

APPENDIX 2

WWTP PIPELINE REPORTS

S.I LTD. SITE INVESTIGATION REPORT JANUARY 2016

HAZARDOUS WASTE REPORT APRIL 2006

OCCUPATIONAL HEALTH & SAFETY REQUIREMENTS APRIL
2006

SUSTECH LTD. OBSERVATIONS & RECOMENDATIONS APRIL
2006

SKERRIES WWTS DBO REQUIREMENTS

SKERRIES WWTS DRAWING

600MM Ø RISING MAIN PIPE FAILURE THROUGH LANDFILL 20-
06-06

PHOTO LOGS OF WWTP AND RISING MAIN CONSTRUCTION
2006

AERIAL PHOTOS OF WWTP AND ADJOINING HISTORICAL
LANDFILL TAKEN IN 2012

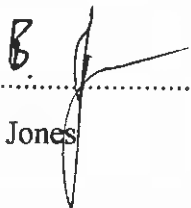
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**Site Investigation for a Proposed
Pipeline through a Lanfill Site at Skerries.**

Interpretative Report

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Prepared by:


.....
Brian Jones

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1.0 Preamble

On the instructions of Mr Mark Dignam of Nicholas O'Dwyer Consulting Engineers, a ground investigation was carried out by "Site Investigations Ltd" over the period 14/10/2005 to 19/01/2006 for a proposed pipeline through a landfill site at the Skerries.

2.0 Scope

The scope of the site investigation was to investigate subsurface ground conditions by means of cable percussion boreholes with associated lab testing and follow-on rotary drilling to penetrate through obstructions and prove rock if encountered.

3.0 Site Works

3.1 General

The ground investigation and sampling was carried out in accordance with BS5930:1999 - 'British Standard Code of Practice for Site Investigation', and BS1377:1990 - 'British Standard Methods of Test for Soils for Civil Engineering Purposes.'

The locations of all the site works are shown on the Exploratory Hole Location Plan in Appendix I.

3.2 Boreholes

Cable percussion boreholes were sunk at four locations. Several attempts generally had to be made to progress the cable percussion boreholes through near surface obstructions, the deepest of the holes at each location being continued by rotary drilling techniques. CPTs were taken during rotary drilling in boreholes BH1A and BH2B. Standpipes for gas and ground-water monitoring were installed in each of the boreholes where rotary follow-on drilling was carried out ie BH1A, BH2B, BH3A and BH4A.

The borehole records are presented in Appendix II.

Notes on the methodology and limitations of cable percussion boring are given in Appendix V.

4.0 Lab Testing

The following testing was carried out on selected samples from the boreholes:

- Six number ICRCL maxi suite of chemical tests (soil)
- Six number DRO/Mineral Oils (soil)
- Six number PRO/BTEX (soil)
- Six number water soluble sulphate (2:1 water/soil extract on soil)
- Six number Chloride

- Six number dissolved metals (leachate prep) (soil)
- Six number sulphide (leachate prep) (soil)
- Six number sulphate (leachate prep) (soil)
- Six number chloride (leachate prep) (soil)
- Six number pH (leachate prep) (soil)

No groundwater was encountered to the depths drilled at the site.

The lab testing was carried out in accordance with BS1377:1990 - 'British Standard Methods of Test for Soils for Civil Engineering Purposes and the results are presented in Appendix III.

5.0 Revealed Ground Conditions

A generalised summary of the ground profile is given below. Reference should be made to the borehole records in Appendix II for the full strata information at specific locations.

- FILL (to depths varying between approximately 6.0mBGL and 9.2mBGL)
- Stiff grey slightly sandy gravelly CLAY with some cobbles and boulders.
- Very dense GRAVEL and BOULDERS with some finer material.
- Presumed very poor quality ROCK (possible large boulders)

6.00 Gas and Groundwater Monitoring

Groundwater levels and/or seepage into the boreholes at the time of excavation are noted on the logs in Appendix II. Gas and ground-water monitoring in the installations in the boreholes are presented in Appendix IV.

It should be noted that waterlevels and waterstrikes noted on the borehole logs do not generally give an accurate indication of the actual groundwater conditions as the borehole is rarely left standing at the relevant depth for a sufficient time for the waterlevel to reach equilibrium, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to facilitate progress. (Perforated standpipe or piezometer installations and associated waterlevel monitoring are required to provide more accurate information regarding groundwater conditions).

Furthermore, groundwater levels vary with time of year, rainfall, nearby construction and other factors.

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7.0 Recommendations and Conclusions

7.1 General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between the exploratory hole locations or below the final level of excavation, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. It is further recommended that all bearing surfaces when excavated should be inspected to verify the information given in this report.

Excavated surfaces in clay strata should be kept dry to avoid softening prior to foundation placement. Foundations should always be taken to a minimum depth of 0.50mBGL to avoid the effects of frost action and possible seasonal shrinkage/swelling.

If it is intended that on-site materials are to be used as fill, then the necessary laboratory testing should be specified by the Client to confirm the suitability. Also, relevant lab testing should be specified where stability of side slopes to excavations is a concern.

7.2 Foundations

In view of the depth of fill at the site then it is recommended that the pipeline is supported on piles.

The results of the chemical testing (Appendix III) indicate that the pH is near neutral and that the water soluble (2:1 soil/water extract) sulphate content is high. It is therefore recommended that precautions be taken to prevent sulphate attack of foundation concrete in accordance with BS8110.

It should be noted that more exhaustive sulphate and sulphide testing will be required should lime and/or cement soil stabilisation be employed at the site.

The pile design should be carried out by a specialist piling contractor

7.3 Gas Monitoring

The results of the gas monitoring indicates that the levels of methane and carbon dioxide do not exceed the safe levels given in the Department of the Environment Publication - "Protection of New Buildings and Occupants from Landfill Gas", 1994.

7.4 Chemical/Contamination Testing

When dealing with potential contamination, the Irish Building Regulations call for the use of the Code of Practice for the Identification of Potentially Contaminated Sites(ref 3) which in turn cites the use of the UK Standard(ref 1). However, the UK Standard is currently under revision and therefore the Dutch action levels are generally being used.

The results indicate that under the Dutch Standard (ref 2), the arsenic level in borehole BH1A at 5.0mBGL slightly exceeds trigger level requiring action, although no trace of arsenic was found in the other five samples tested in the other boreholes at various depths. It would be prudent for workers at the site to wear suitable protective clothing in view of this finding.

The only other slightly elevated contaminants at the site are copper and zinc which are harmful to plants (phyto-toxic) but are not a problem for humans at these relatively low levels.

References

1. Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL 59/83)
2. "New" Dutch List
3. DD175: Code of Practice for the Identification of Potentially Contaminated Sites, 1985

Appendix I

Exploratory Hole Location Plan

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CH: 3360.00
CH: 3350.00

Cairn
(site of)

CH: 3300.00

CH: 3278.00

CH: 3261.00

CH: 3250.00

CH: 3241.50

CH: 3204.00
CH: 3200.00

BH 4

BH 3

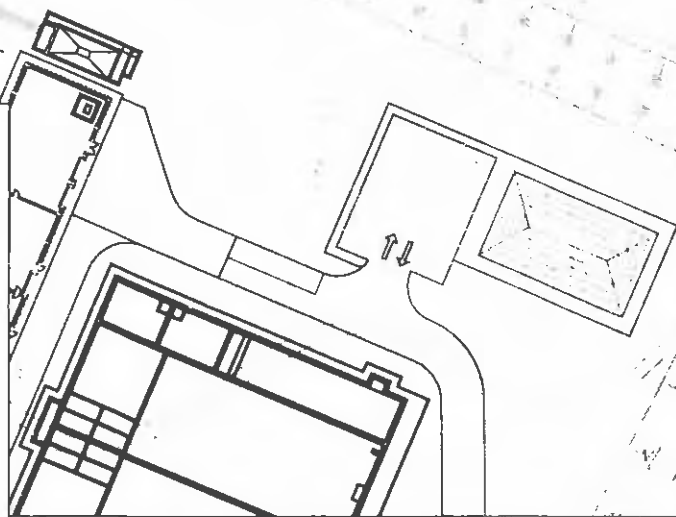
BH 2

BH 1

H.B.

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150.00



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Nicholas O'Dwyer

BALBRIGGAN & SKERRIES

BOREHOLE LOCATIONS

Sk-30240-(123)

Appendix II

Borehole Records

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BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH1**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 14/10/2005
 Boring Completed: 14/10/2005
 Type of Boring: Cable Percussion

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 mm
 Drilled by: J. QuINN
 Logged by: B. Jones

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Greyish brown sandy gravelly CLAY with inclusions of metal, concrete, timber, and plastic bags)	0.0								
	1.0		B	1.00	1683				
			C(50)	1.00					
	2.0		B	2.00	1684				
		C(50)	2.00						
Obstruction	2.50								
	3.0		3.00	Hole End			3.00	14/10/2005	dry(pm)
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

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BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 1.10m - 1.40m for 0.75hr, from 2m-3m for 2.5hrs
 Refusal at 3m (driving a boulder)
 Moved 1m to position BH1A

Key to Symbols			
B	Bulk Disturbed Sample	U(9)	Undisturbed Sample(drive blows)
D	Small disturbed sample	C(9)	Cone Penetration Test(N value)
S(9)	Standard Penetration Test(N value)	C(*)	Cone Penetration Test(refusal)
S(*)	Standard Penetration Test(refusal)	W	Waterstrike depth
W	Water Sample	W-20	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)


CONTRACT: Skerries Landfill

HOLE ID: **BH1A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 14/10/2005
 Boring Completed: 09/01/2006
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water			
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)	
FILL (Greyish brown sandy gravelly clay with inclusions of timber, plastic bags, metal and glass)	0.00			B	1.00	2101				
	1.00			C(35)	1.00					
	2.00			B	2.00	2102				
	2.70			C(32)	2.00					
	FILL (Black sandy gravelly silt)			3.00	B	3.00				2103
				4.00	C(34)	3.00				
5.00		B	4.00	2194						
6.00	C(14)	4.00								
FILL (Clay, brick and concrete blocks)	6.20	B	5.00	2105						
	7.00	C(23)	5.00							
	8.00	B	6.00	2106						
	8.30	C(30)	6.00							
Stiff sandy gravelly CLAY	7.00	B	7.00	2107						
	8.00	C(50)	7.00							
SAND and GRAVEL	8.00	B	8.00	2198						
	8.30	C(50)	8.00							
Very dense BOULDERS and clayey gravel (drillers description)	9.00	B	9.00	2109						
	9.60	C(50)	9.00							

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling off and on for 5hrs from 1.5m to 9.5m, and for 2.5hrs from 9.5m to 10.2m
 110mm diameter temporary plastic liner inserted to 10.2m for follow on coring
 Rotary follow on from 10.2 to 15.0m (rockrolled)
 Standpipe installed to 6.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols			
B	Bulk Disturbed Sample	U(9)	Undisturbed Sample(drive blows)
D	Small disturbed sample	C(9)	Cone Penetration Test(N value)
S(9)	Standard Penetration Test(N value)	C(*)	Cone Penetration Test(refusal)
S(*)	Standard Penetration Test(refusal)	∇	Waterstrike depth
W	Water Sample	∇ ₂₀	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH1A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 14/10/2005
 Boring Completed: 09/01/2006
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
As previous	10.0			C(50)	10.00		10.20	15/10/2005	dry(pm)
	11.0			C(50)	11.80				
Very stiff grey sandy boulder CLAY (drillers description)	12.00			C(50)	12.60				
	13.0			C(50)	13.90				
	14.0		C(50)	15.00					
	15.0	Hole End		C(50)	15.00				
	16.0								
	17.0								
	18.0								
	19.0								
	20.0								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling off and on for 5hrs from 1.5m to 9.5m, and for 2.5hrs from 9.5m to 10.2m
 110mm diameter temporary plastic liner inserted to 10.2m for follow on coring
 Rotary follow on from 10.2 to 15.0m (rockrolled)
 Standpipe installed to 8.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols	
B	Bulk Disturbed Sample
D	Small disturbed sample
S(9)	Standard Penetration Test(N value)
S(*)	Standard Penetration Test(refusal)
W	Water Sample
U(9)	Undisturbed Sample(drive blows)
C(9)	Cone Penetration Test(N value)
C(*)	Cone Penetration Test(refusal)
∇	Waterstrike depth
∇-20	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH2**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 15/10/2005
 Boring Completed: 15/10/2005
 Type of Boring: Cable Percussion

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 mm
 Drilled by: J. Quinn
 Logged by: B. Jones

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Greyish brown sandy gravelly clay with inclusions of concrete, metal, timber and plastic bags)	0.00								
	1.00		B C(50)	1.00 1.00	2111				
	2.00		B C(38)	2.00 2.00	2112				
	3.00		B C(50)	3.00 3.00	2113				
	4.00		B C(50)	3.80 3.80	2114	4.00	15/10/2005	dry(pm)	
	4.00	Hole End							
	5.00								
	6.00								
	7.00								
	8.00								
	9.00								
	10.00								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 1 1m-1.4m for 0.75hr. and from 3 3m-4m for 2.5hrs
 Refusal at 4m.
 Moved 1m to position BH2A

Key to Symbols

- | | |
|---|--|
| <ul style="list-style-type: none"> B Bulk Disturbed Sample D Small disturbed sample S(9) Standard Penetration Test(N value) S(*) Standard Penetration Test(refusal) W Water Sample | <ul style="list-style-type: none"> U(9) Undisturbed Sample(drive blows) C(9) Cone Penetration Test(N value) C(*) Cone Penetration Test(refusal) ▽₁₀ Waterstrike depth ▽₂₀ Water level depth 20mins after strike |
|---|--|

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BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH2A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 15/10/2005
 Boring Completed: 15/10/2005
 Type of Boring: Cable Percussion

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 mm
 Drilled by: J. Quinn
 Logged by: B. Jones

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Greyish brown, sandy, gravelly clay with inclusions of metal, cloth, timber and plastic bags)	0.0	[Cross-hatched pattern]		B	1.00	2115			
	1.0			C(18)	1.00				
	2.0			B	2.00	2116			
	2.0			C(13)	2.00				
	3.0			B	3.00	2117			
	4.0			B	4.00	2118			
	4.0			C(34)	4.00				
	5.0			B	5.00	2119			
	5.0			C(50)	5.00		5.30	15/10/2005	dry(pm)
	5.30	Hole End							
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 4.8m to 5.3m for 2hrs
 Refusal at 5.3m
 Moved 1m to position BH2B

Key to Symbols	
B	Bulk Disturbed Sample
D	Small disturbed sample
S(9)	Standard Penetration Test(N value)
S(*)	Standard Penetration Test(refusal)
W	Water Sample
U(9)	Undisturbed Sample(drive blows)
C(9)	Cone Penetration Test(N value)
C(*)	Cone Penetration Test(refusal)
▽**	Waterstrike depth
▽	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH2B**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 16/10/2005
 Boring Completed: 05/01/2006
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 1 of 3

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Greyish brown sandy, gravelly clay)	0.00	[Cross-hatch pattern]		B	1.00	2120			
	1.00			C(13)	1.00				
FILL (Black sandy, gravelly silt...incl cloth, metal, timber, glass)	1.40	[Cross-hatch pattern]		B	2.00	2121			
	2.00			C(8)	2.00				
	3.00			B	3.00	2122			
	3.00			C(6)	3.00				
	4.00			B	4.00	2123			
	4.00			C(8)	4.00				
5.00	B	5.00	2124						
5.00	C(18)	5.00							
FILL (Clay, concrete, brick)	5.80	[Cross-hatch pattern]		B	6.00	2125			
	6.00			C(50)	6.00				
	7.00			B	7.00	2126			
	7.00			C(24)	7.00				
8.00	B	8.00	2127						
8.00	C(23)	8.00							
Very Stiff grey boulder CLAY (drillers description)	9.20	[Boulder pattern]		B	9.00	2128	9.20	16/10/2005	()
	9.20			C(50)	9.00				

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BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.5m to 0.8m for 0.75hr, 6.1m to 6.9m for 2.5hrs, 8.8m to 9.2m for 2hrs
 Refusal at 9.2m
 110mm diameter temporary plastic liner inserted to 9.2m for follow on coring
 Follow-on rotary from 9.2 to 20.0m (rockrolled)
 Standpipe installed to 6.5m, with pea gravel surround bentonite surface seal gas valve and raised steel cover

Key to Symbols

- | | |
|---|---|
| B Bulk Disturbed Sample | U(9) Undisturbed Sample(drive blows) |
| D Small disturbed sample | C(9) Cone Penetration Test(N value) |
| S(9) Standard Penetration Test(N value) | C(*) Cone Penetration Test(refusal) |
| S(*) Standard Penetration Test(refusal) | ∇ ₁₀ Waterstrike depth |
| W Water Sample | ∇ ₂₀ Water level depth 20mins after strike |

Site Investigations Ltd

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH2B**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 16/10/2005
 Boring Completed: 05/01/2006
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 2 of 3

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
As previous	10.0			C(50)	10.20				
	11.0			C(50)	11.60				
	12.0								
	13.0			C(50)	13.10				
	14.0			C(50)	14.70				
	15.0								
	16.0			C(50)	16.00				
Very dense BOULDERS and clayey gravel (drillers description)	16.90								
	18.0			C(50)	18.00				
	19.0								
	20.0								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.5m to 0.8m for 0.75hr. 6.1m to 6.9m for 2.5hrs. 8.8m to 9.2m for 2hrs
 Refusal at 9.2m
 110mm diameter temporary plastic liner inserted to 9.2m for follow on coring
 Follow-on rotary from 9.2 to 20.0m (rockrolled)
 Standpipe installed to 6.5m, with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols			
B	Bulk Disturbed Sample	U(9)	Undisturbed Sample(drive blows)
D	Small disturbed sample	C(9)	Cone Penetration Test(N value)
S(9)	Standard Penetration Test(N value)	C(*)	Cone Penetration Test(refusal)
S(*)	Standard Penetration Test(refusal)	W	Water Sample
W	Water Sample	W	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH2B**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 16/10/2005
 Boring Completed: 05/01/2006
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 3 of 3

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
<div style="position: absolute; top: 0; left: 0; right: 0; bottom: 0; text-align: center; color: red; font-size: 2em; opacity: 0.5; pointer-events: none;"> For inspection purposes only. Consent of copyright owner required for any other use. </div>	20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0	Hole End		C(50)	20.00				

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.5m to 0.8m for 0.75hrs, 6.1m to 6.9m for 2.5hrs, 8.8m to 9.2m for 2hrs
 Refusal at 9.2m
 110mm diameter temporary plastic liner inserted to 9.2m for follow on coring
 Follow-on rotary from 9.2 to 20.0m (rockrolled)
 Standpipe installed to 6.5m, with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols	
B Bulk Disturbed Sample	U(9) Undisturbed Sample(drive blows)
D Small disturbed sample	C(9) Cone Penetration Test(N value)
S(9) Standard Penetration Test(N value)	C(*) Cone Penetration Test(refusal)
S(*) Standard Penetration Test(refusal)	∇ Waterstrike depth
W Water Sample	∇ 20mins Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH GFJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH3**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 17/10/2005
 Boring Completed: 17/10/2005
 Type of Boring: Cable Percussion

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 mm
 Drilled by: J. Quinn
 Logged by: B. Jones

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Grey and black sandy gravelly clay with some cobbles and boulders).	0.00								
	1.00	Hole End				1.00	17/10/2005	dry(pm)	

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BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.6 to 1m for 1.5hr
 Refusal at 1.0m
 Moved 1m to position BH3A

Key to Symbols

- | | |
|---|--|
| B Bulk Disturbed Sample | U(9) Undisturbed Sample(drive blows) |
| D Small disturbed sample | C(9) Cone Penetration Test(N value) |
| S(9) Standard Penetration Test(N value) | C(*) Cone Penetration Test(refusal) |
| S(*) Standard Penetration Test(refusal) | ▽ ¹⁰⁰ Waterstrike depth |
| W Water Sample | ▽ ^{20min} Water level depth 20mins after strike |

Site Investigations Ltd

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH3A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 17/10/2005
 Boring Completed: 21/12/2005
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Grey and black sandy gravelly CLAY with some cobbles and inclusions of cloth, timber, metal, glass and plastic bags)	0.00								
	1.00		B C(5)	1.00 1.00	2129				
	2.00		B C(22)	2.00 2.00	2130				
	3.00		B C(5)	3.00 3.00	2131				
	4.00		B C(4)	4.00 4.00	2132				
	5.00		B C(4)	5.00 5.00	2133				
	6.00		B C(12)	6.00 6.00	2134				
FILL (Grey and black sandy gravelly CLAY with some cobbles and boulders with inclusions of cloth, timber, metal, glass and plastic bags)	7.20								
	8.00		B C(50)	8.00 8.00	2136				
GRAVEL with some boulders.	8.70					8.70	17/10/2005	dry(pm)	
	8.70		B C(50)	8.50 8.50	2137	8.70	20/12/2005	-(am)	
Dark gravelly CLAY wash returns.	9.60								

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BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 8.2m to 8.7m for 3hrs
 Refusal at 8.7m
 Rotary follow-on from 8.7m.
 Hole rock rolled. Geological descriptions from 8.7m based on drillers notes
 Water flush used
 Standpipe installed to 5.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols	
B Bulk Disturbed Sample	U(9) Undisturbed Sample(drive blows)
D Small disturbed sample	C(9) Cone Penetration Test(N value)
S(9) Standard Penetration Test(N value)	C(*) Cone Penetration Test(refusal)
S(*) Standard Penetration Test(refusal)	↕ Waterstrike depth
W Water Sample	↕ Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH3A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 17/10/2005
 Boring Completed: 21/12/2005
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
As previous	10.0								
Dark gravelly CLAY with some boulders.	12.50								
Gravelly BOULDERS	15.40								
	18.7	Hole End					18.70	21/12/2005	-(pm)

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BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 8.2m to 8.7m for 3hrs
 Refusal at 8.7m
 Rotary follow-on from 8.7m
 Hole rock rolled Geological descriptions from 8.7m based on drillers notes
 Water flush used
 Standpipe installed to 5.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols

- | | |
|---|--|
| B Bulk Disturbed Sample | U(9) Undisturbed Sample(drive blows) |
| D Small disturbed sample | C(9) Cone Penetration Test(N value) |
| S(9) Standard Penetration Test(N value) | C(*) Cone Penetration Test(refusal) |
| S(*) Standard Penetration Test(refusal) | ∇** Waterstrike depth |
| W Water Sample | ∇*** Water level depth 20mins after strike |

Site Investigations Ltd

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH4**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 18/10/2005
 Boring Completed: 18/10/2005
 Type of Boring: Cable Percussion

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 mm
 Drilled by: J. Quinn
 Logged by: B. Jones

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Greyish brown sandy gravelly CLAY)	0.00								
FILL (Grey and black sandy gravelly CLAY with many cobbles and boulders)	1.20			B	1.00	2138			
	2.00	Hole End					2.00	18/10/2005	dry(pm)
	3.00								
	4.00								
	5.00								
	6.00								
	7.00								
	8.00								
	9.00								
	10.00								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 1.3m to 2m for 2hrs
 Refusal at 2m
 Moved 1m to position BH4A

Key to Symbols	
B	Bulk Disturbed Sample
D	Small disturbed sample
S(9)	Standard Penetration Test(N value)
S(*)	Standard Penetration Test(refusal)
W	Water Sample
U(9)	Undisturbed Sample(drive blows)
C(9)	Cone Penetration Test(N value)
C(*)	Cone Penetration Test(refusal)
▽	Waterstrike depth
▽	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH4A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 18/10/2005
 Boring Completed: 19/12/2005
 Type of Boring: Cable Percussion with rotary follow-on

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
FILL (Brownish grey sandy gravelly CLAY)	0.0								
	1.0			B	1.00	2139			
FILL (Grey and black sandy gravelly CLAY)	1.20			C(9)	1.00				
	2.0			B	2.00	2140			
	2.0			C(2)	2.00				
	3.0			B	3.00	2141			
	3.0		C(13)	3.00					
	4.0		B	4.00	2142				
	4.0		C(16)	4.00					
	5.0		B	5.00	2143				
	5.0		C(50)	5.00					
	5.80		C(50)	5.80					
GRAVEL with some boulders	6.0					6.00	18/10/2005	DRY(PM)	
	6.00					6.00	19/12/2005	5.70(am)	
	7.0								
	8.0								
	9.0								
	10.0								

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.5m to 0.6m for 0.75hrs, from 5.3m to 6m for 2.5hrs
 Refusal at 6m
 Standing water level at 19/12/2005 am (prior to rotary drilling) 5.7m
 Rotary follow-on from 6.0m
 Hole rock rolled. Geological descriptions from 6.0m based on drillers notes
 Water flush used
 Unable to advance casing beyond 12.0m
 Standpipe installed to 7.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols			
B	Bulk Disturbed Sample	U(9)	Undisturbed Sample(drive blows)
D	Small disturbed sample	C(9)	Cone Penetration Test(N value)
S(9)	Standard Penetration Test(N value)	C(*)	Cone Penetration Test(refusal)
S(*)	Standard Penetration Test(refusal)	▽	Waterstrike depth
W	Water Sample	▽	Water level depth 20mins after strike

Site Investigations Ltd

BOREHOLE 4250BH.GPJ COREHOLE GDT 24/01/06

BOREHOLE RECORD

(where relevant, refer to attached coring record for rock core details)

CONTRACT: Skerries Landfill

HOLE ID: **BH4A**

Client:
 Consultant: Nicholas O' Dwyer
 Site Address: Skerries, Co. Dublin
 Boring Commenced: 18/10/2005
 Boring Completed: 19/12/2005

Elevation: m.O.D.
 Co-ordinates: E N
 Hole Diameter: 200 & 70 mm
 Drilled by: J. Quinn & P. Halligan
 Logged by: B. Jones

Type of Boring: Cable Percussion with rotary follow-on

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
As previous	10.0								
Gravelly BOULDERS	12.30								
GRAVEL with some boulders	14.10								
Possible Boulder / Presumed ROCK	15.50								
	17.00	Hole End					17.00	19/12/2005	-(pm)

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Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Chiselling from 0.5m to 0.8m for 0.75hrs, from 5.3m to 6m for 2.5hrs
 Refusal at 6m

Standing water level at 19/12/2005 am (prior to rotary drilling) 5.7m
 Rotary follow-on from 6.0m
 Hole rock rolled. Geological descriptions from 6.0m based on drillers notes
 Water flush used
 Unable to advance casing beyond 12.0m
 Standpipe installed to 7.0m with pea gravel surround, bentonite surface seal, gas valve and raised steel cover

Key to Symbols

- | | | | |
|------|------------------------------------|------|---------------------------------------|
| B | Bulk Disturbed Sample | U(9) | Undisturbed Sample(drive blows) |
| D | Small disturbed sample | C(9) | Cone Penetration Test(N value) |
| S(9) | Standard Penetration Test(N value) | C(*) | Cone Penetration Test(refusal) |
| S(*) | Standard Penetration Test(refusal) | ▼ | Waterstrike depth |
| W | Water Sample | ◻ | Water level depth 20mins after strike |

Site Investigations Ltd

BOREHOLE 4250BH GPJ COREHOLE GDT 24/01/06

Appendix III

Lab Results

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ALcontrol Laboratories Ireland

Table Of Results

 Interim

 Validated

Ref Number: 05-B05655/01

Sample Type: SOIL

Client: Site Investigations Ltd (Newcastle)

Location: SKERRIES

Date of Receipt: 25/10/2005
(of first sample)

Client Contact: Brian Jones

Client Ref: 4250

ALcontrol Reference	Sample Identity	Other ID	Detection Method		CV AA mg/kg	DR LANGE mg/kg	GC mg/kg	GC n/a	GC mg/kg	GC ug/kg	GC ug/kg	GC ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg		
			Method Detection Limit															
			UKAS Accredited															
05-B05655-S0013	BH 1A 5.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	
05-B05655-S0014	BH 2B 1.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	
05-B05655-S0015	BH 2B 8.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	
05-B05655-S0016	BH 3A 2.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	16	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	
05-B05655-S0017	BH 3A 7.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	
05-B05655-S0018	BH 4A 5.0M	UNKNOWN	mg/kg	ug/kg	<0.0005	<0.1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/kg	

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

THE DATA ON THIS PRELIMINARY REPORT IS NOT VALIDATED AND MAY BE SUBJECT TO CHANGE.

Checked By : Dylan Halpin

Printed at 15:19 on 08/11/2005

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

NDP = NO DETERMINATION POSSIBLE

ALcontrol Laboratories Ireland

Table Of Results

- Interim
- Validated

Ref Number: 05-B05655/01

Sample Type: SOIL

Client: Site Investigations Ltd (Newcastle)

Location: SKERRIES

Date of Receipt: 25/10/2005

Client Contact: Brian Jones

(of first sample)

Client Ref: 4250

ALcontrol Reference	Sample Identity	Other ID	Detection Method															
			Method Detection Limit UKAS Accredited	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GCMS <1ug/kg	GRAVIMETRIC <0.1%	HPLC <0.01mg/kg	ICP <50mg/kg			
	BH 1A	5.0M	UNKNOW	226	72	99	137	78	399	37	46	22	38	90	1538	9.0	0.12	18850
	BH 2B	1.0M	UNKNOW	224	156	601	545	359	412	48	283	313	98	287	3507	15.5	<0.01	1516
	BH 2B	8.0M	UNKNOW	79	60	180	170	125	151	110	66	61	21	86	1220	16.1	<0.01	12980
	BH 3A	2.0M	UNKNOW	94	70	295	289	208	214	229	168	202	77	232	2213	24.1	0.05	3424
	BH 3A	7.0M	UNKNOW	2389	798	3874	2728	1199	1358	83	781	700	261	712	15569	23.3	<0.01	3313
	BH 4A	5.0M	UNKNOW	164	71	322	270	99	202	158	120	119	42	127	1851	13.5	<0.01	3026

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Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. THE DATA ON THIS PRELIMINARY REPORT IS NOT VALIDATED AND MAY BE SUBJECT TO CHANGE. NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin



Interim



Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 05-B05655/01

Sample Type: SOIL

Client: Site Investigations Ltd (Newcastle)

Location: SKERRIES

Date of Receipt: 25/10/2005

Client Contact: Brian Jones

(of first sample)

Client Ref: 4250

ALcontrol Reference	Sample Identity	Other ID	Detection Method																
			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP						
Method Detection Limit			<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg		
UKAS Accredited			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Arsenic			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Cadmium			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Chromium			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Copper			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Lead			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Mercury			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Nickel			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Selenium			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Zinc			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Antimony Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Arsenic Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Barium Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Cadmium Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Chromium Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
Dissolved Copper Low CEN 10:1 Leach			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
05-B05655-S0013	BH 1A	5.0M	57	<1	26	183	211	<1	72	<1	<1	<1	<1	<1	845	0.06	2.48	0.02	0.26
05-B05655-S0014	BH 2B	1.0M	<1	<1	24	34	68	<1	31	<1	<1	<1	<1	<1	823	0.04	2.26	0.02	0.29
05-B05655-S0015	BH 2B	8.0M	<1	<1	44	355	335	<1	49	<1	<1	<1	<1	<1	991	0.03	2.69	0.02	0.25
05-B05655-S0016	BH 3A	2.0M	<1	<1	47	78	343	<1	45	<1	<1	<1	<1	<1	525	0.03	2.57	0.02	0.21
05-B05655-S0017	BH 3A	7.0M	<1	<1	46	155	157	<1	67	<1	<1	<1	<1	<1	461	0.12	3.00	0.03	1.22
05-B05655-S0018	BH 4A	5.0M	<1	<1	52	130	317	<1	56	<1	<1	<1	<1	<1	598	0.06	2.54	0.03	0.87

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. NIDP = NO DETERMINATION POSSIBLE

THE DATA ON THIS PRELIMINARY REPORT IS NOT VALIDATED AND MAY BE SUBJECT TO CHANGE.

Checked By : Dylan Halpin

Printed at 15:19 on 08/11/2005 * SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Table Of Results

Interim
 Validated

Ref Number: 05-B05655/01 Sample Type: SOIL
 Client: Site Investigations Ltd (Newcastle) Location: SKERRIES
 Date of Receipt: 25/10/2005 Client Contact: Brian Jones
 (of first sample) Client Ref: 4250

ALcontrol Reference	Detection Method		SPECTRO	SPECTRO	SPECTRO	SPECTRO	SPECTRO	SPECTRO	SPECTRO	SPECTRO	SPECTRO
	Method Detection Limit	UKAS Accredited									
	Sample Identity	Other ID	Sulphide in CEN 10:1 Leachate	Thiocyanate	Total Cyanide	For inspection purposes only: Consent of copyright owner required for any other use.					
			mg/kg	mg/kg	mg/kg						
05-B05655-S0013	BH 1A 5.0M	UNKNOWN	<0.1	2	<2.5						
05-B05655-S0014	BH 2B 1.0M	UNKNOWN	<0.1	<1	<2.5						
05-B05655-S0015	BH 2B 8.0M	UNKNOWN	<0.1	<1	<2.5						
05-B05655-S0016	BH 3A 2.0M	UNKNOWN	<0.1	<1	<2.5						
05-B05655-S0017	BH 3A 7.0M	UNKNOWN	<0.1	2	<2.5						
05-B05655-S0018	BH 4A 5.0M	UNKNOWN	<0.1	<1	<2.5						

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. **NDP = NO DETERMINATION POSSIBLE**
 THE DATA ON THIS PRELIMINARY REPORT IS NOT VALIDATED AND MAY BE SUBJECT TO CHANGE.
 Checked By : Dylan Halpin
 * SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY
 Printed at 15:19 on 08/11/2005

Geochem Analytical Services
 Diesel Range Organics/Mineral Oil

by
 G.C.

Client Name Site Investigations Ltd (Newcastle)
 Client Ref 4250
 Sample Matrix Soil

Job Number B05655
 Date Extracted/Prepared 11/02/2005
 Date Analysed 11/03/2005

Separatory Funnel Ext Yes
 Soxtec Extraction No
 Column Extraction No

Sample number	Sample Identity	Depth	Diesel Range Hydrocarbons (mg/kg)	Mineral Oil (mg/kg)	Interpretation
013	BH 1A	5.0m	46	< 1	No Identification Possible
014	BH 2B	1.0m	84	< 1	Unknown Peak Detected at 18.6 minutes
015	BH 2B	8.0m	27	< 1	No Identification Possible
016	BH 3A	2.0m	80	16	Possible Highly Degraded Diesel
017	BH 3A	7.0m	25	< 1	No Identification Possible
018	BH 4A	5.0m	31	< 1	No Identification Possible

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Checked by Maria Mendez

Appendix IV

Gas and Groundwater Monitoring

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Gas and Water Monitoring Results

Project:	4250 Landfill Skerries
Client:	Nicholas O' Dwyer
Contractor:	

Hole ID	Date	Time	Flow	Gas Levels						Waterlevels (mBGL)	Comment
				CH ₄ %vol	CO ₂ %vol	O ₂ %vol	H ₂ S ppm	Atmos. Pressure(mb)			
BH1	23/01/2006			0.0	0.2	19.8	0.0	1035		Dry	Depth to base of installation 7.4m
BH2	23/01/2006			0.0	0.1	19.9	0.0	1035		Dry	Depth to base of installation 5.5m
BH3	23/01/2006			0.0	0.2	19.8	0.0	1035		Dry	Depth to base of installation 6.5m
BH4	23/01/2006			-	-	-	-	-		Dry	Depth to base of installation 6.8m Headworks destroyed, so no gas readings

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Gas levels requiring action

CH ₄ %vol	>1%	CO ₂ %vol	>0.5%	O ₂ %vol	n/a	H ₂ S ppm	n/a
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Note: H₂S is not usually generated at landfill sites, and has been monitored as a precautionary measure only.

Appendix V

Notes on the Methodology and Limitations of Cable Percussion Boring

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Notes on the Methodology and Limitations of Cable Percussion Boring

The notes below outline the general procedures adopted in this geotechnical site investigation for cable percussion boreholes and the associated in-situ tests and sampling techniques. The procedures are in accordance with BS5930:1999 - 'British Standard Code of Practice for Site Investigation', and BS1377:1990 - 'British Standard Methods of Test for Soils for Civil Engineering Purposes.

The standard method of boring in soil for site investigation is known as the cable percussion method. It consists of using a shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the shell. Where ground conditions make it necessary, the boreholes are lined with 200mm diameter steel casing. While the use of the shell & auger method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason thin lenses of granular material may not be noticed.

Undisturbed samples cannot be obtained in coarse soils or in fine soils containing coarse gravel or cobbles.

Disturbed samples are taken from the boring tools at depths such that a representative sample is obtained from the top of each stratum and at regular intervals within each stratum. The samples are then sealed and sent to the laboratory where they are visually examined and tested as per the Client's schedule.

Borehole water levels are recorded, together with the depths at which seepage of water or inflows are detected and the observations are presented on the borehole logs. In general these observations do not give an accurate indication of the actual ground water conditions as the borehole is rarely left standing at the relevant depth for a sufficient time for the water level to reach equilibrium, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to the borehole to facilitate progress.

Standard Penetration Tests are carried out in all the boreholes. The results of these tests, together with the depths at which the tests were taken are presented on the borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 65Kg and with a free drop of 760mm. For gravels and glacial till the driving shoe is replaced by a solid 60° cone.

The Standard Penetration Test number, referred to as the 'N' value, is the number of blows required to drive the tube 300mm, after an initial seating penetration of 150mm. The number gives a guide to the consistency or density of the soil and can also be used to estimate the bearing capacity and compressibility of the soil.

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17th April, 2006 – Draft Not Issued

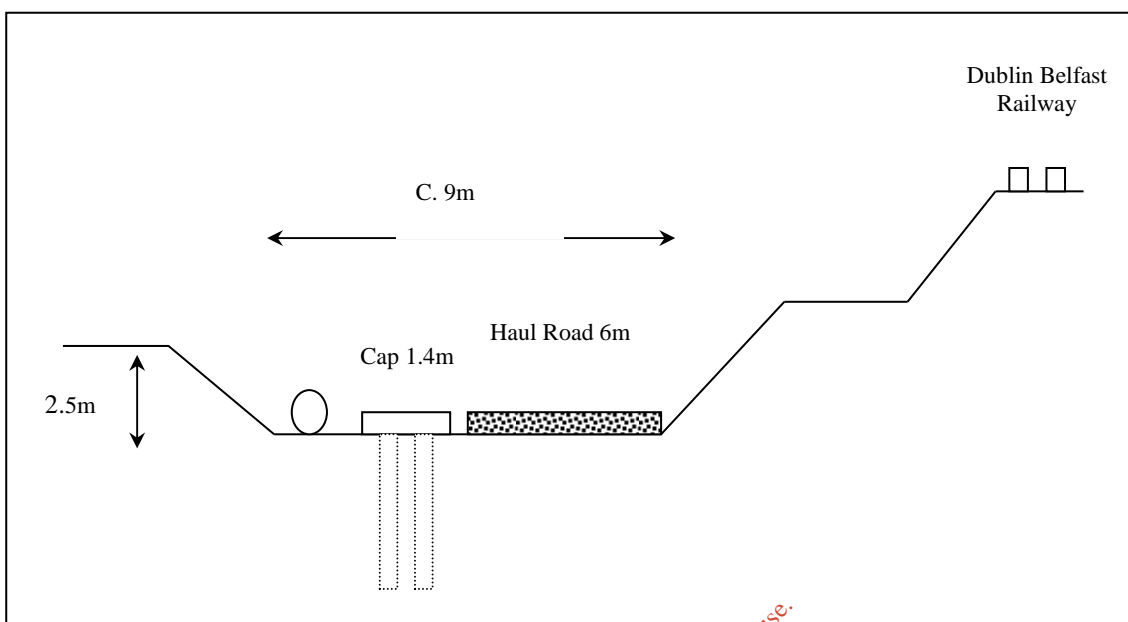
HAZARDOUS LANDFILL WASTE ALONG ROUTE OF BALBRIGGAN/SKERRIES PIPELINE

Fingal County Council's Water Services department are currently constructing a new treatment works at Barnageeragh, Skerries, North County Dublin. In conjunction with this contract a series of pipelines are also being constructed. Sewage from the town of Balbriggan will be pumped southwards to the new treatment plant through a 600mm diameter rising main. Along the route of this pipeline, an old landfill site was encountered at Barnageeragh, approximately 100m from the treatment works site. This is the last section of pipeline to be completed on the project. The landfill was shut 20-30 years ago and was privately run (to be confirmed). On visual inspection, the area appears to be stabilised/inert (no evidence of anaerobic activity) and with the maturity of the landfill, this would be a reasonable assumption. Work was temporarily stopped and some investigation work was carried out to ascertain the nature of the site. A location map of the area is shown in Figure 1.

The landfill is approximately 100m long by 20m wide by 6-9m deep. The material originally encountered appeared to be mainly domestic in nature with some construction waste and samples taken did not show any serious contamination. Work resumed on the pipeline, which included some re-design. This resulted in the construction of 18 pairs of concrete piles to support the pipe over the 100m landfill section. Figure 2 shows details of the excavated trench and piling. Work through the landfill is approximately two thirds complete, as follows:

- All excavation works are currently complete (circa 9m wide by 2.5m deep).
- 12 of the 18 pile caps are complete.
- 11 of the 17 support beams are in place.
- The pipe has been placed in protective wrapping and is ready to be placed.

FIGURE 2 - TYPICAL CROSS SECTION THROUGH WORKS



On Thursday March 23rd, site personnel noticed syringes and other clinical or veterinary waste through the sides of the excavations. On closer examination similar hazardous waste was discovered strewn along the excavated material. Work was suspended and the hazardous material marked. Figure 3 shows photos of some of the material found.

FIGURE 3 - CLINICAL WASTE FOUND 23/03/06



The contractor, SIAC, commissioned EHS Services to undertake a safety review of the area (their report is appended). The report stated that a sample taken in one borehole showed elevated levels of arsenic, however, this would not be unusual. The EHS report lays out the relevant Environmental and Health and Safety legislation that needs to be adhered to, in order for Fingal County Council and SIAC, to safely complete the laying of the pipeline. The report also suggests a number of recommendations.

Taking these recommendations on board, Fingal County Council's Water Services Dept., hope to complete the laying of the pipeline while prioritising the health and safety of personnel and without effecting any long term rehabilitation of the area. This may happen at a later date following the issuing of guidelines/risk assessment procedures by the EPA to all Local Authorities. The remediation of the site is outside the scope of the current contract.

The following is the suggested course of action:-

- Risk assessment carried out on all activities required in the area
- Agree a revised Method Statement with Contractor
- The contractors Health and Safety statement to be updated and issued to all employees
- All personnel working in the vicinity to have appropriate safety training including the use of PPE equipment
- Entrance to area only for personnel with "Permit to Work".
- Area appropriately sectioned off and controlled entrance at all times
- Safety Signs erected advising of Hazards
- Personnel supervised at all times to ensure compliance with all procedures
- Professional support to supervise and document all activities
- PPE to be worn when working closely with material (ie when not using mechanical excavators etc)
- Daily Gas monitoring of area prior to work commencing
- Decontamination area set up at exit for bagging of disposable PPE and cleaning of other non disposable PPE, handwashing facilities etc.
- Prohibition of eating, drinking, smoking in the working area
- Health Surveillance records to be kept of all staff working in the area
- A risk assessment in line with the pregnant employees regulations

We do not envisage removing any of the excavated material off the site but will re-level and cap the area with clean boulder clay from our main treatment works site. As this will be similar to the fill material already there, it will not pose the threat of creating a "draining" effect.

As we are close to the end of our contract, and hope to have sewage entering the plant in June this year, it is imperative that we get this last section of pipeline connected to the treatment plant as soon as possible. We would appreciate your urgent attention on the matter and an early indication on whether we can proceed with the work as outlined above.

Niamh McDonald
Senior Executive Engineer

Report on Occupational Health & Safety Requirements, Ballbriggan/Skerries Landfill Site for SIAC Construction Ltd.

Client Project No: N/A
 Project No: 011-000-002
 Document No: 21.11.2005-HS-001

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ISSUE	DATE	ORIG	AUTH CHK	REVIEW	APPRVD EHSRMS	APPRVD CLIENT	DESCRIPTION
A	04/04/06	B M Leavy	BG				DRAFT
B	07/04/06	B. M Leavy	MK				Final

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Executive Summary

During excavation works on the Balbriggan & Skerries Waste Water Treatment Facility hazardous waste of unknown origin was uncovered in the landfill section of the site.

Work was suspended.

Work should remain suspended until the Environmental Protection Agency present written directions in relation to how to proceed with the works. In the meantime the area should remain cordoned off from any other site works.

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1.0 INTRODUCTION

SIAC Construction Ltd commissioned EHS Services to undertake a health and safety review of operator safety following the discovery of hazardous waste in a landfill site on which excavation work was being carried out in relation to the construction of a new waste water treatment plant. A visit was made to the site on March 29th 2006 and the area was reviewed.

1.1 Objectives of the Review

The overall objectives of the review are to –

- ◆ Carry out a risk assessment of any work being carried out in the area of the landfill site.
- ◆ Identify applicable legislation and advise on ensuring compliance.

2.0 AREA DESCRIPTION

The landfill site is located on the south west corner of the construction site. It is bordered on one side by the northern railway line and on the other by fields, which are zoned for development. It is being excavated for the laying of a pipeline and the intention was to backfill the material excavated. The excavation work did not involve digging to the base of the landfill site but to a level of approximately two to three metres. The material removed was placed on top of the main section of the fill site.

It is estimated that the fill site may be approximately twenty to thirty years old though this has not been independently verified. It is thought that the site was a quarry originally. From the site investigations carried out it is estimated that the fill is to depths of approximately six to nine metres. The fill is approximately one hundred metres long and twenty metres wide. The excavation work has taken place to one side of the fill area. Site investigations revealed that the level of arsenic detected in one borehole BH1A at five metres was above the trigger level requiring action according to the Dutch Standard used for this part of the process. (see Appendix 1 for extract from report)

2.1 Discussion

On Thursday March 23rd and Friday 24th 2006 during the excavation work personnel noticed syringes and needles and some other clinical waste through the sides of the excavated material. On closer inspection further syringes and needles were discovered throughout the length of the fill. Other items were also discovered which have not yet been identified but are also considered to be hazardous waste. Work was suspended and the material marked. EHS Services carried out an inspection of the area on Thursday March 29th. In the intervening period considerable rain had fallen and much of the marking was lost.

However the syringes were still visible in many cases. The materials were collected and photographed. The photographs are in appendix 2. It was noted that there were no large deposits/clusters of hazardous waste but that it appeared to be scattered through out the length of the fill. Whilst no further excavated was carried out during the inspection it was noted that the fill material was mainly household waste with some construction waste. There were no incineration bins noted in any of the areas where materials were found. These bins have been in use for the disposal of hazardous waste for a number of years and are a distinctive yellow colour usually. It is not yet known if the materials found originate from human or veterinary treatment facilities though all investigations are not complete.

2.2 Issues

There are a number of issues from a legislation point of view in dealing with hazardous waste. For personnel working in the vicinity of the material there is potential exposure to chemical or biological agents from the contaminated material. This can be managed through the application of the relevant legislation and the use of a number of different control measures and is detailed in section 3.0.

The second main issue is the environmental impact of the hazardous waste in the form of emissions to air, water and land. As this is not a managed landfill site there appears to be no plan in place for its restoration, aftercare and management of environmental pollution control systems. An absolute requirement of the environmental legislation, which is mentioned in section 3.1, is that the Environmental Protection Agency (EPA) should be advised of any landfill sites. In a separate development the EPA have contacted all councils and asked them to identify all landfill sites in their area. They will be contacting all councils again in a few months with guidance on risk assessment procedures for these identified sites.

3.0 RELEVANT HEALTH & SAFETY LEGISLATION

A number of different health and safety regulations are applicable to this area and process. This list is non exhaustive and details the main pieces of applicable legislation. Each of the relevant regulations is discussed below and recommendations made as appropriate –

The Safety Health and Welfare at Work Act, 2005

This act provides the framework legislation covering all persons at work and imposing general duties on employers, employees etc. Section 20 of the Act requires that a Safety Statement be prepared which specifies the manner in which the safety, health or welfare of employees at work will be secured. The employer is required to bring the statement to the attention of all employees.

Recommendation 1 – The Safety Statement should be reviewed, updated in light of recent findings and brought to the attention of all employees working in the vicinity.

Safety, Health and Welfare at Work (General Applications) Regulations, 1993 & Subsequent Amendments

These regulations give effect to Directive 89/391 and 91/383 on the introduction of measures to encourage improvements in the safety and health of workers at work. The main duty of the employer is:

- To be in possession of an assessment in writing of the risks to safety and health at the place of work as required under section 19 of the Act, such risks to include, any which put groups of employees at unusual, risk. and
- To decide on any protective measures to be taken and if necessary the protective equipment to be used.

Section 10 of the Regulation requires the employer to carry out a comprehensive Risk Assessment, which should be the basis for making decisions on protective measures and protective equipment, which may be necessary.

Recommendation 2 - A comprehensive process of identifying and assessing risks should be carried out.

Risk assessments should be carried out for all activities and processes on the site.

The risk assessments should be used as the basis for reviewing the Safety Statement. It should include determination of an action plan and follow up/close out system as required in the new act.

Agreement should be reached with other organisations onsite to ensure that shared areas are also addressed and managed appropriately.

Regulation 13 of the General Application regulations state:

- It shall be the duty of every employer to provide health and safety training to employees.

Recommendation 2 – Ensure that personnel are trained appropriately in the equipment including PPE they are required to use during the course of their work.

Safety Health and Welfare at Work (Chemical Agents) Regulations 2001.

These regulations implement Directive 88/642/EEC and 91/322/EEC on the protection of workers from risks related to chemical agents at work. A chemical agent is defined as any chemical substance present at work and likely to be hazardous to health. The over-riding requirement as with other health and safety legislation is the need to carry out a risk assessment of all procedures involving chemical agents. However in this situation it is difficult at this stage to identify exactly what chemicals personnel may be exposed to during the course of further work in the area. Arsenic has been identified in the site investigations and in the Chemical Agents Regulations, Code of Practice its occupational exposure limit value (OELV) is defined at 0.1mg/m³, 8hr time weighted average (TWA). It is also identified as a Category 1 carcinogen so the requirements of the Carcinogen Regulations should also be applied.

Recommendation -3. All extraneous personnel should be excluded from the area.

Recommendation -4 Safety signs should be placed at the entrance to the area advising of the main hazards and the PPE requirements.

Recommendation -5 Further work should not be carried out until direction is taken from other regulatory bodies involved.

Recommendation -6 A decontamination area should be demarcated at the exit of the area. All disposable PPE should be removed at this point and bagged. Reusable PPE should be decontaminated thoroughly.

Recommendation -7 Hand washing facilities should be available as close to the exit from the site as possible.

Recommendation -8 Eating, drinking and smoking should be prohibited in the landfill area.

Recommendation -9 Personnel should be advised of the hazards of the area and the control measures in place.

Recommendation -10 Personnel should be supervised to ensure compliance with the control measures.

Recommendation -11 Personal protective equipment recommended is the use of chemical resistant disposable full body suits, chemical and puncture resistant gloves if manual work at ground level is being carried out. Chemical and puncture resistant safety boots for all personnel entering the area.

Safety Health and Welfare at Work (Carcinogen) Regulations 2001.

These regulations implement Directive 67/548/EEC on the protection of workers from risks related to carcinogens at work. Carcinogens are chemicals that can cause cancer in humans.

Recommendation -12 The control measures identified above should be implemented.

Recommendation -13 Health surveillance records in accordance with the requirements of the regulations should be compiled by a competent Occupational Health Adviser.

Safety Health and Welfare at Work (Pregnant Employees etc) Regulations 1994 & Subsequent Amendments.

These regulations give effect to Directive 92/85/EEC on the introduction of measures to encourage improvements in the safety and health at work of pregnant workers and workers who have recently given birth or are breast-feeding. Special duties are placed on the employer to assess any risk to a pregnant or breast feeding employee from exposure to an agent, process or working conditions specified in the first schedule.

Recommendation 14 - A risk assessment in line with the pregnant employees regulations should be carried out.

3.1 Environmental Legislation

There are a number of applicable pieces of legislation and they are detailed below though the requirements are not discussed in detail. It should be noted that this list is not exhaustive.

- Waste Management Act 2001
- Protection of the Environment Act 2003
- Waste Management (Licensing) Regulations, 2004.

How the legislation will be applied in this situation is difficult to say but a number of cases involving landfill sites elsewhere have set precedents.

Recommendation –15 Prior to any further work being carried out take written direction from the EPA.

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APPENDIX 1 SITE INVESTIGATION RPT FROM SI LTD

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APPENDIX 2 PHOTOGRAPHS OF RECOVERED MATERIALS

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Observations and Recommendations with respect to completion of the effluent pipeline installation where it intersects with an old landfill at the Balbriggan – Skerries MWWTP site

Introduction

Tadg O’Flaherty, Director, Sustech Ltd, was informed of the circumstances and requested by J.B. Barry and Partners Ltd. to advise on technical and legal aspects relating to the handling of material excavated from the line of the pipeline and the haul roadway and on its reinstatement.

A site visit was arranged for Tuesday 18th April 2006, and additional information in the form of the S.I Ltd. Contract 4250/05 Interpretative Report (24/01/06 Final) and the EHSRMS report to SIAC Construction Ltd. (07/04/06) were provided.

The following comments, observations and recommendation are made without prejudice to any intervention by any statutory body in exercise of its functions in these matters and are solely made on the basis of the material provided and discussions held on site. They also draw on recent practice and experience on analogous projects in Ireland in recent years.

At issue is the completion of approximately 100 m of pipeline (gravity section) falling towards the MWWTP site adjacent to the Dublin Belfast railway line. At this point the pipeline is gravitating to the site ultimately 2.0 m below intended finished GL with an adjacent haul roadway.

The work is being carried out outside the main curtilage of the site works but within an approximate 5.0 m way leave. No other services are envisaged within the way leave at present.

At the point at which the gradient flattens (proximate to the main site) a new surface drain has been instated.

The layout, ground conditions and overburden and fill profile are as detailed in the SI Ltd. report.

The appended photographs show the section.

The fill material has been removed to below the invert level of the pipe and a significant portion of the piled pipe plinths have been installed.

The flanged sections of the pipe at each end of the section in question are in place and only this short section remains to be completed.

Pipeline Installation at Balbriggan – Skerries MWWTP

The works are largely complete from a civils perspective and are undergoing M & E fit-out for a commissioning date in June 2006.

The filled material has been subject to the normal analyses for priority List I and II compounds and leachate analyses.

The site has gas monitoring boreholes and water monitoring boreholes in place adjacent to the area in question.

Two high yielding production wells for process water related to screen washing etc are also located on site. These will generate a radius of influence or cone of depression in the vicinity.

Concern was raised when the excavations exposed medical sharps and other materials thought to be (on a prima facie basis) to be 'hazardous ' in nature.

The basic questions to be answered are:-

- What actions are required and what interpretation can be placed or relied upon as to the legal requirements under the waste and other environmental regulations to complete the work.
- What indications as to the appropriate measures to protect workers under an appropriate Risk Assessment in similar circumstances have been held to be appropriate and prudent?

Landfill History

The landfill was reported to be a dilute and disperse 'site of a small scale in an old sand and gravel quarry operational some 20-30 years ago. The site is thought to have been operated by the Local Authority or on its behalf for disposal of mixed domestic refuse, commercial and other wastes

The nature of the exposed material shows a high degree of boulder clay / overburden mixed with residual plastic packaging and inorganics such as glass and metal containers typical of mixed domestic, construction and demolition and commercial waste.

Condition of the fill

The filled material is very mature and no significant evidence of residual anaerobic decomposition is visible in the exposed faces. This is understandable as any putrescible material would have been expected to have undergone anaerobic and aerobic stabilisation in the early years of the post fill maturation and would now be stable. This material would also be stabilised by the considerable proportion of construction and demolition clays present which has been a feature of landfills of this era.

The unlined nature of the fill, the fact that the site was a sand and gravel quarry with an attendance high transmissivity aquifer (demonstrated by the high yield boreholes) would also be strong presumptive evidence that leachable material has long since been eluted from the matrix particularly in the upper layers.

Similarly the aerobic appearance of the face material and the absence of any evidence of anaerobic processes or sulphidic material and the low analytical results for related anions mean that protection from sulphidic attack is not suggested. The low sulphate values with some spots of elevated levels are more suggestive of builders' rubble containing gypsum /plaster and plasterboard than presenting a general significant sulphate attack potential. In any case this is further prevented if a recommendation on clay backfill is utilised

Presence of Medical and /or hazardous waste

It must be remembered that the recommendations on best practice in the era to which the landfill falls , were considerably different from the present.

The general waste regulations of 1979 and the toxic and dangerous waste regulations of 1981 were the first formal mechanisms to specifically control waste arisals and disposal in the State following on from the first Waste Directive of 1975 and the Water Pollution Act of 1977 which required the protection of 'waters' which included groundwaters and aquifers. The WPA 1977 assisted the implementation of the Control of Dangerous Substances in Waters Directive of 1976 which established the List I and List II categories of compounds

As late as 1982 a ministerial letter was issued to local Authorities recommending the co-disposal of commercial, industrial and toxic and dangerous wastes where no threat to the external environment would result. Similarly, coastal sites with unexploited aquifers or saline intruded aquifers underneath were preferred sites on the basis of minimising potential adverse impacts.

Therefore, the presence of mixed wastes is unsurprising as it was common practice and no other outlets commonly existed.

Even domestic use and hospital derived medical sharps commonly occur.

Ireland, had a relatively low generation of hazardous wastes because of the nature of the industrial base and because the emerging multinational sector used export for incineration or recovery as the main outlet for solvent and active pharmaceutical ingredients (API's). Therefore the main hazardous components were paints and oils and household chemicals co-disposed with domestic refuse.

These were a very small component of the wastes and were further diluted in weight and volume by the large component of construction waste.

Current legal Controls of relevance

Ireland does not have any contaminated land legislation and as a consequence issues relating to the presence of contaminants in soils and their control give rise to considerable confusion and angst.

The basic control of ‘waste related activities’ is under the Waste Act 1996 as amended. This requires that any ‘waste related activity’ requires a Waste Licence issued by EPA under the regulations or for some limited recovery reuse operations a permit issued by a Local Authority. This also applies to the transport and disposal of wastes which can only be carried out under permit or licence.

However, the important consideration is what constitutes a waste related activity. This is defined in the primary act and regulations and essentially involves carrying out a physical chemical or biological process to a waste for the purposes of changing its nature or recovering it or emplacing it for disposal.

Simply moving or re-depositing waste within an existing landfill operated by or for a local Authority was adjudicated by EPA in the case of the Dublin Port Tunnel waste extraction and re-deposition at Fairview, not to be a ‘waste related activity’ in very similar but much greater in scale circumstances. Similarly the Arklow bypass was a similar case.

It must be also remembered that in this case the actions are in a way leave and are not the acquisition for redevelopment of an entire site. Therefore the objective is to ensure that the actions are environmentally ‘neutral’ or improve the situation without undue cost or loss of time.

In a like manner ‘digging and dumping’ which is the description given to removal for re-deposition or other treatment of waste to or at a licensed site is not a licensable activity as the ‘activity’ occurs at another licensed facility here or abroad.

However even simple sorting, sizing, or other physical processing is such an activity.

Therefore the opening of a trench in the mature fill is not a licensable activity based on previous adjudications but this does not absolve the operator /contractor from other environmental considerations.

Those considerations are the generic prevention of adverse impact on the environment or the creation of a statutory nuisance under the Water Pollution Act, EPA Act and Protection of the Environment Act 2003, Air Pollution Act 1987.

These provisions mean that the operations must not give rise to a source of pollution or to the occurrence of environmental damage.

In the case of the installation of the pipeline and backfilling, this is highly unlikely and can be virtually assured once several simple precautions are taken for added safety. These are absolutely separate from Worker Protection issues addressed later.

- **Management of temporarily excavated material** – this should be either covered or screened as judged necessary to prevent litter and dust blow or vermin nuisance. At this time and in view of the stable nature of the material, the litter aspect is the one of practical concern.
- **Proper management of pockets of high hazard materials** - Because it is possible but very unlikely at this stage, that pockets ie many identifiable bags or drums of medical wastes, car batteries, partly filled or full waste oil drums etc may be encountered, these should be moved to a secure area for removal for disposal by a licensed contractor in accordance with the regulations. Incidental or individual items consistent with domestic refuse need not be so treated as their re-deposition represents no significant change in the level of hazard or the potential for ongoing contamination commensurate with the rest of the site.
- **Supervision and Record Keeping during excavation , movement and reinstatement-** because of the foregoing and the fact that it is imperative to be able to produce documentary evidence (with photographic records and analyses where relevant) as to what material was placed where and that any high hazard material was identified and dealt with under the regulations , it is strongly recommended that the work be carried out under supervision with a specific record keeping brief .
- **Prevention of the introduction of new drainage** – This means that no new enhanced access for contamination of groundwaters or surface waters should be introduced. For example, surrounding a deeply buried pipe with a layer of hardcore is a known mechanism for transporting leachate to groundwater or surface water as are open trenches or the removal or impervious cover material. To avoid this the pipeline should be covered with clean clay material of a similar transmissivity to that of the fill material (ie the clay stockpiled on site). And the reworked area capped with the same material to prevent new leachate formation.
- **Isolation of boundaries from fill material** – It would be prudent to move small remaining quantities of fill material from the railway embankment over to the other side of the haul road and the pipeline. this would mean that when refinished to final grade the upper two meters of the site at the site edge is isolated from the external environment by a ‘trench’ and cap of clean material .This would reduce the risk of gradual exposure of plastic litter material etc.and would aid landscaping of the way leave. It also means that should access to the pipe section be required in the future or maintenance of the haul road – that work would be carried out in ‘clean’ material only.
- **Installation of in-situ monitoring** – On completion a couple of permanent gas monitoring boreholes should remain close to the pipeline in the ‘old’ fill material and similarly a water monitoring borehole can be finished on the fill side of the new drainage pipe finished to detect leachate quality at the base of the slope in the vicinity of the pipeline. These will serve to prove if any new anaerobic or aerobic activity has been generated by the disturbance and if any significant or poor quality leachate is being generated. Some gas generation would be expected as would some short term elevation of leachate COD’s and Ammonia. The metal burdens are very low. Any significant impact would be seen in the main production wells but this is unlikely.

These recommendations are designed to follow good practice and to ensure that no adverse effect can result and also to prevent the need to re-enter contaminated material at a later date. The monitoring recommendations are more to protect the development from the accusation of an adverse effect as to enable or suggest intervention.

Occupational Health and Safety Aspects

The comments of the EHSRMS report are noted. The foregoing has addressed the issues raised in respect of the environmental legal status of the activity and the fact that the EPA has not got a role to play unless a 'waste related activity' were necessary or contemplated. Therefore the practice specified above follows similar practice on other projects which have been successfully executed. In a similar vein, the observation is made, again without prejudice to any intervention by the NAOSH as the relevant statutory body or to any other advices sought, that a pragmatic solution to implementing a safe working practice in similar circumstances (Docklands sites, Barrow street and others) and where in some of those cases more exposure to higher hazard materials were possible, that that portion of the activity was treated as a Yellow Hazard status and PPE issued and trained for appropriately.

In essence this means maximising the mechanical handling and marshalling of the material, use of appropriate gloves at all times, avoidance of sharps (long reach claw pickups or grips and placement in a sharps box for appropriate disposal. Dust masks are only necessary where significant exposure by inhalation is possible but may be issued as a precautionary measure.

Similar practical measures can be gleaned from the safety statement and SOP's for operators at landfill facilities, but the level of hazard here and the potential risks are lower and of discrete and limited duration.

Conclusions

The materials encountered are unexceptional for dumps of this age and type. The material is at an advanced stage of stabilisation and contains a significant quantity of inert construction and demolition waste. The recommendations are designed to ensure an environmental and occupational health and safety satisfactory execution based on good practice and current experience at similar or more challenging projects. The proposals do not include activities which require either a waste licence or waste permit as currently understood and adjudicated upon in similar circumstances.

Tadg O'Flaherty,
Director,
Sustech Ltd.

Balbriggan-Skerries Waste Water Treatment Plant Site Investigation.

The Treatment Works Site is situated running N-S from Balbriggan to Skerries along the R127, to the east lies the sea front and to the west the site is edged by an active railway line on an embankment. The project is set to go out to DBO tender within the next few weeks. In order to allow for accurate pricing for the contract, a Site Investigation is currently being undertaken. This site investigation has highlighted a number of issues relevant to the civil works aspect of the DBO contract: -

1. Dewatering of the embankment due to the drawdown, which could in turn result in the consolidation of the ground beneath the railway line.
2. Gravels in the boreholes, stability? Permeability.
3. Unsure of geological conditions
4. River Diversions

Dewatering: - The embankment is currently at a height of 3-4m above the ground level of the Treatment Works site, if any dewatering of the site occurs in order to construct the treatment works site, it is feared that this will have an adverse effect upon the embankment, i.e. dewatering will cause a drawdown which could result in the consolidation and instability of the embankment.

Geological conditions: - In core holes D6 & D7 there are two fracture planes occurring, one parallel to the drill direction, one oblique. This type and level of fracturing is indicative of a nearby fracture zone. There is also a marked difference in the rock head level between C8 & C7, with rock head going from 0.80m to 6.30m in the space of 20m, which also indicates a possible fault zone.

It is not possible to find rock dip and dip direction from the cores as they are often twisted as they are coming up the casing. Two methods are available for calculating core orientation, one uses an instrument being placed down the borehole the other is a 'down the hole' camera, the latter generally works out more successful. Outcrops are present by the sea and dip direction can be estimated should dip direction be required.

Rock head is high, approximately 1m depth at the south end of the field, but falls off as you go north except again for C2 which goes against the other levels present being found at 1m.

River Diversions: - The first river crosscuts the field, i.e. runs E-W, along a gully and encounters almost perpendicularly with the embankment. The second runs parallel with the embankment but the two rivers do not transect as the second river stops along its path.

This poses the question as to the source of the second river, which is very slow moving. The source of the river may be a tributary of the first river, which for a period runs underground and surfaces 30m away as the source of the second river. Or, perhaps the source of the river is totally independent of the first river and originates from another source; this may in turn have something to do with the possible presence of a fault. To test to find the true scenario it was suggested that a dye be placed in the first river.

The first river, which runs perpendicular to the embankment en route to the sea, was originally to be moved and channeled along the proposed access road but acquisition of the access road is proving difficult. The second was planned to channel along the foot of the new embankment. The diversion of the second river is further complicated by the requirement that it be channeled along an interpretive centre where the water flow turns a mill wheel.

Options Available

Permeability Tests.

Conduct permeability tests on both the gravel and the rock using the manpower and machinery available on site. In-situ permeability tests are allowed for in the bill. Therefore, one option is to conduct these tests and find out the Permeability, or K values for both the rock and the gravels and let the recipient of the information, i.e. the contractors decide as to the effect this will have upon the railway line. The Employer's Requirements should contain details from CIE/Iarnrod Eireann regarding maximum settlement allowed along the Embankment due to construction. The Contractor can therefore decide on a construction method to meet these requirements and include for it in his tender price.

In-situ permeability tests would consist of falling head tests in the gravels and packer tests in the limestone.

Pumping Tests.

Rock head is uneven throughout the site, a well contractor will have to be hired to drill the main well and to conduct the pump test. Care must be taken so that the test itself does not cause any unnecessary adverse effect upon the Embankment. This presents a number of options as to the type of Pump test undertaken,

1. Pump test in the gravels, testing the drawdown in the gravels, this is restricted by the high rock head, as the bedrock is extremely fractured, then the volume of water possibly flowing through the limestone aquifer is possibly high and there also may be some inter-relation between the two.
2. Pump test the aquifer, this presumes that there is an interrelation between the two and judge the effect of the pump test upon the observation holes

As rock head is generally high throughout the site, then a major Drilling company, such as Dunnes is required to drill a well of sufficient diameter so as to pump out sufficient volumes of water equivalent to those required for dewatering of the site. This would be monitoring both the gravels and the rock.

A 10m well of sufficient diameter, using mud drilling due to the presence of the gravels, air drilling would place too much pressure down the hole around the gravels, placing a Johnston well screen to prevent the gravels collapsing within the hole.
Pricing for well and pump test: £10,000.

Summary of Options

1. Full Stop, no dewatering/drawdown, use alternative arrangements/methods.
2. Put standpipes in the 5 observation holes scheduled along the embankment; organize a pump-test to see the effect of the drawdown on the groundwater/gravel situation at the embankment. This would enable us to give strict guidelines to the contractor as to the level of dewatering permitted if any.
3. Find the permeability of the rock and the gravels in the direction of the embankment and present this to the tenderers and let them decide upon the best approach, alternatively use a computer program; such as MODFLOW, to calculate the possible effect drawdown would have on the groundwater along the embankment. The latter is perhaps tending towards a more interpretive report.

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600mm Ø Rising Main Pipe Failure

600mm Ø Rising Main Pipe Failure (Structural) Through Landfill 20/06/06.

History:

While trying to pressurise the pipeline from Inlet works at Ch 3143m to coast road at Ch 4200m approx. it was found that the pipeline was not pressurising and therefore had a leak. After checking the Air Valve and Hatch Box Chambers in which all valves etc. were found to be sealed the contractor started to dig trial holes to search for signs of water.

After several trial holes it was found that the problem lay between Ch 3143 (inlet works) and Ch 3368m (Air Valve). This section of pipeline incorporated a section of pipeline through the Landfill (Ch 3200m-3320m approx.) where the pipeline had already been backfilled over to a depth of 2-3m in areas.

The section of pipeline between Ch 3210m and 3312m had been piled with 18 No. sets of piles at 6m centres with pile caps poured on top of each set tied together laterally with tie beams at a level of 150mm approx. below pile caps and then the pipe laid to rest only on the pile caps themselves as can be seen from photograph 1 & 2. Pipes were backfilled as can be seen from Photographs 3,4 & 5 and no plant traversed the pipeline during this backfilling operation.



Photo No. 1 taken 28/04/06.

600mm Ø Rising Main Pipe Failure



Photo No. 2 taken 23/05/06.



Photo No. 3 taken 23/05/06.

600mm Ø Rising Main Pipe Failure



Photo No. 4 taken 23/05/06.



Photo No. 5 taken 23/05/06.

600mm Ø Rising Main Pipe Failure

Events of 20/06/06:

A major leak was detected after excavating a trial hole at Ch 3261m at a joint between 2 pipes, it was noted that the material underneath the mid section of the pipes (between the pile caps) had either settled away from the pipe due to the nature of the ground or had not been compacted correctly around and over the tie beams.

This had the effect of causing a point load to be applied to the pipes at each pile cap over a small bearing area as the pile caps were rectangle in shape and the pipe round. The pipe between Ch3255 & Ch3261m was cut and a section near the failed joint removed. When the interior of the pipe was inspected the pipe had deformed (see Photographs 6 & 7) and broke the cement lining off the inside of the pipes at the location of the pile caps (see photographs 8-10).

SIAC stated that they would remove any damaged pipes through this area and would have their consultants Nicolas O'Dwyers assess the situation and rectify the design accordingly. Pipe testing would continue on the remainder of the 600mm Ø pipeline despite these events.



Photo No. 6 taken 20/06/06.

600mm Ø Rising Main Pipe Failure



Photo No. 7 taken 20/06/06.



Photo No. 8 taken 20/06/06.

600mm Ø Rising Main Pipe Failure



Photo No. 9 taken 20/06/06.



Photo No. 10 taken 20/06/06.

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PHOTO LOGS OF WWTP AND RISING MAIN CONSTRUCTION 2006

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Plate A2.1 Photograph of Construction of WWTP and Rising Main taken in 2005 from western boundary facing west with Dublin-Belfast railway line to the south and historical landfill located to the west



Plate A2.2 Photograph of excavation of soils for Rising Main taken in 2005 from western boundary facing west with Dublin-Belfast railway line to the south and historical landfill located to the north

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**AERIAL PHOTOS OF WWTP AND ADJOINING HISTORICAL
LANDFILL TAKEN IN 2012**

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1D200019 Photo: © Peter Barrow Photography 16th May 2012, Tel: 0872-559638

Plate A2.3 Photograph of historic landfill on 16/05/12 taken from southern boundary facing northwards with Dublin-Belfast railway line to the south and WWTP located to the east



1D200018 Photo: © Peter Barrow Photography 16th May 2012, Tel: 0872-559638

Plate A2.4 Photograph of historic landfill on 16/05/12 taken from south west boundary facing northeast with Dublin-Belfast railway line to the south and WWTP located to the east



1D200022 Photo: © Peter Barrow Photography 16th May 2012, Tel: 0872-559638

Plate A2.5 Photograph of historic landfill on 16/05/12 taken from south east boundary facing northwest with Dublin-Belfast railway line to the south and WWTP located to the east



1D200023 Photo: © Peter Barrow Photography 16th May 2012, Tel: 0872-559638

Plate A2.6 Photograph of WWTP on 16/05/12 taken from western boundary facing west with Dublin-Belfast railway line to the south and historical landfill located directly to the west