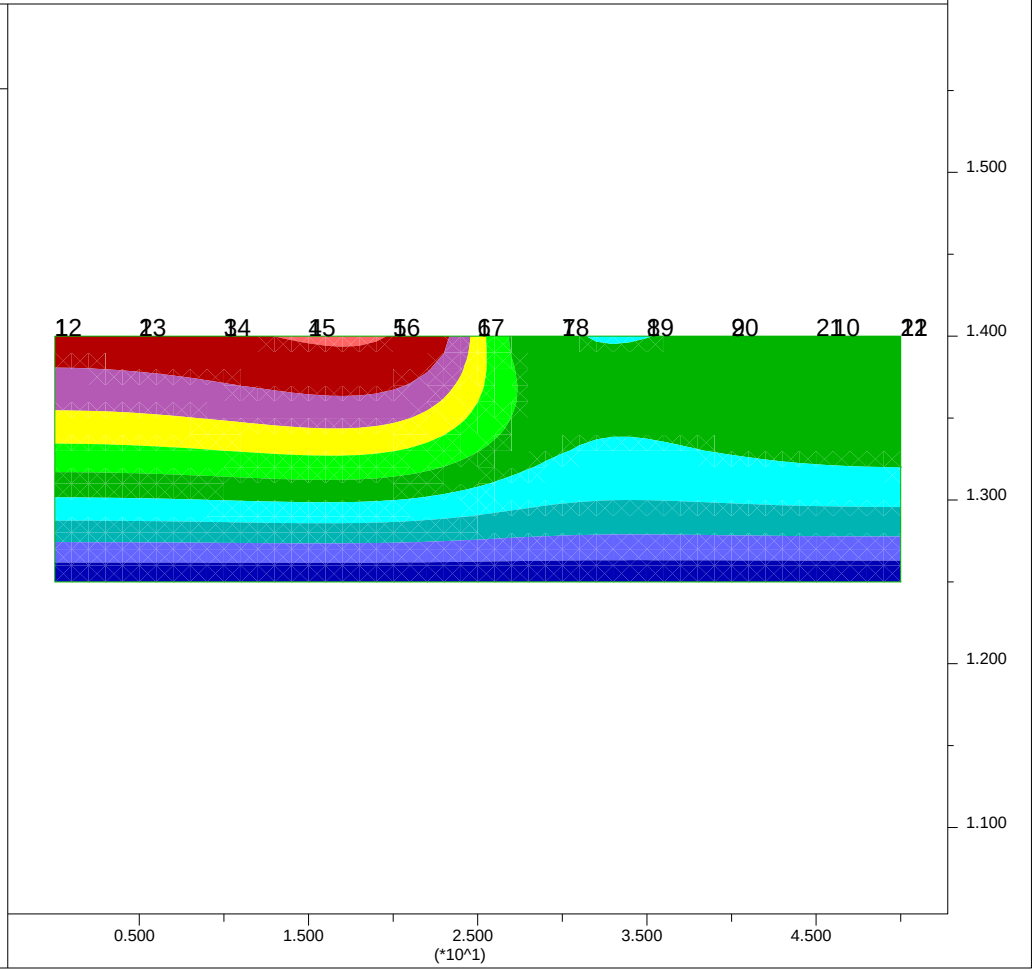
9-May-14 14:21
step 3514
-2.778E+00 <x< 5.278E+01
1.047E+02 <y< 1.603E+02

Y-displacement contours
-2.25E+00
-2.00E+00
-1.75E+00
-1.50E+00
-1.25E+00
-1.00E+00
-7.50E-01
-5.00E-01
-2.50E-01
0.00E+00

Contour interval= 2.50E-01
Boundary plot
0 1E 1

History Locations

TerraConsult
Vertical Displacement contours



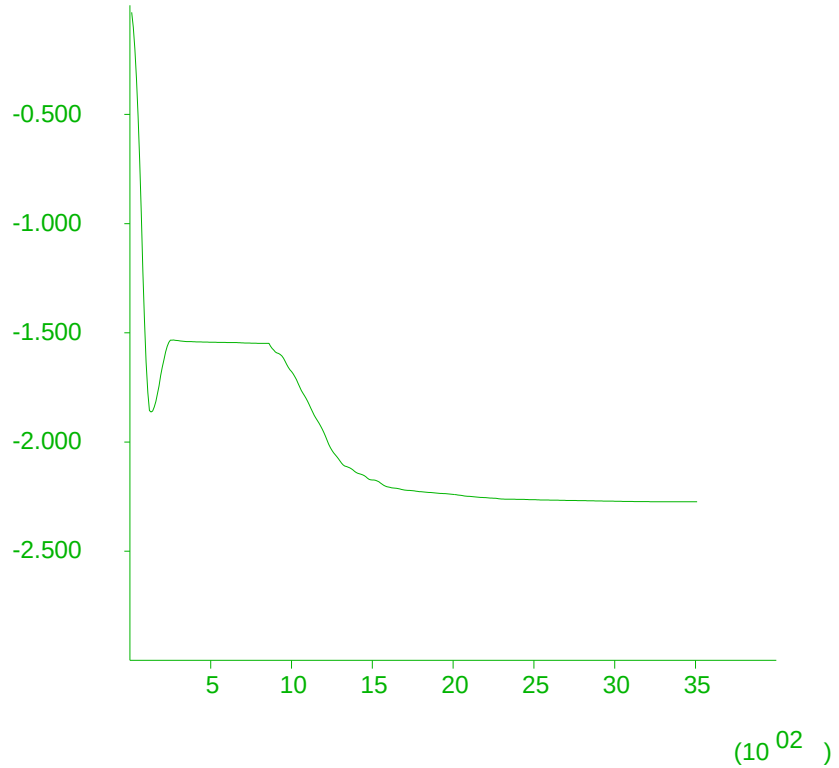
JOB TITLE : 1963 Standard Road Settlement under 1 m of fill

FLAC (Version 7.00)

LEGEND

9-May-14 14:39
step 3514
-2.778E+00 <x< 5.278E+01
1.047E+02 <y< 1.603E+02

HISTORY PLOT
Y-axis :
4 Y displacement(16, 16)
X-axis :
Number of steps



TerraConsult
Vert Disp point 4 20kPa

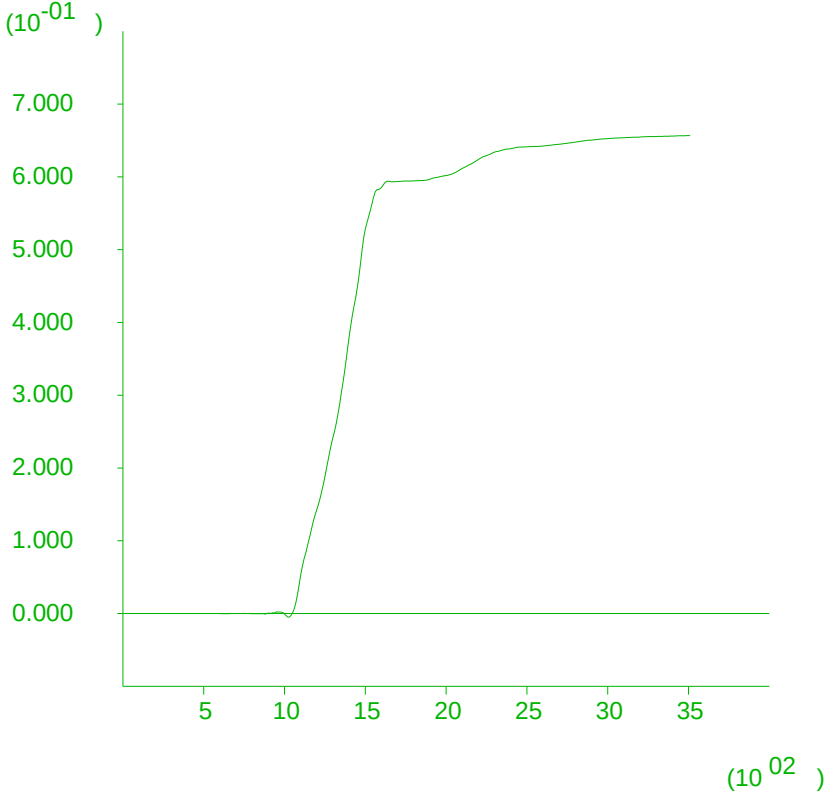
JOB TITLE : 1963 Standard Road Settlement under 1 m of fill

FLAC (Version 7.00)

LEGEND

9-May-14 14:42
step 3514
-2.778E+00 <x< 5.278E+01
1.047E+02 <y< 1.603E+02

HISTORY PLOT
Y-axis :
15 X displacement(16, 16)
X-axis :
Number of steps



TerraConsult
Horiz Disp point 4 20kPa

Client: Flintshire County Council
Project Name: Standard Road LFS
Project No: 1936

Strains in Capping

TerraConsult

Point on capping	Original X	Horiz movement	New X	Original Y	Settlement	New Y	Original length	Final Length	Strain (+ = tension)
4 & 15	15	0.660	15.66	140.0	2.280	137.720			
							5.00	5.14	2.80
5 & 16	20	0.800	20.80	140.0	2.25	137.75			
							5.00	5.10	1.96
6 & 17	25	0.860	25.86	140.0	1.630	138.37			
							5.00	4.98	-0.47
7 &18	30	0.800	30.80	140.0	1.030	138.97			
							5.00	4.86	-2.80
8 & 19	35	0.660	35.66	140.0	1.000	139.000			

Appendix C

Global Stability

FLACSlope outputs

JOB TITLE : 2651 Standard Rd SectionA Run 01 EFF Waste c=2. phi=27.5

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 15:44

Factor of Safety 1.30

User-defined Groups

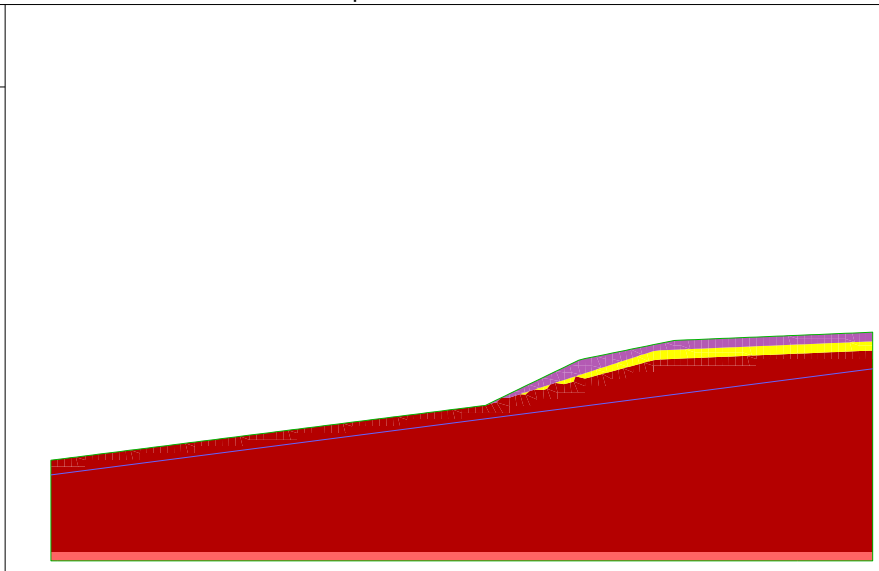
- 'Weathered Rock:Weath Mudst
- Waste:MSW
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 2E 1

Water Table

TerraConsult
Materials



(*10^2)
1.750
1.650
1.550
1.450
1.350
1.250
1.150
1.050
0.950
0.850

0.150 0.250 0.350 0.450 0.550 0.650 0.750 0.850 0.950 1.050
(*10^2)

Project file: 2651 Standard Rd - SectionA Run 01 EFF.psl
Project title: 2651 Standard Rd – SectionA Run 01 EFF Waste c=2. phi=27.5

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW	1100.0	4000.0	0.0	20.5	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_01_EFF_Model_1	Mohr-Coulomb	General slope	Z120	fc	1.30

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Wed Feb 10 15:44:37 GMT 2016

JOB TITLE : 2651 Standard Rd SectionA Run 01 EFF Waste c=2. phi=27.5

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 15:42

Factor of Safety 1.30

Shear Strain Rate Contours

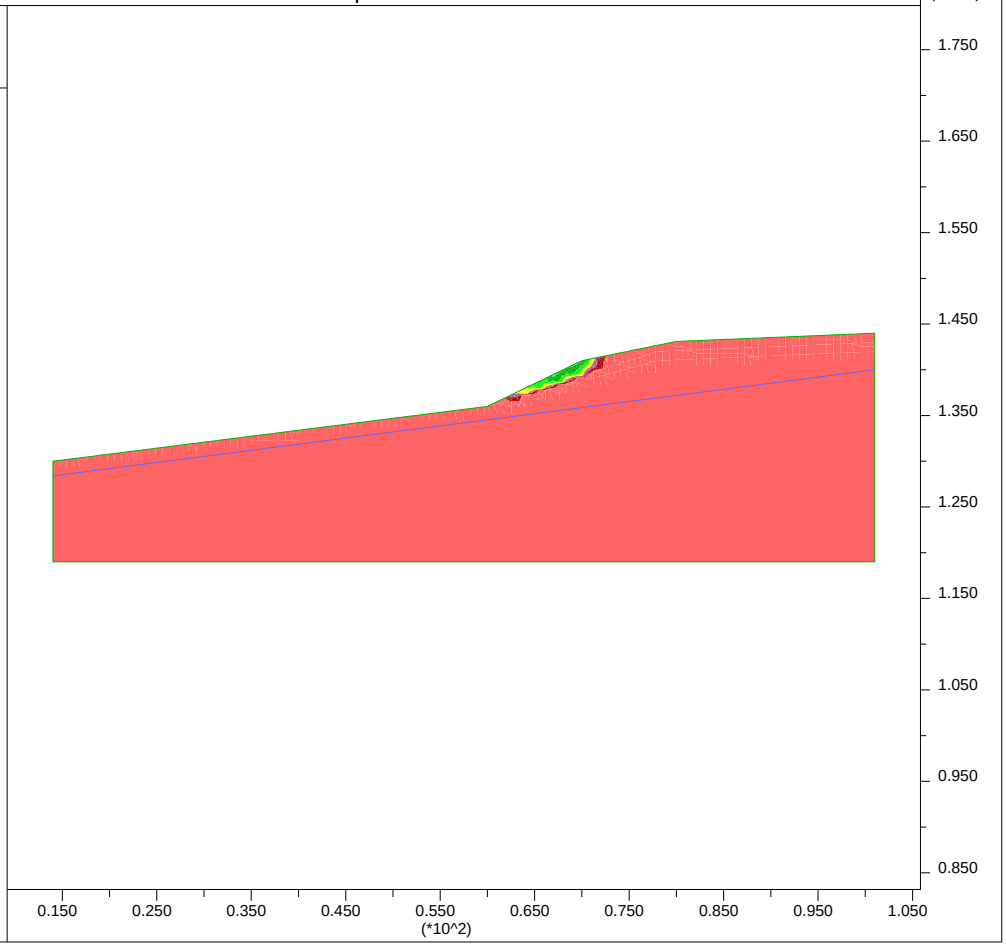
- 2.50E-05
- 5.00E-05
- 7.50E-05
- 1.00E-04
- 1.25E-04
- 1.50E-04

Contour interval= 2.50E-05
(zero contour omitted)
Boundary plot

0 2E 1

Water Table

TerraConsult
Strains



JOB TITLE : 2651 Standard Rd SectionA Run 02 EFF Waste c=2. phi=27.5 VHigh water in w

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 16:03

Factor of Safety 1.08

User-defined Groups

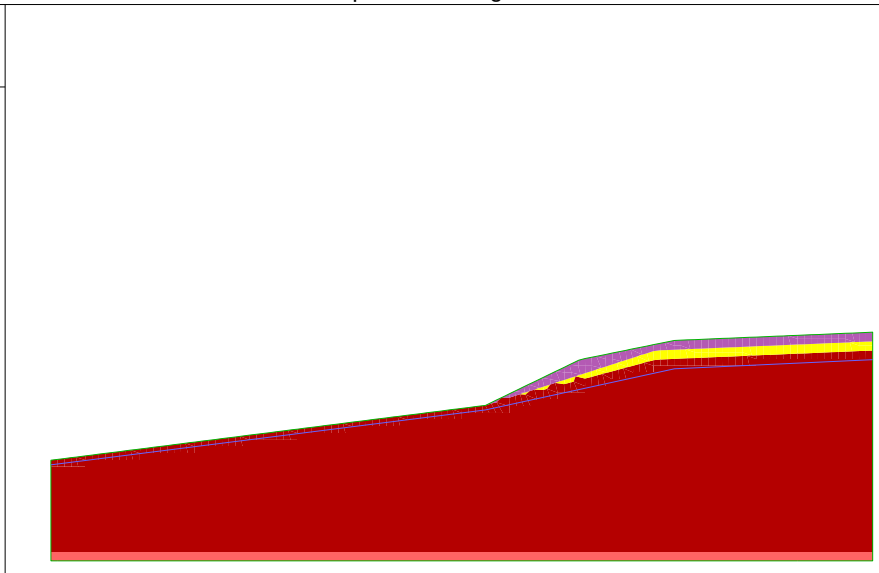
- 'Weathered Rock:Weath Mudst
- Waste:MSW
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 2E 1

Water Table

TerraConsult
Materials



(*10^2)
1.750
1.650
1.550
1.450
1.350
1.250
1.150
1.050
0.950
0.850

0.150 0.250 0.350 0.450 0.550 0.650 0.750 0.850 0.950 1.050
(*10^2)

Project file: 2651 Standard Rd - SectionA Run 02 EFF.psl
Project title: 2651 Standard Rd – SectionA Run 02 EFF Waste c=2. phi=27.5 VHigh water in waste

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW	1100.0	4000.0	0.0	20.5	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_02_EFF_Model_1	Mohr-Coulomb	General slope	Z120	fc	1.08

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Wed Feb 10 16:04:54 GMT 2016

JOB TITLE : 2651 Standard Rd SectionA Run 02 EFF Waste c=2. phi=27.5 VHigh water in w

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 16:04

Factor of Safety 1.08

Shear Strain Rate Contours

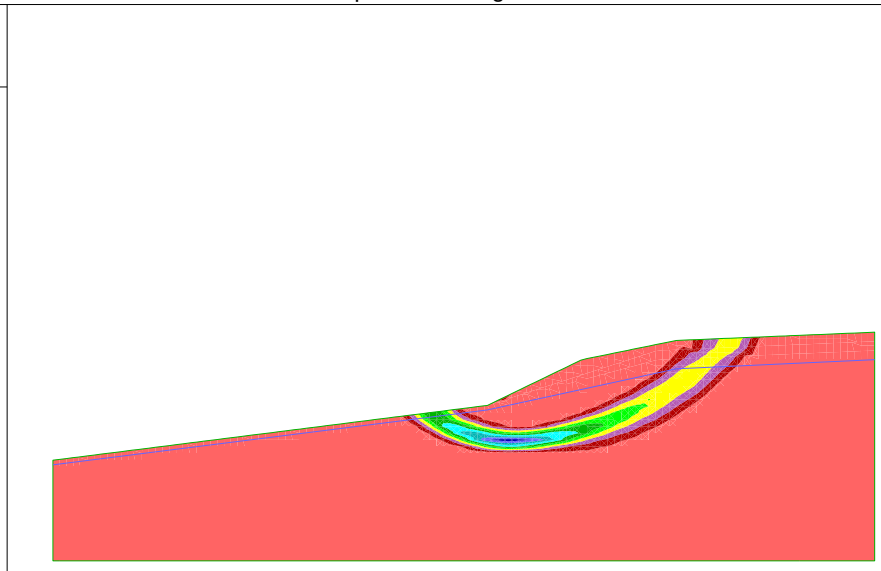
- 1.00E-07
- 2.00E-07
- 3.00E-07
- 4.00E-07
- 5.00E-07
- 6.00E-07
- 7.00E-07
- 8.00E-07
- 9.00E-07

Contour interval= 1.00E-07
(zero contour omitted)
Boundary plot

0 2E 1

Water Table

TerraConsult
Strains



(*10^2)
1.750
1.650
1.550
1.450
1.350
1.250
1.150
1.050
0.950
0.850

0.150 0.250 0.350 0.450 0.550 0.650 0.750 0.850 0.950 1.050
(*10^2)

Appendix D

Capping Veneer Stability

FLACSlope outputs

JOB TITLE : 2651 Standard Rd SectionA Run 03 EFF Waste c=2. phi=27.5 No water

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 16:31

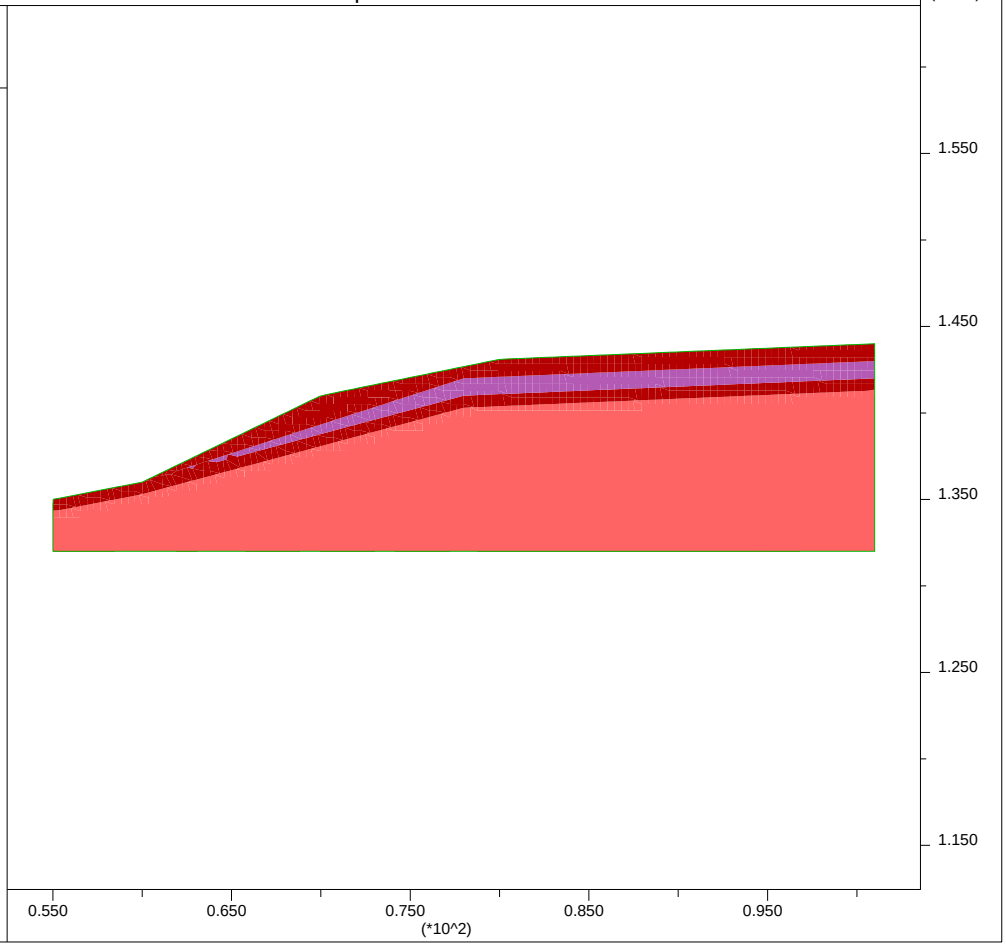
Factor of Safety 1.27

User-defined Groups
- 'Waste:MSW - strong'
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 1E 1

TerraConsult
Materials



Project file: 2651 Standard Rd - SectionA Run 03 EFF.psl
Project title: 2651 Standard Rd – SectionA Run 03 EFF Waste c=2. phi=27.5 No water

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW - strong	1100.0	40000.0	0.0	41.0	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_03_EFF_Model_1	Mohr-Coulomb	General slope	Z120	fc	1.27

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Wed Feb 10 16:31:42 GMT 2016

JOB TITLE : 2651 Standard Rd SectionA Run 03 EFF Waste c=2. phi=27.5 No water

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 16:30

Factor of Safety 1.27

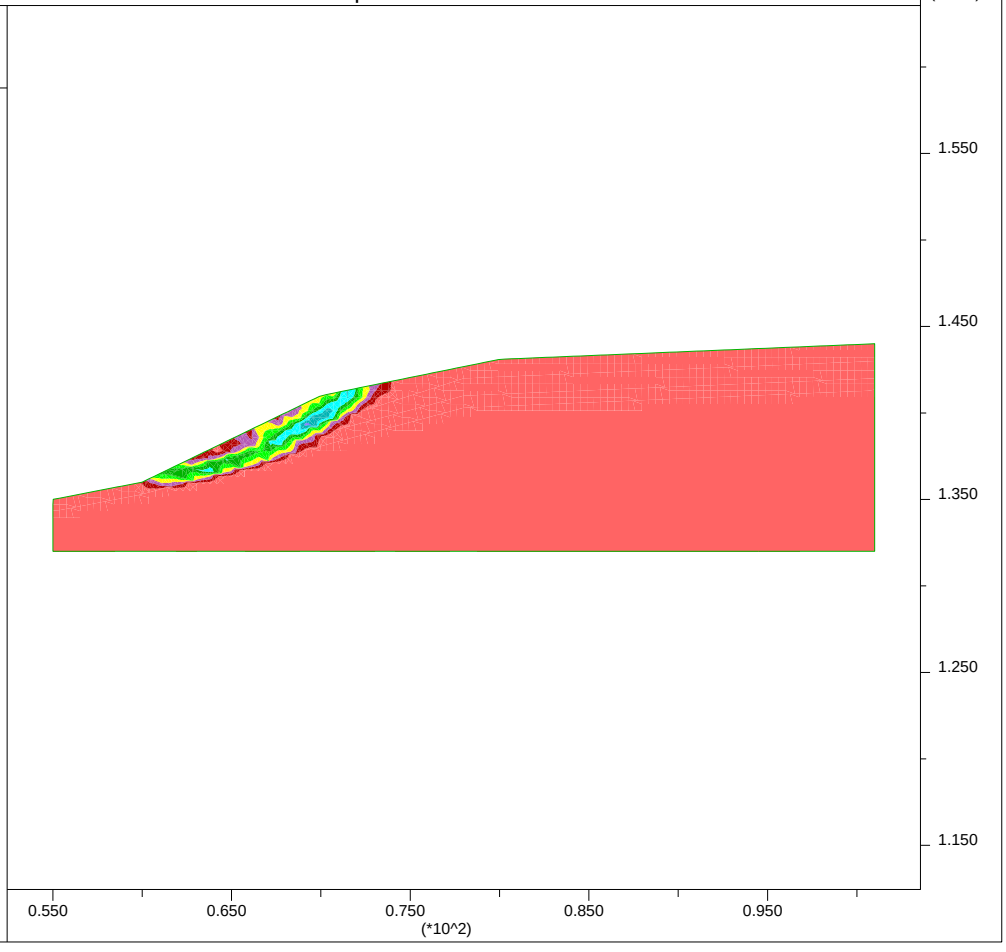
Shear Strain Rate Contours

- 2.50E-08
- 5.00E-08
- 7.50E-08
- 1.00E-07
- 1.25E-07
- 1.50E-07
- 1.75E-07
- 2.00E-07

Contour interval= 2.50E-08
(zero contour omitted)
Boundary plot

0 1E 1

TerraConsult
Strains



JOB TITLE : 2651 Standard Rd SectionA Run 04 EFF Waste c=2. phi=27.5 PSR=0.5

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 16:58

Factor of Safety 1.15

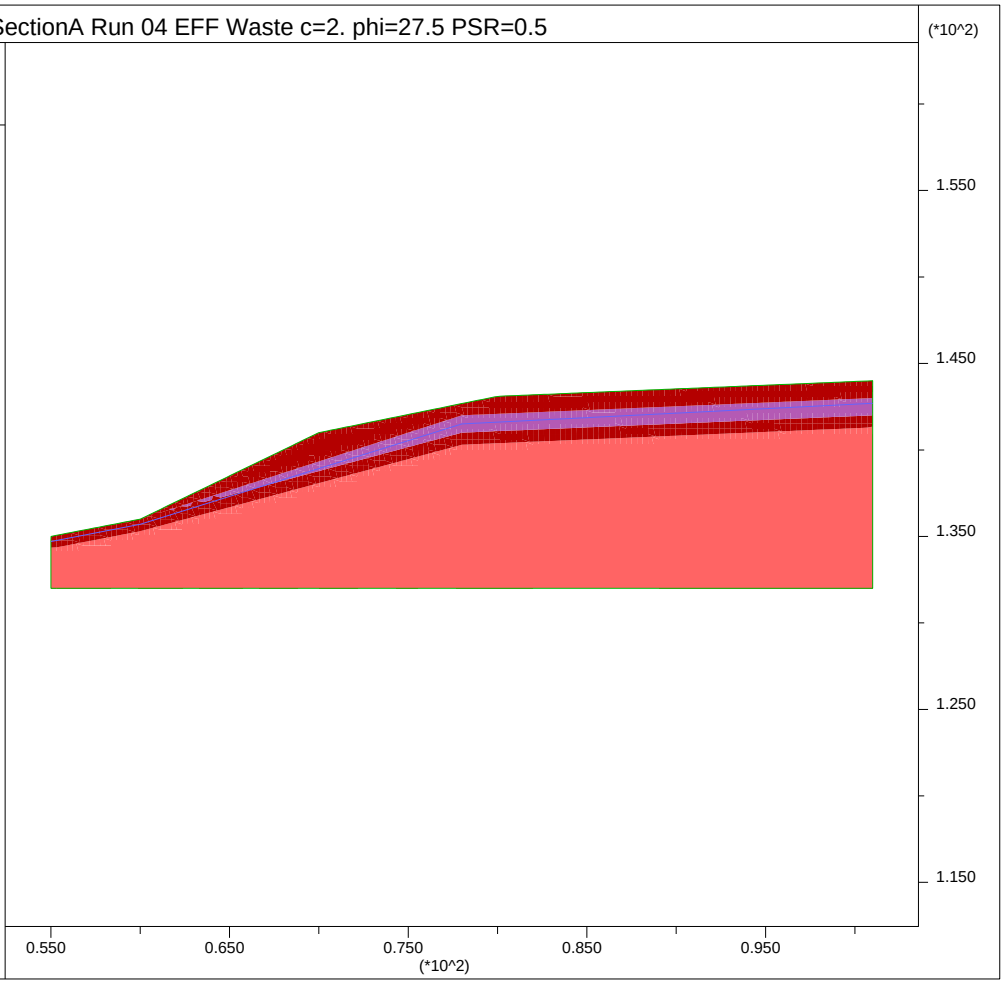
User-defined Groups
- 'Waste:MSW - strong'
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 1E 1

Water Table

TerraConsult
Materials



Project file: 2651 Standard Rd - SectionA Run 04 EFF.psl
Project title: 2651 Standard Rd – SectionA Run 04 EFF Waste c=2. phi=27.5 PSR=0.5

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW - strong	1100.0	40000.0	0.0	41.0	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_04_EFF_Model_1	Mohr-Coulomb	General slope	Z150	fc	1.15

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Wed Feb 10 17:00:42 GMT 2016

JOB TITLE : 2651 Standard Rd SectionA Run 04 EFF Waste c=2. phi=27.5 PSR=0.5

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 17:00

Factor of Safety 1.15

Shear Strain Rate Contours

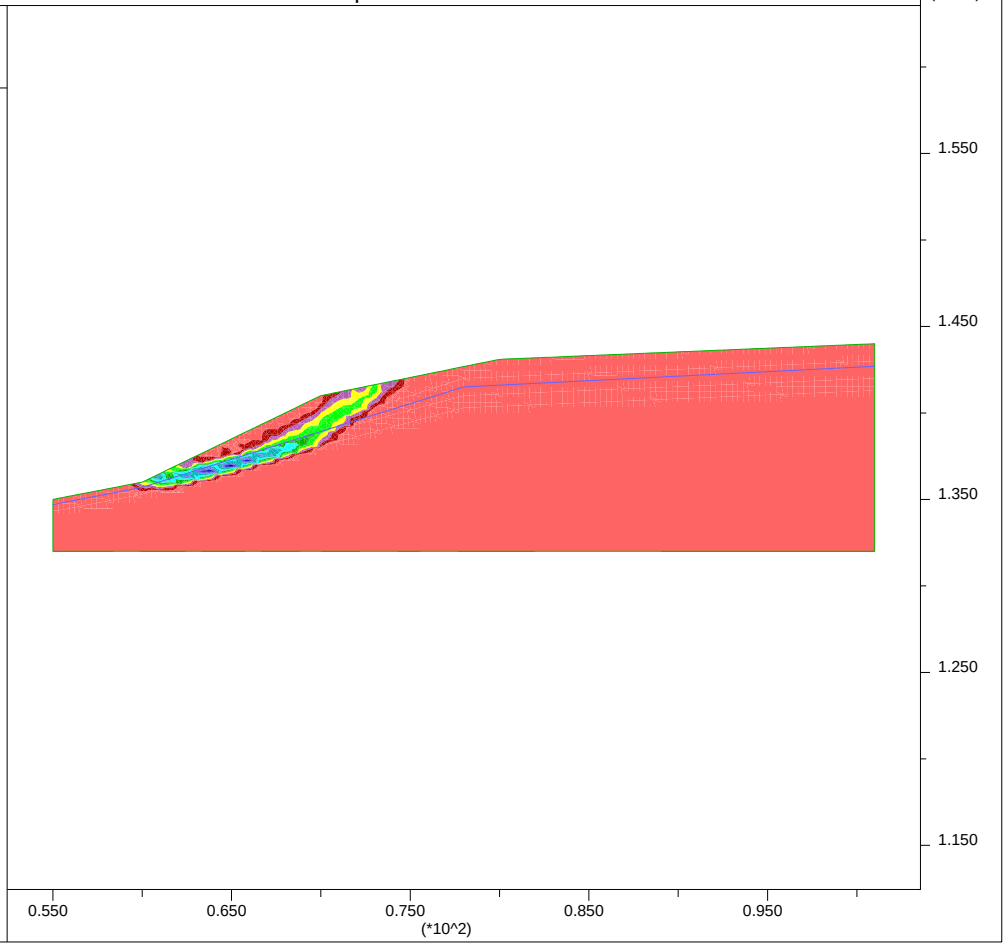
- 1.00E-09
- 2.00E-09
- 3.00E-09
- 4.00E-09
- 5.00E-09
- 6.00E-09
- 7.00E-09
- 8.00E-09
- 9.00E-09

Contour interval= 1.00E-09
(zero contour omitted)
Boundary plot

0 1E 1

Water Table

TerraConsult
Strains



JOB TITLE : 2651 Standard Rd SectionA Run 05 EFF Waste c=2. phi=27.5 PSR=0.6

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 17:31

Factor of Safety 0.94

User-defined Groups

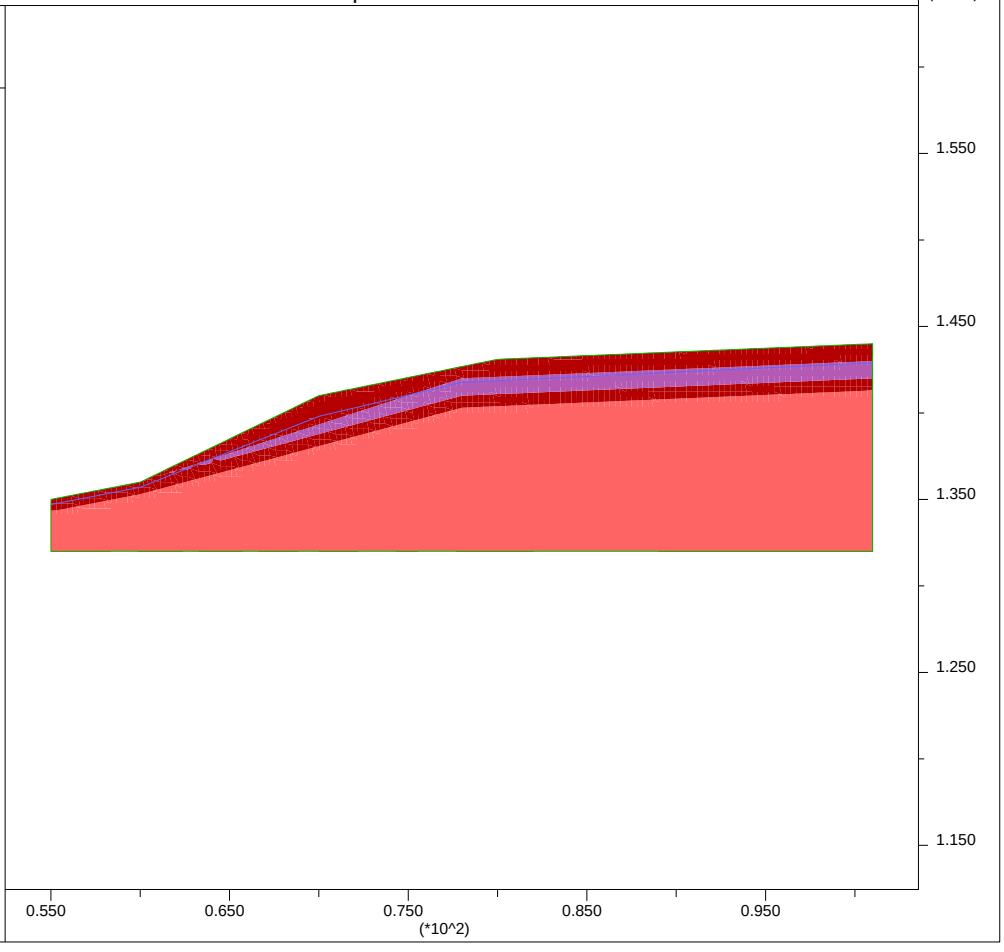
- 'Waste:MSW - strong'
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 1E 1

Water Table

TerraConsult
Materials



JOB TITLE : 2651 Standard Rd SectionA Run 05 EFF Waste c=2. phi=27.5 PSR=0.6

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 17:30

Factor of Safety 0.94

Shear Strain Rate Contours

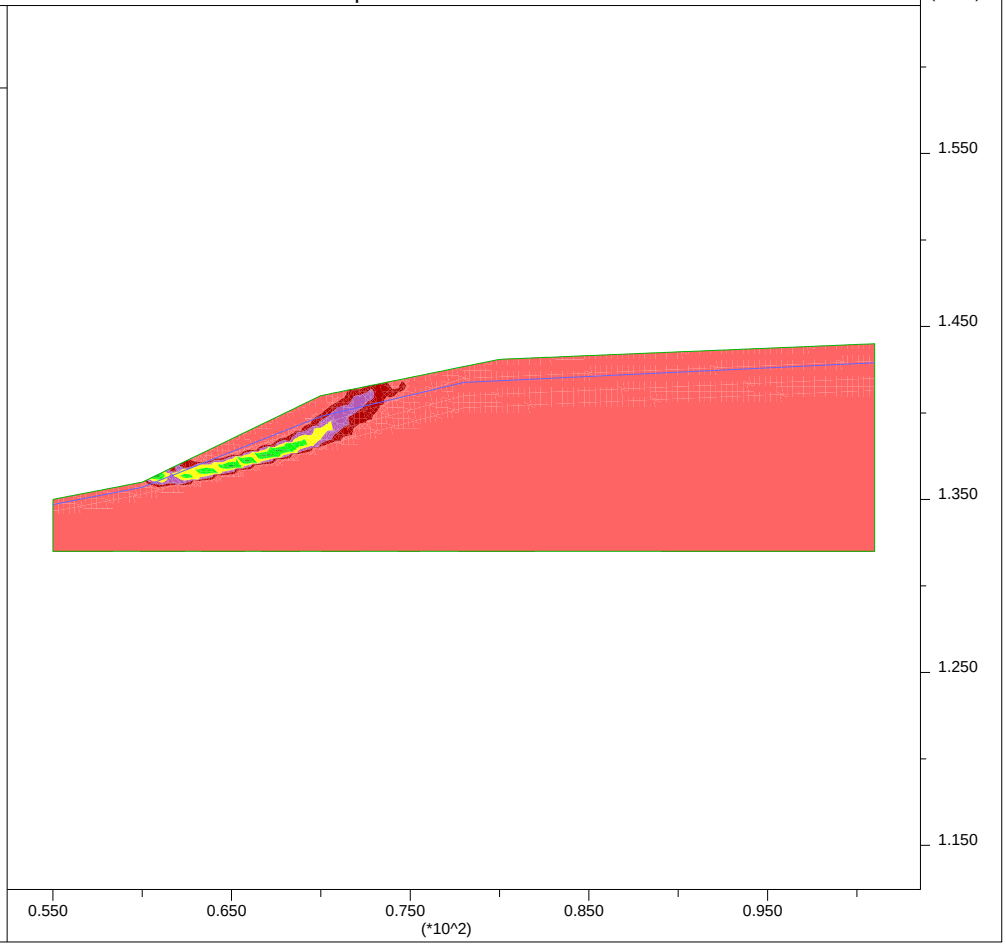
1.00E-08
2.00E-08
3.00E-08
4.00E-08
5.00E-08
6.00E-08

Contour interval= 1.00E-08
(zero contour omitted)
Boundary plot

0 1E 1

Water Table

TerraConsult
Strains



JOB TITLE : 2651 Standard Rd SectionA Part Run 06 EFF Waste c=2 phi=33 PSR=0.6 FML

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 17:52

Factor of Safety 1.22

User-defined Groups

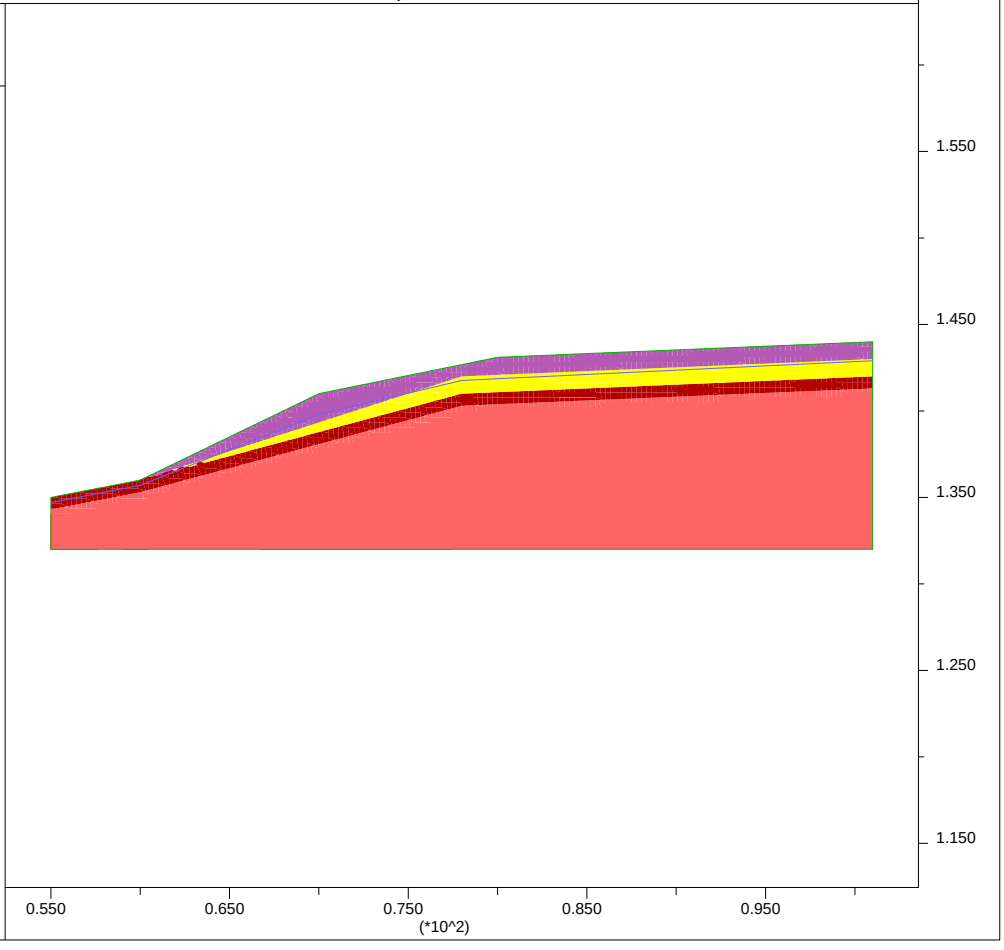
- 'Waste:MSW - strong'
- 'Soil-Sand:Restoration subs
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 1E 1

Water Table

TerraConsult
Materials



Project file: 2651 Standard Rd - SectionA Run 06 EFF.psl
Project title: 2651 Standard Rd – SectionA Part Run 06 EFF Waste c=2 phi=33 PSR=0.6 FML

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW - strong	1100.0	40000.0	0.0	41.0	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0
Soil-Sand Restoration subsoil-FML	1700.0	5500.0	0.0	21.14	0.0

Interface Properties

Class Name	Cohesion Pa	Tensile Str Pa	Friction Deg.	Dilation Deg.
User new 1	0.0	0.0	0.0	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_06_EFF_Model_1	Mohr-Coulomb	General slope	Z160	fc	1.22

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Wed Feb 10 17:54:35 GMT 2016

JOB TITLE : 2651 Standard Rd SectionA Part Run 06 EFF Waste c=2 phi=33 PSR=0.6 FML

FLAC/SLOPE (Version 7.00)

LEGEND

10-Feb-16 17:54

Factor of Safety 1.22

Shear Strain Rate Contours

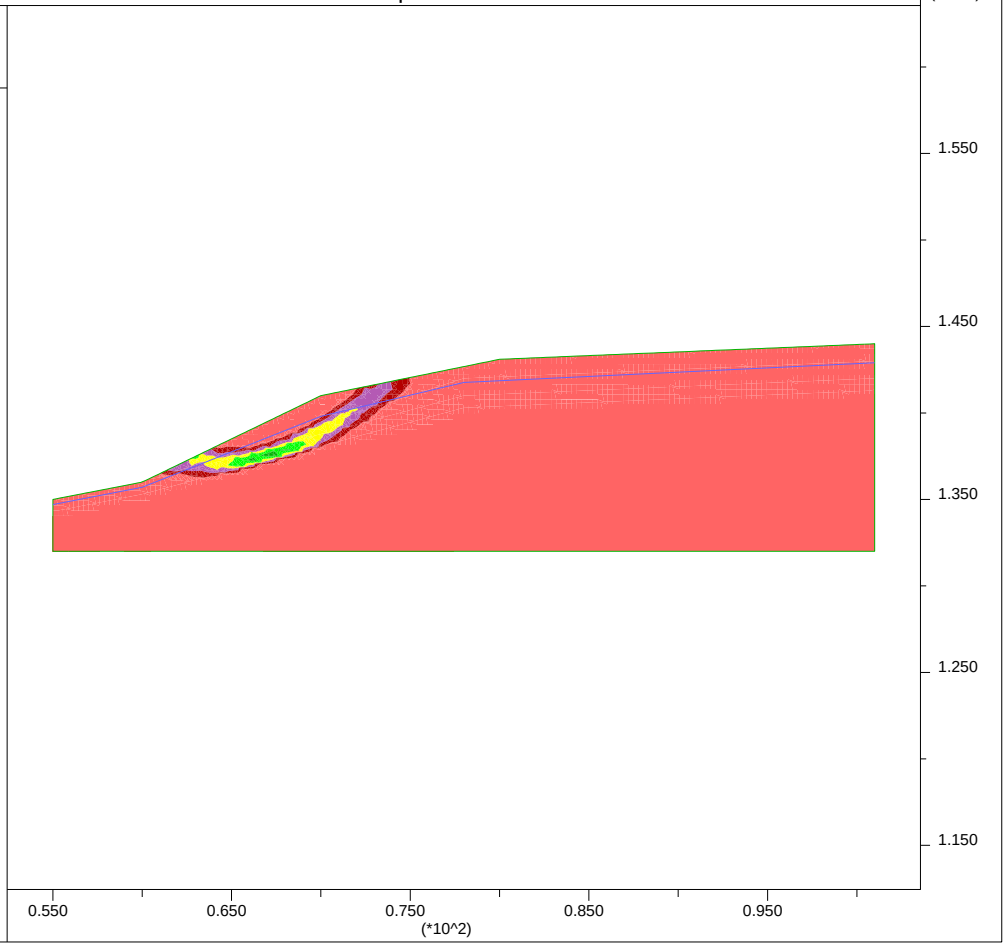
- 2.00E-06
- 4.00E-06
- 6.00E-06
- 8.00E-06
- 1.00E-05

Contour interval= 2.00E-06
(zero contour omitted)
Boundary plot

0 1E 1

Water Table

TerraConsult
Strains



JOB TITLE : 2651 Standard Rd Section A Part Run07 EFF Waste c=2 phi=33 PSR=0.6 Geotexti

FLAC/SLOPE (Version 7.00)

LEGEND

11-Feb-16 8:52

Factor of Safety 1.21

User-defined Groups
- 'Waste:MSW - strong'
- 'Soil-Sand:Restoration subs
- 'Soil-Sand:Restoration subs
- 'Waste:Stockpile eff'

Boundary plot

0 1E 1

Water Table

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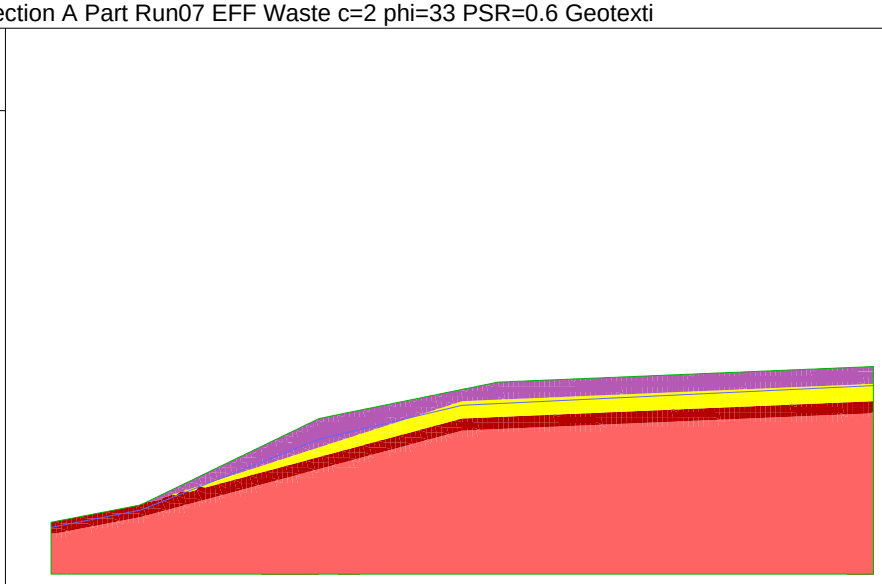
Materials



(*10^2)
1.550
1.450
1.350
1.250
1.150
0.550
0.650
0.750
0.850
0.950
(*10^2)

Project file: 2651 Standard Rd - SectionA Run 07 EFF.psl
Project title: 2651 Standard Rd Section A Part Run07 EFF Waste c=2 phi=33 PSR=0.6 Geotextile

Material Properties - Mohr-Coulomb

Class Name	Density ρ	Cohesion c	Tension σ^t	Friction φ	Dilation ψ
Units	**kg/m^3**	**Pa**	**Pa**	**Deg.**	**Deg.**
Waste MSW - strong	1100.0	40000.0	0.0	41.0	0.0
Waste Stockpile eff	1800.0	2000.0	0.0	27.5	0.0
Soil-Sand Restoration subsoil	1700.0	1000.0	0.0	26.0	0.0
Weathered Rock Weath' Mudst Eff	2200.0	40000.0	0.0	21.3	0.0
Soil-Sand Restoration subsoil-FML	1700.0	5500.0	0.0	21.14	0.0
Soil-Sand Restoration subsoil-Geotex	1700.0	3500.0	0.0	27.0	0.0

Interface Properties

Class Name	Cohesion Pa	Tensile Str Pa	Friction Deg.	Dilation Deg.
User new 1	0.0	0.0	0.0	0.0

Factor of Safety

Project	Model	Material Type	Shape	Mesh	Switches	FOS
2651	Standard_Rd__SectionA_Run_07_EFF_Model_1	Mohr-Coulomb	General slope	Z160	fc	1.21

Program: FLAC/Slope v7.0.421 & GIIC/Slope v2.20.489
Created: Thu Feb 11 08:54:16 GMT 2016

JOB TITLE : 2651 Standard Rd Section A Part Run07 EFF Waste c=2 phi=33 PSR=0.6 Geotexti

FLAC/SLOPE (Version 7.00)

LEGEND

11-Feb-16 8:51

Factor of Safety 1.21

Shear Strain Rate Contours

1.00E-08
2.00E-08
3.00E-08
4.00E-08
5.00E-08
6.00E-08
7.00E-08

Contour interval= 1.00E-08
(zero contour omitted)
Boundary plot

0 1E 1

Water Table

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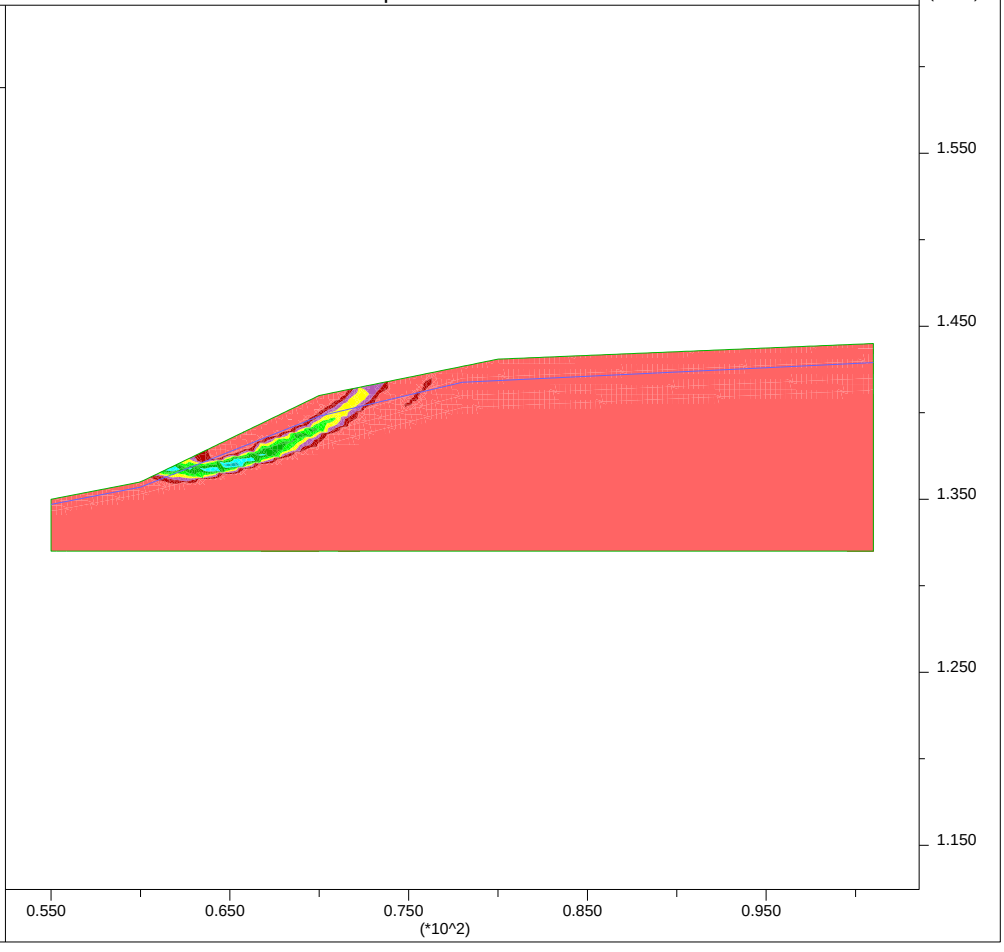
Strains



Appendix E

Photographs of restored area of stockpile

Taken 17.02.2016

Appendix E: Photographs of restored area of stockpile - Taken 17.02.2016

	View along "crest" looking south west towards office area
	Similar to above view but further round showing more of the slope
	View from top of slope looking north west.







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