

GROUNDWATER QUALITY		Sampling Point										
Parameter	PW2	PW5	PW6	PW9	PW10	PW11	PW12	PW13	PW15	SA1		
pH	7.8	7.8	6.5	7.4	7.5	7.5	6.3	7.0	7.5	7.4		
Temperature	11	10	10	10	9	9	9	nm	10	9		
Electrical Conductivity EC (µS/cm)	484	560	280	495	464	480	170	345	568	571		
Ammonia (mg/l N)	<0.03	0.04	<0.03	0.45	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		
Dissolved Oxygen (% Saturation)	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		
Cadmium (mg/l)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Chloride Cl (mg/l)	11	11	45	17	20	12	18	22	12	10		
Cyanide Cn (mg/l)	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Iron (mg/l)	0.3488	0.6656	0.1348	0.0687	0.0053	0.05	0.05	0.8097	0.795	0.165		
Phenol (µg/l)	1	1	1	1	1	1	1	1	1	1		
Potassium (mg/l)	2.16	0.96	2.51	1.4	0.76	0.78	5.66	1.42	0.94	4.83		
Sodium (mg/l)	17.24	23.69	19.82	2.89	11.73	17.34	9.11	13.24	23.59	8.63		
Faecal coliforms (No/100 ml)	0	0	1	3	0	0	1	20	0	0		
Total coliforms (No/100 ml)	7	41	>2419	770	21	201	770	219	0	2419		
Depth (m)	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		
Total organic carbon mg/l C	3.3	1	3	2.9	2.4	0.7	3.7	2.1	0.8	5.8		
Total oxidised nitrogen (mg/l N)	0.06	<0.03	1.8	<0.03	0.05	0.05	0.88	0.84	<0.03	0.19		

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GROUNDWATER QUALITY		Sampling Point:										
06/06/02		PW2	PW5	PW6	PW7	PW8	PW9	PW10	PW11	PW12	SA1	
Parameter												
pH		8	7.7	6.5	7.6	7.6	7.5	7.5	7.6	5.9	7.5	
Temperature		12	11	12	12	12	12	12	12	12	12	
Electrical Conductivity EC (µS/cm)		361	565	249	531	486	493	462	469	150	597	
Ammonia (mg/l N)		<0.03	0.04	<0.03	<0.03	<0.03	0.42	<0.03	<0.03	<0.03	<0.03	
Dissolved Oxygen (% Saturation)		58	32	65	nm	nm	nm	nm	nm	15	29	
Cadmium (mg/l)		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chloride Cl (mg/l)		7	12	34	17	12	17	21	12	16	9	
Cyanide (mg/l)		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Iron (mg/l)		3.1772	1.755	0.2188	1.261	0.054	0.162	0.0578	0.088	0.096	0.247	
Phenol (µg/l)		244	161	128	142	69	17	108	52	23	131	
Potassium (mg/l)		2.66	1.06	2.62	0.64	0.84	1.46	0.86	0.8	6.28	5.29	
Sodium (mg/l)		10.7	24.92	20.94	14.61	14.61	13.52	12.91	18.15	10.04	9.19	
Faecal coliforms (No/100 ml)		22	2	3	0	0	31	0	0	0	4	
Total coliforms (No/100 ml)		980	86	1414	114	0	118	108	2	47	2419	
Total organic carbon (mg/l C)		6.9	0.8	3.1	0.9	0.7	2.9	2.4	0.7	4.7	6.4	
Total oxidised nitrogen (mg/l N)		0.07	<0.03	1.12	<0.03	0.25	<0.03	0.08	0.08	0.11	0.06	
Bromodichloromethane (µg/l)		<0.1	<0.1	ND	<0.1	<0.1	ND	<0.1	<0.1	ND	ND	
Bromoform (µg/l)		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Chloroform (µg/l)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Dibromochloromethane (µg/l)		ND	ND	ND	ND	<0.1	ND	ND	ND	<0.1	<0.1	
Total Trihalomethanes (µg/l)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

GROUNDWATER QUALITY		Sampling Point		
06/06/02	Parameter	PW/13	PW/15	
	pH	7.20	7.60	
	Temperature	11.00	12.00	
	Electrical Conductivity EC (µS/cm)	258.00	566.00	
	Ammonia (mg/l N)	0.03	0.03	
	Dissolved Oxygen (% Saturation)	61.00	nm	
	Cadmium (mg/l)	<0.0001	<0.0001	
	Chloride Cl (mg/l)	15.00	12.00	
	Cyanide Cn (mg/l)	<0.01	<0.01	
	Iron (mg/l)	0.29	0.95	
	Phenol (µg/l)	32	24	
	Potassium (mg/l)	1.62	1.05	
	Sodium (mg/l)	13.29	24.20	
	Faecal coliforms (No/100 ml)	22.00	2.00	
	Total coliforms (No/100 ml)	228	0	
	Total organic carbon (mg/l C)	45.00	0.00	
	Total oxidised nitrogen (mg/l N)	0.4	<0.03	
	Bromodichloromethane (µg/l)		<0.1	
	Bromoform (µg/l)		ND	
	Chloroform (µg/l)		11.50	
	Dibromochloromethane (µg/l)		ND	
	Total Trihalomethanes (µg/l)		11.80	

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GROUNDWATER QUALITY	Sampling Point														
	PW2	PW5	PW6	PW8	PW9	PW10	PW11	PW12	PW13	PW15					
23/09/02															
Parameter															
pH	7.9	8.3	6.9	7.6	7.5	7.6	7.6	6.2	7.4	7.5					
Temperature	11	13	14	15	13	13	13	13	13	14					
Electrical Conductivity EC (µS/cm)	566	487	314	505	494	461	468	133	393	774					
Ammonia (mg/l N)	0.03	<0.03	0.03	<0.03	0.47	<0.03	<0.03	<0.03	<0.03	<0.03					
Dissolved Oxygen (% Saturation)	35	73	41	47	20	20	58	49	35	71					
Ammonia (mg/l N)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					
Dissolved Oxygen (mg/l)	12	11	40	12	18	21	12	12	nm	nm					
Cadmium (mg/l)	nm	nm	nm	nm	nm	nm	nm	nm	nm	2.609					
Chloride Cl (mg/l)	6.472	3.068	0.05	0.121	0.538	0.236	0.082	0.587	1.015	13					
Cyanide (mg/l)	33	1	1	1	26	18	1	1	16	0.84					
Iron (mg/l)	1.72	0.94	1.72	0.78	1.21	0.78	0.71	4.09	1.48	57.13					
Phenol (µg/l)	18.3	20.5	14.26	12.47	10.83	10.44	14.59	7.51	12.36	0					
Potassium (mg/l)	5	5	249	0	4	1	0	6	7	0					
Sodium (mg/l)	1046	1046	>2415	0	5	104	2	2419	172	0					
Faecal coliforms (No/100 ml)	26.9	5.3	4.2	1	2.9	2.6	1	5.1	1.4	1.5					
Total coliforms (No/100 ml)	2	0.9	2.1	0.05	<0.04	0.04	0.09	0.04	0.67	<0.04					
Depth (m)			0.65												
Total organic carbon (mg/l C)															
Total oxidised nitrogen (mg/l N)															

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GROUNDWATER QUALITY		23/09/2002	06/11/2002	Sampling Point																	
Parameter		SA1	SA1																		
pH		7.4																			
Temperature		12																			
Electrical Conductivity EC ($\mu\text{S/cm}$)		1054																			
Ammonia (mg/l N)		0.03																			
Dissolved Oxygen (% Saturation)		48																			
		0.0002																			
Cadmium (mg/l)		8																			
Chloride Cl (mg/l)		nm																			
Cyanide (mg/l)		1.8959																			
Iron (mg/l)		20																			
Phenol ($\mu\text{g/l}$)		2.26																			
Potassium (mg/l)		42.5																			
Sodium (mg/l)		45																			
Faecal coliforms (No/100 ml)		613																			
Total coliforms (No/100 ml)		4.1																			
Total organic carbon (mg/l C)		0.54																			
Total oxidised nitrogen (mg/l N)		12.5																			
Depth (m)																					

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GROUNDWATER QUALITY		Sampling Point									
Parameter		PW2	PW5 BT	PW6 AT	PW6	PW8	PW9	PW10	PW11	PW12	PW15
06/11/02											
Faecal coliforms (No/100 ml)		37.00	0.00	1.00	8.00	0.00	2.00	0.00	0.00	3.00	0.00
Total coliforms (No/100 ml)		>2419	58	22	>2419	0	114	101	23	126	0

GROUNDWATER QUALITY 25/11/02	SA1	Sampling Point
Parameter	7.40	
pH	10.00	
Temperature	594.00	
Electrical Conductivity EC ($\mu\text{S/cm}$)	0.54	
Ammonia (mg/l N)	nm	
Dissolved Oxygen (% Saturation)	17.00	
Chloride Cl (mg/l)	<0.01	
Cyanide Cn (mg/l)	53	
Phenol ($\mu\text{g/l}$)	4.6	
Potassium (mg/l)	0.15	
Flouride (mg/l)	0.0001	
Cadmium (mg/l)	0.0022	
Zinc (mg/l)	1.0867	
Iron (mg/l)	93.82	
Calcium (mg/l)	0.4785	
Manganese (mg/l)	0.0023	
Chromium (mg/l)	0.0027	
Copper (mg/l)	4.6	
Potassium (mg/l)	7.08	
Sodium (mg/l)	0.001	
Lead (mg/l)	12.3	
Sulphate (mg/l SO4)	7.29	
Magnesium (mg/l)	<0.04	
Total oxidised nitrogen (mg/l N)	0.0049	
Nickel (mg/l)	0.001	
Mercury (mg/l)	0.001	
Arsenic (mg/l)	365.00	
Faecal coliforms (No/100 ml)	>2419	
Total coliforms (No/100 ml)	0.05	
Boron (mg/l)	8.00	
Total organic carbon (mg/l C)		

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Parameter	SURFACE WATER QUALITY 12/01/00				Sampling Point			
	K1	K2	K3	K4	K1	K2	K3	K4
pH	7.5	7.6	7.7	7.1	7.5	7.6	7.7	7.1
Temperature (°C)	5	6	6	5	5	6	6	5
Electrical Conductivity EC (µS/cm)	126	704	333	266	126	704	333	266
Ammonia (mg/l N)	0.03	16.71	2.35	0.03	0.03	16.71	2.35	0.03
Chemical Oxygen Demand (mg/l O2)	15	64	13	<1.0	15	64	13	<1.0
Biochemical Oxygen Demand (mg/l O2)	<1.0	7.1	<1.0	96	<1.0	7.1	<1.0	96
Dissolved Oxygen DO (% Saturation)	96	82	90	14	96	82	90	14
Chloride (mg/l Cl)	16	64	25	<0.005	16	64	25	<0.005
Cadmium (mg/l)	<0.005	<0.005	0.0218	0.0176	<0.005	<0.005	0.0218	0.0176
Zinc (mg/l)	0.152	0.323	0.1709	0.1276	0.152	0.323	0.1709	0.1276
Aluminium (mg/l)	<0.1	0.1095	0.2864	0.3559	<0.1	0.1095	0.2864	0.3559
Iron (mg/l)	0.1545	0.6334	35.7	39.1	0.1545	0.6334	35.7	39.1
Calcium (mg/l)	11.3	30.9	<0.005	<0.005	11.3	30.9	<0.005	<0.005
Arsenic (mg/l)	<0.005	<0.005	<0.1	0.005	<0.005	<0.005	<0.1	0.005
Barium (mg/l)	<0.1	0.0074	0.0092	<0.005	<0.1	0.0074	0.0092	<0.005
Nickel (mg/l)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt (mg/l)	<0.005	0.0081	<0.005	0.0056	<0.005	0.0081	<0.005	0.0056
Chromium (mg/l)	<0.005	0.0061	0.0079	38	<0.005	0.0061	0.0079	38
Copper (mg/l)	1.5	26	6.8	0.1	1.5	26	6.8	0.1
Potassium (mg/l)	0.1	0.1375	0.1	8.7	0.1	0.1375	0.1	8.7
Boron (mg/l)	8	35.3	13.9	<0.005	8	35.3	13.9	<0.005
Sodium (mg/l)	<0.005	<0.005	<0.005	98	<0.005	<0.005	<0.005	98
Lead (mg/l)	32	228	26	14	32	228	26	14
Alkalinity (mg/l CaCO3)	1	14	5.6	3.7	1	14	5.6	3.7
Sulphate (mg/l SO4)	1.8	8	2.25	0.53	1.8	8	2.25	0.53
Magnesium (mg/l)	0.56	2.45	13.00	10.00	0.56	2.45	13.00	10.00
Total oxidised nitrogen (mg/l N)	11.00	26.00	<0.005	<0.005	11.00	26.00	<0.005	<0.005
Total suspended solids (mg/l)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum (mg/l)	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001
Selenium (mg/l)	<0.001	<0.001	<0.001	0.12	<0.001	<0.001	<0.001	0.12
Mercury (mg/l)	0.03	0.21	0.12	0.03	0.03	0.21	0.12	0.03
Ortho-Phosphate (mg/l P)								

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Parameter	28/06/00	Sampling Point
	8	K3
pH	660	
Electrical Conductivity EC (μ S/cm)	0.1	
Ammonia (mg/l N)	28	
Chemical Oxygen Demand (mg/l O ₂)	2.4	
Biochemical Oxygen Demand (mg/l O ₂)	44	
Chloride (mg/l Cl)	0.0001	
Cadmium (mg/l)	<0.001	
Zinc (mg/l)	0.0591	
Aluminium (mg/l)	0.3836	
Iron (mg/l)	69.99	
Calcium (mg/l)	0.0651	
Manganese (mg/l)	<0.001	
Arsenic (mg/l)	0.0802	
Barium (mg/l)	0.0068	
Nickel (mg/l)	<0.001	
Cobalt (mg/l)	0.0021	
Chromium (mg/l)	0.0048	
Copper (mg/l)	14.5	
Potassium (mg/l)	0.1066	
Boron (mg/l)	29.71	
Sodium (mg/l)	<0.001	
Lead (mg/l)	178	
Alkalinity (mg/l CaCO ₃)	43	
Sulphate (mg/l SO ₄)	6.24	
Magnesium (mg/l)	26.4	
Total organic carbon (mg/l C)	12.12	
Total oxidised nitrogen (mg/l N)	nm	
Total suspended solids (mg/l)	<0.05	
Silver (mg/l)	<0.001	
Molybdenum (mg/l)	<0.001	
Selenium (mg/l)	<0.001	
Mercury (mg/l)	0.19	
Ortho-Phosphate (mg/l P)		

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SURFACE WATER QUALITY 01/05/02		Sampling Point			
Parameter	A2	K1	K2	K3	K4
pH	7.6	7.5	7.3	7.5	7.4
Temperature (°C)	nm	9.0	8	9	11
Electrical Conductivity EC (µS/cm)	250	157	204	287	309
Ammonia (mg/l N)	0.060	0.8	1.11	0.14	1.9
Chemical Oxygen Demand (mg/l O2)	31	181	190	123	203
Biochemical Oxygen Demand (mg/l O2)	2.8	12.3	7.3	5.9	14.2
Dissolved Oxygen DO (% Saturation)	nm	97	94	95	85
Chloride (mg/l Cl)	13.0	24.0	15.0	17.0	13.0
Total suspended solids (mg/l)	8.0	182.0	390.0	280.0	455.0

SURFACE WATER QUALITY 06/06/02		Sampling Point			
Parameter	A2	K1	K2	K3	K4
pH	8	8	7.8	8	7.3
Temperature (°C)	13	12.0	14	13	12
Electrical Conductivity EC (µS/cm)	284	131	360	387	717
Ammonia (mg/l N)	0.170	0.03	2.38	0.03	12.57
Chemical Oxygen Demand (mg/l O2)	51	48	20	79	87
Biochemical Oxygen Demand (mg/l O2)	1.8	1.3	1	12.3	9.4
Dissolved Oxygen DO (% Saturation)	119	97	84	94	nm
Chloride (mg/l Cl)	12.0	10.0	19.0	18.0	26.0
Total suspended solids (mg/l)	5.0	47.0	5.0	44.0	121.0

SURFACE WATER QUALITY 23/09/02		Sampling Point			
Parameter	A2	K1	K2	K3	K4
pH	7.8			8.1	7.4
Temperature (°C)	13			12	13
Electrical Conductivity EC (µS/cm)	566			610	1564
Ammonia (mg/l N)	1.190			1.56	47.79
Chemical Oxygen Demand (mg/l O2)	34			38	94
Biochemical Oxygen Demand (mg/l O2)	6.3			4.1	4.7
Dissolved Oxygen DO (% Saturation)	87			92	65
Chloride (mg/l Cl)	33.0			29.0	86.0
Total suspended solids (mg/l)	12.0			12.0	<5

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SURFACE WATER QUALITY		28/11/02		Sampling Point			
Parameter	A2	K1	K2	K3	K4		
pH	7.4	7.6	7.3	7.8	7.1		
Temperature (°C)	nm	nm	nm	nm	nm		
Electrical Conductivity EC (µS/cm)	261	115	971	398	346		
Ammonia (mg/l N)	2.62	<0.03	20.89	2.65	0.53		
Chemical Oxygen Demand (mg/l O2)	56	39	1116	59	38		
Biochemical Oxygen Demand (mg/l O2)	8.8	1.7	160.8	<6	2.6		
Dissolved Oxygen DO (% Saturation)	nm	nm	nm	nm	nm		
Chloride Cl (mg/l Cl)	15	11	69	24	13		
Cadmium (mg/l)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Zinc (mg/l)	0.0092	0.004	0.0241	0.0201	0.0096		
Iron (mg/l)	1.742	0.0996	2.4282	3.2462	1.3302		
Calcium (mg/l)	31.66	11.46	91.5	48.99	49.38		
Manganese (mg/l)	0.0913	0.0144	1.642	0.266	0.2581		
Chromium (mg/l)	0.0023	0.001	0.0104	0.0077	0.0019		
Copper (mg/l)	0.0053	0.0035	0.0114	0.0101	0.0044		
Potassium (mg/l)	3.88	2.32	25.9	8.3	3.56		
Sodium (mg/l)	7.29	6.56	49.3	15.32	9.22		
Lead (mg/l)	<0.001	<0.001	0.0112	0.0037	0.001		
Alkalinity (mg/l CaCO3)	94	33	440	140	124		
Sulphate (mg/l SO4)	9.1	3.5	10.1	26.5	21.2		
Magnesium (mg/l)	3.94	2.11	24.73	8.45	5.36		
Total oxidised nitrogen (mg/l N)	1.09	0.28	0.99	1.29	1.06		
Total suspended solids (mg/l)	100	54	25700	152	42		
Mercury (mg/l)	<0.0001	<0.0001	nm	<0.0001	<0.0001		
Ortho-Phosphate (mg/l P)	0.02	0.03	0.11	0.02	0.03		

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FOREWORD

Geophysical surveying is an indirect, non-invasive process and involves interpretation of readings made at the ground surface in terms of likely subsurface conditions. This interpretation is based on the existing knowledge of ground conditions, typical geophysical responses of known materials and the experience of the author. This report has been prepared by BMA GeoServices in line with best current practice and with all reasonable skill, care and diligence within the limitations imposed by the survey technique applied and the resources devoted to it by agreement with the client. The client should take the interpretative basis for any conclusions or opinions contained therein into account in any future use of this report.

1. SUMMARY.....	1
2. INTRODUCTION.....	2
3. RESULTS.....	4
5. REFERENCES.....	6

Maps Enclosed

Map 1: Location of Geophysical Readings Map	1:2000
Map 2: Em-31 Conductivity Contour Map	1:2000

Interpreted Sections Enclosed

Interpreted 2D-resistivity Profile	4	1:1000
Interpreted 2D-resistivity Profiles	1-3	1:750
Interpreted 2D-resistivity Profile	5	1:500

Appendices

Appendix I	Geophysical Methodology.
Appendix II	Seismic Spreads.

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1. Summary

- BMA Geoservices, Geophysical Consultants, were requested by M. C. O'Sullivan & Co. Ltd., to carry out a geophysical survey of a proposed landfill extension at Corranure, Co Cavan, on behalf of Cavan Co. Council.
- The geophysical survey consisted of EM-31, seismic spreads, and 2D-Resistivity profiles. Information from boreholes drilled in the current landfill in 1998 were also integrated into this study.
- The EM-31 Survey showed generally uniform results throughout the area. An area in the southeast did show some higher results. This could be due to higher clay content in the boulder clay.
- The interpretation of the results of the 2D-Resistivity profiling (Sections 1-5) and seismic profiling (Appendix II) may be summarised as follows:

Interpretation	Thickness (m)	Velocity (m/s)	Resistivity (ohm-m)	Estimated Stiffness/ Rock Quality*	Excavatability
Gravelly Clay	< 5	500 - 1300	100 - 300	Soft - Firm	Diggable
Boulder Clay	15 - 20	1700 - 2400	30 - 120	Firm - V. Stiff	Diggable
Fractured Siltstone/Shale Bedrock	-	2700 - 3300	100 - 1900	Strong	Break - Blast

*Estimates of soil stiffness and rock quality are based on the measured geophysical properties.

- Based on the results of the geophysical data, depth to bedrock across the site is quite consistent. The depth varies from 8 – 40 m b.g.l. with the average depth at approximately 20m.
- Depths to bedrock of 15 – 20 m have been verified from borehole data from the south of the site, in the current landfill, and from geophysical data carried out by BMA in 1998.
- Borehole data also confirms the presence of a top layer of gravelly clay, underlain by the boulder clay and fractured siltstone/shale bedrock.
- Low resistivities measured for bedrock from the 2D-Res profiles may be due to fracturing of the bedrock.
- Further boreholes are recommended in the site to confirm the findings of this report.

2.0 Introduction

BMA Geoservices, Geophysical Consultants, were requested by M. C. O'Sullivan & Co. Ltd., to carry out a geophysical survey for a proposed landfill extension at Corranure, Co. Cavan.

Objectives

- To outline and investigate by non-destructive geophysical methods the suitability of the site for a proposed extension to the existing landfill in the area.
- To determine variations in overburden type and thickness.
- To determine depth to bedrock and variation in bedrock type.

Methodology

- EM-31 Conductivity mapping to produce a contour map, outlining variations in overburden type and thickness across the site and indicating areas of soft ground and near surface bedrock.
- 2D-resistivity profiles to estimate the overburden thickness and variation in rock type with depth.
- Seismic refraction lines to map the depth to bedrock and determine overburden stiffness and rock quality.
- Integration of borehole data into the geophysical interpretation.

The locations of the geophysical readings are shown on Map 1. Maps were provided by M. C. O'Sullivan & Co. Ltd.

Site Description and Geological Setting

Corranure Landfill lies approximately 2 km to the northeast of Cavan Town. The geological bedrock map (Geology of Monaghan-Carlingford, sheet 8, 1997) indicates that Northern Belt Ordovician rocks underlie the site. The northern belt in this area consists of the Red Island Formation, which consists of green to grey, medium to coarse-grained greywackes with subordinate shales.

The survey area, which is the proposed extension to the landfill, lies to the north of the existing landfill and encompasses an area of approximately 8 hectares. Ground elevation varies from 92 to 119 mOD, with the average elevation at approximately 105 mOD. Ground conditions vary from well to poorly drained. The predominant ground condition is poorly drained boggy ground. Reeds and rushes are common, particularly in the northern half of the site. A series of ditches randomly dissect the area.

Report Outline

The results are discussed in Section 3. A detailed account of the geophysical methods and equipment used and data processing is contained in Appendix I.

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Method	Frequency	Resolution
EM38	30 Hz	10 m
EM31	30 Hz	10 m
EM37	30 Hz	10 m

3.0 Results

This section integrates the geophysical results with the available geological data together with the borehole data. The interpretation is based on the available factual information, typical geophysical responses of known materials and the experience of the author. The interpreted 2D-Resistivity sections are shown at the end of this report, the seismic sections are displayed in Appendix II.

EM-31 Ground Conductivity

The EM-31 ground conductivity survey has highlighted variations in conductivity across the site with conductivity values ranging from 3 - 53 mS/m. A contour map of the conductivity data is shown on Map 2.

The area of higher elevation, in the southeast, typically has values greater than 12 mS/m. These higher values are possibly due to a thicker layer of boulder clay and a more clay rich boulder clay. Small, localized areas of boggy, poorly drained ground also have high values. Most of the site has values of less than 12 mS/m.

2D-Resistivity profiles and Seismic spreads were located based on the results of the EM-31 survey.

2D-Resistivity

The 2D-Resistivity profiles are generally consistent with the EM-31 data. The recorded resistivities range from less than 30 ohm-m to greater than 1900 ohm-m. Three layers have been interpreted on each 2D-resistivity profile. The resistivity data may be summarised as follows:

Resistivity (ohm-m)	Interpretation
100 - 300	Gravelly Clay
30 - 120	Boulder Clay
> 100 (below 15m depth)	Fractured Shale/Siltstone

Seismic Refraction

Two layers have been interpreted on 4 of the seismic spreads. These layers correspond to the gravelly clay and the boulder clay. The bedrock is generally too deep to be picked up by the seismic.

Seismic spreads 1 and 5 indicate 3 layers. The third layer in profile 5 is due to stiffer layers within the gravelly clay or a change to a more gravel rich clay. Spread 1 has three layers because bedrock is close enough to the surface to be picked up by seismics.

The seismic data may be summarised as follows:

Velocity (m/s)	Interpretation	Estimated Stiffness/ Rock Quality*
500 - 1300	Gravelly Clay	Soft - Firm
1700 - 2400	Stiff Boulder Clay	Firm - V. Strong
2700 - 4300	Fractured Shale/Siltstone Bedrock	Strong

*Estimates of soil stiffness and rock quality are based on the measured geophysical properties.

Integrated Interpretation

The 2D-Resistivity information indicates three layers are present. The three layers can be seen in all of the profiles. The top layer is interpreted to be a gravelly clay. The middle layer is boulder clay and below this lies shale/siltstone bedrock. Seismic data confirms the presence of the gravelly layer and the boulder clay. Seismic spread 1 samples the bedrock closely to the surface.

The gravelly clay layer is approximately 5 m thick. The thickness of the boulder clay varies from 15 - 20 m. Depth to bedrock varies from 8 - 40 m. The average depth to bedrock is approximately 20 m.

Information from borehole analysis indicates that the low resistivities of the bedrock are possibly due to fracturing of the bedrock.

2D-Resistivity profile 4 is interpreted as indicating, deeper bedrock in the middle of the section. Lower resistivities in this area may indicate the presence of a fractured zone.

The combined geophysical properties can be summarised as follows:

Interpretation	Thickness (m)	Velocity (m/s)	Resistivity (ohm-m)	Estimated Stiffness/ Rock Quality*	Excavatability
Gravelly Clay	> 5	500 - 1300	100 - 300	Soft	Diggable
Boulder Clay	15 - 20	1700 - 2400	30 - 100	Soft-Firm	Diggable
Fractured Siltstone/Shale Bedrock	-	2700 - 4300	100 - 1900	Strong	Break - Blast

*Estimates of soil stiffness and rock quality are based on the measured geophysical properties.

4. References

Campus Geophysical Instruments, 1997: User Manual for computer program RES2DINV, Birmingham, England.

Interpex, 1997: GREMIX users manual. Golden, Co, USA.

Interpex, 1998: FIRSTPIX users manual. Golden, Co, USA.

Redpath, B.B., 1973: Seismic refraction exploration for engineering site investigations, NTIS, U.S. Dept. of Commerce.

Geraghty, M., 1997: Geology of Monaghan-Carlingford.

Soske, J.L. 1959 The blind zone problem in engineering geophysics, *Geophysics*, 24, pp 359-36

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