

#### 4.3 Soil

# 4.3.1 Sampling

The purpose of the soil sampling was to establish the presence or absence of contamination and to characterise the fill and subsoils. The samples were collected in accordance with OCM soil sampling protocol, a copy of which is included in Appendix 3.

# 4.3.2 Laboratory Analysis

All samples were sent to the STL laboratory in Blanchardstown, Dublin for analysis. The range of parameters tested was based on the nature of the historical site activities. In addition selected samples were tested for a range of parameters specified in the EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

The Decision specifies Waste Acceptance Criteria (WAC) for a range of inorganic and organic parameters that define whether a waste is suitable for disposal to an inert, non-hazardous or hazardous waste landfill. Materials that comply with the inert WAC are deemed to be essentially inert and present a minimal environmental risk.

Three (3) samples of the fill material from BH-7, 9 and 10 were analysed for Total Petroleum Hydrocarbons (TPH), BETX (benzene, toluene, ethylbenzene and xylene), PAH (polycyclic aromatic hydrocarbons) and metals (arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, tin, selenium and zinc).

Nineteen (19) samples, of the fill and natural ground from, BH-7, 9, 10, 12, 14, 15, RC-8 and W-2, were tested for the WAC, which included Total Organic Carbon (TOC), BETX, PCBs (polychlorinated biphenyls, 7 congeners), Mineral Oil (C10 to C40) and PAH sum of 17. They were also subjected to leach testing at a liquid to solid ratio of 10:1 and the leachate analysed for arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, tin, selenium, zinc, chloride, fluoride, sulphate, phenols, dissolved organic carbon and total dissolved solids.

Details of the sample points, sample depth, nature of the sample and analytical tests are presented in Table 4.1

Table 4.1

	Sur	nmary of Soils Sa	mples	
Borehole Name	Sample Type	Sample Type	Sample Depth	Type of Subsoil
	Fill Material	Soil	0.5-1 m	
BH-7	Natural Ground	WAC	4-5 m	Gravel
	Natural Ground	WAC	12-13m	Gravel
BH-9	Fill Material	Soil	0.4-0.8m	
БП-9	Natural Ground	WAC	4-5m	Gravel
BH-10	Fill Material	Soil	1.7.2.5m	
	Fill Material	WAC	0.5-1m	
BH-12	Fill Material	WAC	3-4m	
BH-12	Natural Ground	WAC	4-5m	Clay
	Natural Ground	WAC	8-10m	Clay
	Fill Material	WAC	0.5-1m	
	Fill Material	WAC	1-2m	
BH-14	Fill Material	WAC	2-3m	
	Natural Ground	WAC	3-4m	Clay
	Natural Ground	WAC	8-10m	Gravel
RC-8	Fill Material	WAC	0.5-1m	
RC-8	Fill Material	WAC	1-2m	
W-2	Fill Material	WAC	0.5-1m	
VV - Z	Fill Material	WAC	1-2m	

#### 4.3.3 Results

The results of analysis of three solid samples of the fill material are shown in Table 4.2. The Table includes, for comparative purposes, the EU Council Decision WAC and the Dutch Government Soil Quality Standards commonly referred to as the Dutch List. These guidelines specify two categories, a target level (D) and an intervention level (I). The (D) level is considered representative of background conditions. The (I) level is one at or above which remedial action may be considered necessary depending on the potential environmental exposure risk. Many Irish Local Authorities use these standards to assess the potential for contamination. These samples were also compared with the EPA typical range for non-polluted soils for major elements and trace elements.

TPH was detected in BH-7 (180 mg/kg) and in BH-9 (150 mg/kg). Although this is above the Dutch D limit of 50 mg/kg they are considerably below the Dutch I limit of 5000 mg/kg and also below the inert WAC of 500 mg/kg.

Cadmium was detected in BH-9 and BH-10 at levels of 1.2 mg/kg and 1.6 mg/kg respectively. These are slightly above the Dutch D limit of 0.8 mg/kg, but below the I limit of 12 mg/kg. In BH-9, the mercury level (0.34 mg/kg) is marginally above the Dutch D limit of 0.3 mg/kg. All the remaining heavy metals were below the Dutch D limit and within the EPA range for non-polluted soils.

Table 4.2 Soil Results Dublin Centre 2008

	Sample ID	BH-7	BH-9	BH-10	EPA Range	Dutch D	Dutch I	EU limits
Parameter	Sample Depth	0.5-1m	0.4-0.8m	1.7-2.5m	for Non-	Values	values	for Inert
	Units				polluted Soils	values	values	landfill
Antimony	mg/kg	1.6	1.6	1.7	0.2-3	3	15	0.06
Arsenic	mg/kg	16	12	13	1.0-50	29	55	0.5
Barium	mg/kg	150	72	79	NE	160	625	20
Cadmium	mg/kg	0.65	1.2	1.6	0.1-1	0.8	12	0.04
Chromium	mg/kg	11	14	14	5-250	100	380	0.5
Copper	mg/kg	19	28	30	2-100	36	190	2
Iron	mg/kg	8900	20000	25000	10000-50000	-		-
Lead	mg/kg	42	79	59	2.0-80	85	530	0.5
Manganese	mg/kg	830	1100	1500	20-3000	NE	NE	-
Mercury	mg/kg	< 0.25	0.34	< 0.25	0.3-0.8	0.3	10	0.01
Nickel	mg/kg	24	31	37	0.5-100	35	210	0.4
Tin	mg/kg	<2.0	3.5	3.7	1.0-40	NE	900	-
Zinc	mg/kg	68	86	94	10-200	140	720	4
TPH C6-C40	mg/kg	180	150	<50	NE	50*	5000*	500
BTEX	mg/kg	< 0.2	<0.2	< 0.2	NE	NE	100	6
PAHs (sum of 10)	mg/kg	17.3	2.9	0.3	NE	1	40	-
PAHs (sum of 16)	mg/kg	23.0	3.7	<1.0	NE	NE	-	100

<sup>\*</sup>Denotes limit for mineral oil

In BH-7 and BH-9 PAHs (sum of 10) the PAH, 17.3 mg/kg and 2.9 mg/kg respectively, exceeded the D value of 1 mg/kg, but are well below the 100 mg/kg limit applied at Irish inert waste disposal landfills.

# Waste Acceptance Criteria (WAC) Testing

The results of the WAC testing of the fill material and the natural susbsoils are shown in Table 4.3 and 4.4 respectively. The Tables include the WAC for inert and non-inert landfills. The EU Council Decision does not include a WAC for PAH, but allows individual member states to apply their own limits. The limit used in this assessment is derived from the Waste Licence issued by the EPA for an inert landfill in County Dublin.

TPH was detected above the inert WAC (500 mg/kg) in four of the fill material samples- RC-8 (510 mg/kg and 1800 mg/kg); BH-12 (640 mg/kg), and W-2 (5000 mg/kg).

Antimony exceeded the inert WAC of 0.06 mg/kg in the upper fill sample of OW2 (0.36 mg/kg), but was less than the non-hazardous WAC (0.7 mg/kg). The chromium level in BH-14 (0.53 mg/kg) was slightly above the inert WAC of 0.5 mg/kg, but well below the non-hazardous WAC of 10 mg/kg.

Mercury was detected in samples of the fill taken in BH-12 (0.5-1m) and BH-14 (2-3m) and the natural ground (BH 7 (4-5m) marginally above the inert WAC of 0.01 mg/kg, but below the non-hazardous WAC of 0.2 mg/kg.

PAH levels greater that the inert WAC (100 mg/kg) were detected in both samples from OW-2, 230 mg/kg and 570 mg/kg respectively and the lower sample from RC-8 (280 mg/kg). There is no non-hazardous WAC for PAH.

PCBs were only detected in one sample at RC-8 (0.5-1m) at 0.028 mg/kg. This is considerably below the EU limit of 1 mg/kg.

Sulphate levels exceeded the inert WAC (1000 mg/kg) in two samples from RC-8, however the levels -15000 mg/kg (0.5-1m) and 14000 mg/kg (1-2m) respectively- were less than the non-hazardous WAC of 20,000 mg/kg. The TDS of both samples from RC-8 exceeded the inert WAC, but were less than the non-hazardous WAC.

Table 4.3 Fill Material WAC Dublin Centre 2008

	Sample I.D.	BH-12	BH-12	BH-14	BH-14	EU Limits for Inert	<b>EU Limits for</b>
Parameter	Depth (m) Unit	0.5-1m	3-4 m	0.5-1m	1-2m	Landfill	Non-Hazardous Landfill
Arsenic	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	0.5	2
Barium	mg/kg	0.19	0.033	0.12	0.097	20	100
Cadmium	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.04	1
Chromium	mg/kg	0.33	< 0.10	0.53	0.48	0.5	10
Copper	mg/kg	< 0.10	< 0.10	0.24	0.44	2	50
Mercury	mg/kg	0.016	< 0.003	0.0051	0.0068	0.01	0.2
Molybdenum	mg/kg	0.084	0.31	0.27	0.43	0.5	10
Nickel	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	0.4	10
Lead	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	0.5	10
Antimony	mg/kg	< 0.30	< 0.30	< 0.30	< 0.30	0.06	0.7
Selenium	mg/kg	< 0.060	< 0.060	< 0.060	< 0.060	0.1	0.5
Zinc	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	4	50
Chloride	mg/kg	<25	<25	<25	29	800	15000
Fluoride	mg/kg	3	2.3	<2	2	10	150
Sulphate	mg/kg	910	300	190	820	1,000	20000
Phenols	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	1	
Dissolved Organic Carbon	mg/kg	26	22	58	69	500	800
Total Dissolved Solids	mg/kg	3200	<2000	2900	<2000	4000	60000
Total Organic Carbon	%	5.3	3	4.4	3.8	3*	
BTEX	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	6	-
PCBs	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	1	*
TPH	mg/kg	640	170	99	180	500**	-
PAH (16)	mg/kg	6.6	<1.0	8.1	8.3	-	-
PAH (17).	mg/kg	6.6	<1.0	8.1	8.3	Murphy's 100mg/kg	

\*If DOC is less than 500 then a higher limit can be accepted
\*\* Limit is for Mineral Oil

Table 4.3 continued Fill Material WAC Dublin Centre 2008

	Sample I.D.	BH-14	BH-15	BH-15	BH-8	EU Limits for Inert	EU Limits for
Parameter	Depth (m) Unit	2-3m	0.5-1	1.0-2.0	0.5-1	Landfill	Non-Hazardous Landfill
Arsenic	mg/kg	< 0.50	< 0.5	<0.5	< 0.5	0.5	2
Barium	mg/kg	0.13	0.06	0.055	0.21	20	100
Cadmium	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.04	1
Chromium	mg/kg	0.17	0.18	< 0.1	<1	0.5	10
Copper	mg/kg	0.47	0.36	0.28	<1	2	50
Mercury	mg/kg	0.012	0.0035	0.0049	< 0.003	0.01	0.2
Molybdenum	mg/kg	0.34	0.16	0.13	0.1	0.5	10
Nickel	mg/kg	0.12	0.15	0.14	<1	0.4	10
Lead	mg/kg	< 0.10	0.42	0.43	<1	0.5	10
Antimony	mg/kg	< 0.30	< 0.3	< 0.3	< 0.3	0.06	0.7
Selenium	mg/kg	< 0.060	< 0.06	< 0.06	< 0.06	0.1	0.5
Zinc	mg/kg	< 0.10	< 0.1	0.13	<1	4	50
Chloride	mg/kg	54	<25	<25	43	800	15000
Fluoride	mg/kg	<2	2.3	<2	<2	10	150
Sulphate	mg/kg	140	500	190	15000	1,000	20000
Phenols	mg/kg	< 0.50	< 0.5	< 0.5	< 0.5	1	
Dissolved Organic Carbon	mg/kg	82	62	36	52	500	800
Total Dissolved Solids	mg/kg	<2000	4200	<2000	24000	4000	60000
Total Organic Carbon	%	3.6	3.6	5.2	3.1	3.33%	
BTEX	mg/kg	< 0.5	<0.5	<0.5	<0.5	6	-
PCBs	mg/kg	< 0.01	< 0.01	< 0.01	0.028	1	
Mineral Oil	mg/kg	<50	120	86	510	500	-
PAH (16)	mg/kg	<1.0	4.2	1.4	44	-	-
PAH (17).	mg/kg	<1.0	4.2	1.4	44	Murphy's 100mg/kg	-

\*If DOC is less than 500 then a higher limit can be accepted \*\* Limit is for Mineral Oil

Table 4.3 continued Fill Material WAC Dublin Centre 2008

	Sample I.D.	BH-8	W-2	W-2	EU Limits for Inert	EU Limits for
Parameter	Depth (m)	1020	0.5-1	1.0-2.0	and the state of t	Non-Hazardous
	Unit	1.0-2.0			Landfill	Landfill
Arsenic	mg/kg	< 0.5	< 0.5	<0.5	0.5	2
Barium	mg/kg	0.25	0.24	0.18	20	100
Cadmium	mg/kg	< 0.001	< 0.001	< 0.001	0.04	1
Chromium	mg/kg	<1	0.21	<1	 0.5	10
Copper	mg/kg	<1	0.34	<1	2	50
Mercury	mg/kg	< 0.003	< 0.003	< 0.003	0.01	0.2
Molybdenum	mg/kg	0.095	0.066	0.081	0.5	10
Nickel	mg/kg	<1	0.13	<1	0.4	10
Lead	mg/kg	<1	0.43	<1	0.5	10
Antimony	mg/kg	< 0.3	0.36	< 0.3	0.06	0.7
Selenium	mg/kg	< 0.06	< 0.06	< 0.06	0.1	0.5
Zinc	mg/kg	<1	0.11	<1	4	50
Chloride	mg/kg	58	27	140	800	15000
Fluoride	mg/kg	<2	4.1	<2	10	150
Sulphate	mg/kg	14000	440	1600	1,000	20000
Phenols	mg/kg	< 0.5	< 0.5	< 0.5	1	
Dissolved Organic Carbon	mg/kg	73	45	60	500	800
Total Dissolved Solids	mg/kg	24000	2100	4200	4000	60000
Total Organic Carbon	%	3	5.6	5.4	3.33%	
BTEX	mg/kg	< 0.5	< 0.5	< 0.5	6	
PCBs	mg/kg	< 0.01	< 0.01	< 0.01	1	
Mineral Oil	mg/kg	1800	150	5000	500	
PAH (16)	mg/kg	272	228.5	566	-	
PAH (17).	mg/kg	280	230	570	Murphy's 100mg/kg	

\*If DOC is less than 500 then a higher limit can be accepted
\*\* Limit is for Mineral Oil

Table 4.4 Natural Ground WAC Dublin Centre 2008

	Sample I.D.	BH-7	BH-7	BH-9	BH-12	EU Limits for Inert	EU Limits for
Parameter	Depth (m) Unit	4-5 m	13-14 m	4-5 m	4-5 m	Landfill	Non-Hazardous Landfill
Arsenic	mg/kg	< 0.50	< 0.5	< 0.50	< 0.50	0.5	2
Barium	mg/kg	0.084	0.14	0.076	0.068	20	100
Cadmium	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.04	1
Chromium	mg/kg	< 0.10	< 0.1	< 0.10	< 0.10	0.5	10
Copper	mg/kg	< 0.10	< 0.1	< 0.10	< 0.10	2	50
Mercury	mg/kg	0.012	0.0038	0.0078	< 0.003	0.01	0.2
Molybdenum	mg/kg	< 0.03	0.085	0.056	0.2	0.5	10
Nickel	mg/kg	< 0.10	< 0.1	< 0.10	< 0.10	0.4	10
Lead	mg/kg	< 0.10	< 0.1	< 0.10	< 0.10	0.5	10
Antimony	mg/kg	< 0.30	< 0.3	< 0.30	< 0.30	0.06	0.7
Selenium	mg/kg	< 0.060	< 0.06	< 0.060	< 0.060	0.1	0.5
Zinc	mg/kg	< 0.10	< 0.1	< 0.10	< 0.10	4	50
Chloride	mg/kg	<25	71	<25	<25	800	15000
Fluoride	mg/kg	3	4.2	2.7	2.9	10	150
Sulphate	mg/kg	<110	<110	<110	<110	1,000	20000
Phenols	mg/kg	< 0.50	< 0.5	< 0.50	< 0.50	1	
Dissolved Organic Carbon	mg/kg	13	39	14	19	500	800
Total Dissolved Solids	mg/kg	<2000	<2000	<2000	<2000	4000	60000
Total Organic Carbon	%	3.1	0.52	2.8	2.4	3%*	
BTEX	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	6	
PCBs	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	1	
TPH	mg/kg	<50	<50	<50	57	500**	
PAH (16)	mg/kg	<1.0	<1.0	<1.0	<1.0	-	-
PAH (17).	mg/kg	<1.0	<1.0	<1.0	<1.0	Murphy's 100mg/kg	PARTY PER

\*If DOC is less than 500 then a higher limit can be accepted
\*\* Limit is for Mineral Oil

Table 4.4 continued Natural Ground WAC Dublin Centre 2008

	Sample I.D.	BH-12	BH-14	BH-14	BH-15	EU Limits for Inert	EU Limits for
Parameter	Depth (m) Unit	8-10m	3-4m	8-10m	12.0-13.0	Landfill	Non-Hazardous Landfill
Arsenic	mg/kg	< 0.50	< 0.50	< 0.50	< 0.5	0.5	2
Barium	mg/kg	0.17	0.046	0.27	0.17	20	100
Cadmium	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	0.04	1
Chromium	mg/kg	< 0.10	< 0.10	< 0.10	< 0.1	0.5	10
Copper	mg/kg	< 0.10	< 0.10	< 0.10	0.15	2	50
Mercury	mg/kg	0.0047	0.0039	0.0036	< 0.003	0.01	0.2
Molybdenum	mg/kg	0.1	0.18	0.15	0.046	0.5	10
Nickel	mg/kg	< 0.10	< 0.10	< 0.10	0.14	0.4	10
Lead	mg/kg	< 0.10	< 0.10	< 0.10	0.41	0.5	10
Antimony	mg/kg	< 0.30	< 0.30	< 0.30	< 0.3	0.06	0.7
Selenium	mg/kg	0.079	< 0.060	< 0.060	< 0.06	0.1	0.5
Zinc	mg/kg	0.19	< 0.10	< 0.10	< 0.1	4	50
Chloride	mg/kg	41	<25	35	100	800	15000
Fluoride	mg/kg	2.7	2.3	2.4	4.7	10	150
Sulphate	mg/kg	250	<110	420	130	1,000	20000
Phenols	mg/kg	< 0.50	< 0.50	< 0.50	< 0.5	1	-
Dissolved Organic Carbon	mg/kg	19	27	23	37	500	800
Total Dissolved Solids	mg/kg	<2000	<2000	<2000	<2000	4000	60000
Total Organic Carbon	%	1.4	3.5	1.4	0.34	3%*	
BTEX	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	6	
PCBs	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	1	
TPH	mg/kg	<50	<50	<50	<50	500**	-
PAH (16)	mg/kg	<1.0	<1.0	<1.0	<1.0	-	
PAH (17).	mg/kg	<1.0	<1.0	<1.0	<1.0	Murphy's 100mg/kg	

\*If DOC is less than 500 then a higher limit can be accepted
\*\* Limit is for Mineral Oil

### 4.4 Groundwater

Samples were collected from four groundwater monitoring wells, OW-1 Subsoils (OW-1 S) and OW-1 Bedrock (OW-1 B) and RC-16 Subsoils (RC-16 S) and RC-16 Bedrock (RC-16 B). The samples were collected in accordance with OCM's Groundwater Sampling Protocol, a copy of which is included in Appendix 5.

All the samples were sent to the STL laboratory in Santry for analysis. The range of parameters tested was based on the nature of the historical site activities and included dissolved metals (arsenic, antimony, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, tin and zinc.), sodium, chloride, potassium, magnesium, sulphate, sulphide, total hardness, bicarbonate, TPH, BTEX and PAH.

The laboratory test report is included in Appendix 5 and the results are shown in Table 4.5. The results are compared for discussion purposes with the EPA Interim Guideline Values (IGVs). The IGVs are not statutory guidelines but have been prepared by the EPA to assist in the assessment of impacts on groundwater quality.

TPH was only detected in one well-RC-16- at a level of 8 mg/l, which is above the IGV of 0.01 mg/l. Iron, manganese and potassium exceeded their respective IGVs in both the subsoil and bedrock samples from RC -16. Barium, sodium and copper exceeded the IGV in the bedrock sample from RC-16 and PAH exceeded the IGV in the bedrock sample from RC-16.

PAHs exceeded the IGV in the subsoil and bedrock samples from RC-16 Subsoil and the bedrock sample in OW-1.

Chloride exceeded the IGV of 30 mg/l in both subsoil and bedrock samples from RC-16 and OW-1. The sulphate level in the bedrock sample marginally exceeded the IGV and hardness also exceeded the IGV in the subsoil sample from OW-1 and both subsoil and bedrock samples from RC-16.

Table 4.5 Groundwater Results Dublin Centre December 2008

Compale ID	Tinte	Subsoi	il Wells	Bedroc	k Wells	IGV
Sample I.D.	Units	RC-16 Subsoil	OW-1 Subsoil	RC-16 Bedrock	OW-1 Bedrock	IGV
Antimony	mg/l	0.00048	0.00017	0.0023	0.00015	-
Arsenic	mg/l	0.0069	< 0.0001	0.0059	< 0.0001	0.01
Barium	mg/l	0.056	0.015	0.12	0.018	0.1
Cadmium	mg/l	< 0.0001	0.00014	0.00024	< 0.0001	0.005
Chromium	mg/l	< 0.03	< 0.03	< 0.03	< 0.03	0.03
Copper	mg/l	0.025	< 0.007	0.096	< 0.007	0.03
Iron	mg/l	0.41	0.045	0.55	0.041	0.2
Lead	mg/l	0.0033	< 0.0005	0.00081	< 0.0005	0.01
Manganese	mg/l	0.17	0.022	0.07	< 0.01	0.05
Mercury	mg/l	< 0.0003	< 0.00030	0.00074	< 0.00030	0.001
Nickel	mg/l	0.006	< 0.0005	0.0039	0.0005	0.02
Tin	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	-
Zinc	mg/l	0.053	< 0.005	0.016	0.005	0.1
Magnesium	mg/l	6.6	8.8	28	8.4	50
Potassium	mg/l	60	11	7.6	10	5
Sodium	mg/l	100	35	680	35	150
Hardness (as CaCO3)	mg/l	100	360	210	360	200
Bicarbonate as CaCO3	mg/l	710	200	350	200	-
Chloride as Cl	mg/l	150	39	860	41	30
Sulphate as SO4	mg/l	<11	150	230	160	200
Sulphide as S	mg/l	0.14	< 0.010	0.011	< 0.010	-
ТРН	mg/l	8	< 0.1	<0.1	< 0.1	0.01
PAH Total (Sum of 16)	μg/l	16	< 0.10	0.25	1.7	0.1
Benzene	μg/l	<10	<10	<10	<10	1
Toluene	μg/l	<10	<10	<10	<10	10
Ethylbenzene	μg/l	<10	<10	<10	<10	10
p & m xylene	μg/l	<20	<20	<20	<20	10
o-Xylene	μg/l	<10	<10	<10	<10	10

## 5. DISCUSSION

DDC PLAN NO 5432/22 RECEIVED: 13/12/2022

#### 5.1 Discussion

The purpose of environmental site investigation was to establish if there was contamination in the subsoils or groundwater associated with the historical use of the site. It was also undertaken to establish the nature of the fill material and underlying subsoils in terms of off-site management options for such materials that will have to be removed during site development.

The majority of the Dublin Centre area has been in use as shops, offices, stores and houses since the late 1700's. The 2006 assessment concluded that, given the nature of these historic landuses, the potential for subsurface soil or groundwater contamination is considered to be low. However, the assessment identified areas where there was potential for subsurface contamination. These included the Royal Dublin Hotel; car parking area for Dr. Quirke's Emporium; 5-11 Moore Lane, and 4-8 Henry Place.

The environmental investigation, in so far as the ground conditions allowed, targeted those risk areas identified in the 2006 assessment. Boreholes RC-8 and W-2 were installed in 48A-50 O' Connell Street, which had been designated at moderate risk. It is presently used as an unpaved car park and storage area for Dr. Quirke's Emporium.

### 5.2 Soils

In RC-8 and W-2, the levels of sulphate, total dissolved solids, TPH and PAHs exceeded the inert waste WAC. However all of the levels were less than the non-hazardous WAC.

In BH-12, which was located on the southeast perimeter of the site TPH and mercury were detected above the inert waste WAC in the upper fill sample; however the levels of these parameters in the underlying fill and natural ground were less than the inert WAC.

There was no evidence of significant contamination in any of the other samples and the tested parameters, where detected, are at levels generally below the inert WAC.

#### 5.3 Groundwater

TPH and PAHs above the IGV limits were detected in the well installed in the subsoil in RC-16. A strong hydrocarbon odour was noted during sampling. No TPH or PAH was detected in the bedrock well. RC-16 is located immediately to the south and not within the portion of the site where deep excavation will occur. It is possible therefore that the hydrocarbons detected in this well originate from an off-site location and not from within the development site.

Low levels of PAH were detected in the subsoil and bedrock wells at OW-1 in the centre of the site. While the levels detected are above the IGV limits, they are not indicative of significant pollution.

The elevated iron and manganese levels detected in the subsoil and bedrock wells and are most likely naturally occurring. The copper level detected in OW-1, while slightly above the IGV is less than the drinking water standard for this parameter (2mg/L) and this detection is not therefore considered to be significant.

Elevated potassium and chloride levels were detected in both wells with higher chloride leves detected in RC-16, which is closest to the River Liffey. The levels detected are not indicative of significant contamination from historical site activities and it is possible that there is link via the gravels beneath the site and the brackish waters in the River Liffey.

OCM understand that pumping tests have been carried out to estimate the dewatering rate that will be necessary during the deep excavation and construction of the basement. While the volumes of groundwater in the fill, subsoil and bedrock, higher volumes may be expected from the gravels where present in significant thickness.

The groundwater quality monitoring data indicates that while low levels of PAH are present, the water should be suitable for discharge to sewer. Dublin City Council are likely to require on-site settlement to treat suspended solids and possibly pH control during any concrete forming or piling works.

# 6. CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 Conclusions

The subsurface comprises made ground ranging in thickness from 2-5.2 m, which contains mainly grey brown gravelly clay fill with red brick. This is underlain by natural ground of between 11.1 m and 23.3 m in thickness, that comprises gravels underlain by clay. The minimum depth to bedrock is 12.6 m while the maximum is 27.3 m.

The bedrock ranges from interbedded argillaceous limestone, siliceous limestone and black fossiliferous shale which are part of the Calp Limestone formation. The bedrock is considered to be a Locally Important Aquifer (LI), which is moderately productive only in local zones. Aquifer vulnerability is considered to be moderate to low.

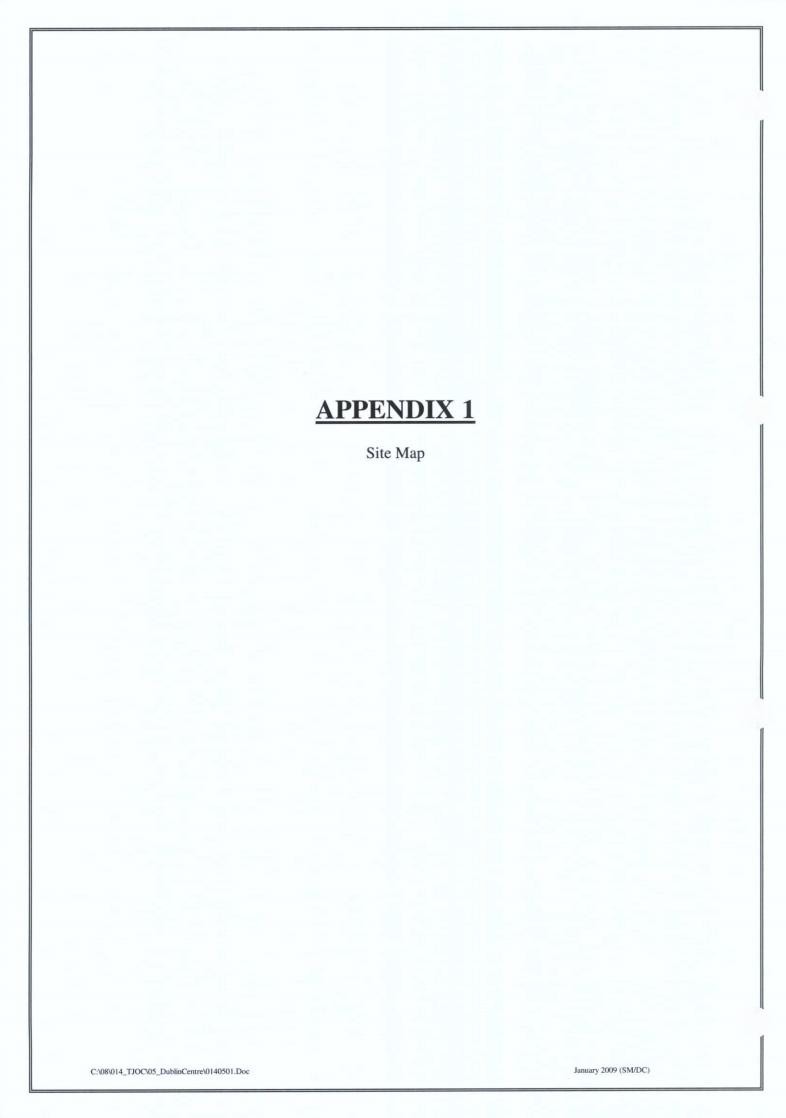
The investigation has established that the fill material and the underlying subsoils can generally be categorised as inert and suitable either for disposal at inert landfill or for use in land reclamation projects. There are localised zones in the fill such as at BH-12, RC-8 and W-2, where the contaminant levels exceed the inert category limits. However in these cases the materials fall into the non-hazardous waste category.

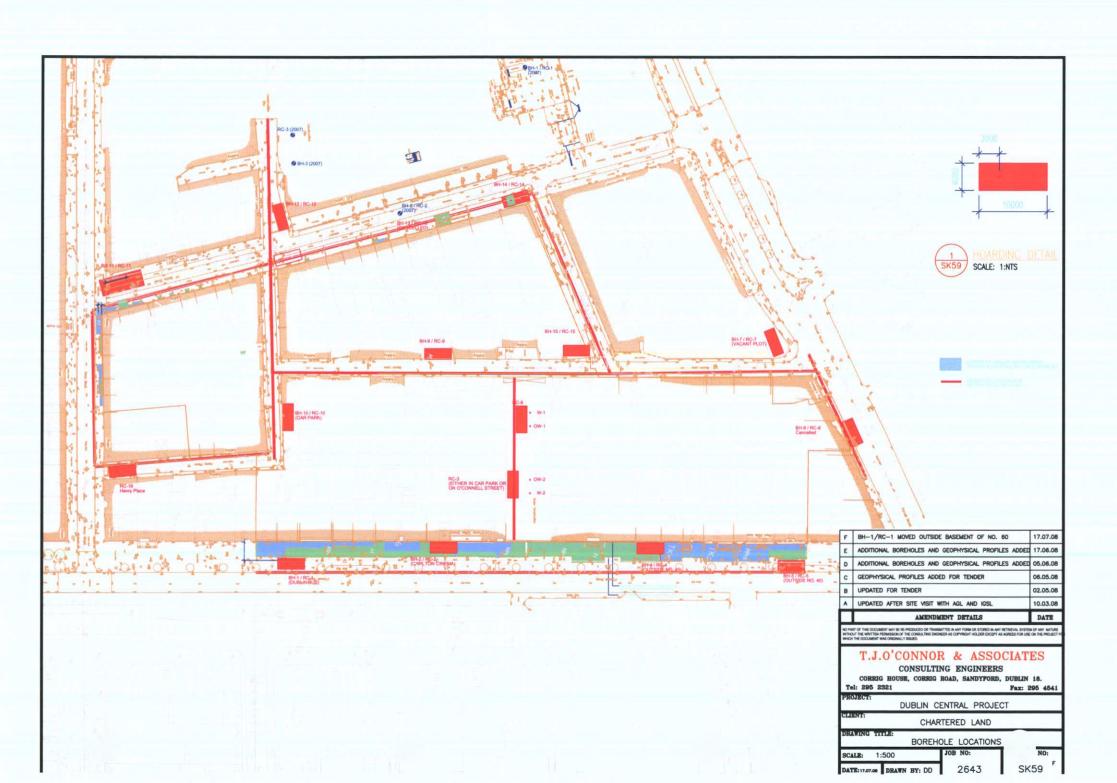
Elevated PAH levels were detected in the groundwater wells immediately to the south but not within the portion of the site where deep excavation will occur. It is possible therefore that these from an off-site location and not from within the development site. Low levels of PAH were detected in the subsoil and bedrock wells in the centre of the site. While the levels are above the IGV limits they are not indicative of significant pollution and the water should be suitable for discharge to sewer during the dewatering programme.

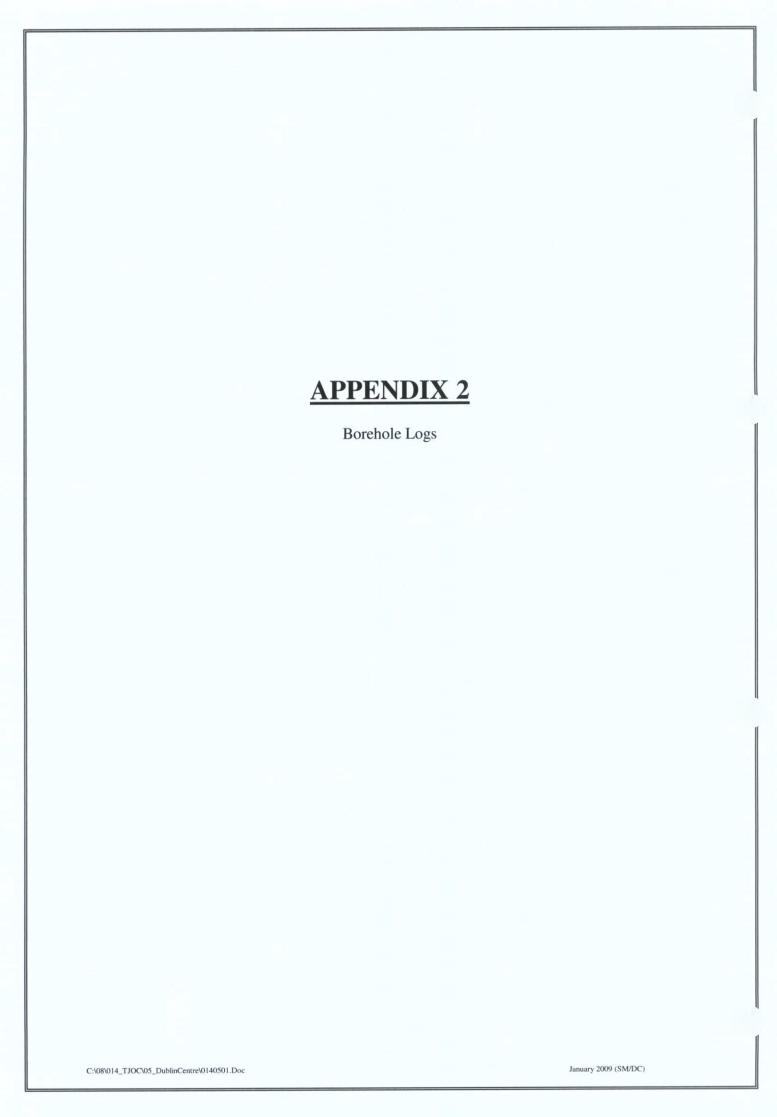
#### 6.2 Recommendations

OCM recommend that following site clearance and as part of the bulk excavation samples of the fill and subsoil excavated in the vicinity of BH-12, W-2 and RC-8 be tested to confirm the waste characterisation i.e. inert or non-hazardous.

OCM recommend that all material excavated and removed from the site be disposed of in accordance with Dublin City Council Waste Management Regulations to suitably permitted or licensed waste management facilities.









REPORT NUMBER

СО	NTRACT	Dubl	in Centr	al Deve	lopm	ent - Draf	t						BOREHO SHEET	OLE NO	D. BH7 Sheet 1 of	2
	ORDINA	ATES EVEL (m	AOD)				RIG TYI BOREH	PE OLE DIAME	TER (m		Dando 15 200	50	DATE S			
	ENT SINEER		in Centr Consulti		lopm	ents Ltd		OLE DEPTH DEPTH (m)			16.00 16.00		BORED PROCES		J. O'Hara S. Letch	
Depth (m)			De	scriptio	n			Legend	Elevation	Depth (m)	Ref. Number	Sample Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe
o O								) j	ᆲ	Ď	N N	Sa	9.5	Rec		Sta
3 3 4 4 5 5 6 6 6 7 7	MADE slightly	gravelly	D consist clay with	eting of I	sand;	n grey sar les and re	ed brick.	1 3 4 4 4 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6		4.20	AF4969  AF4960  AF4961  AF4963  AF4964  AF4965  AF4966	B B B B B B	1.50-1.50 2.70-2.70 3.60-3.60 4.50-4.50 5.50-5.50 6.30-6.30 7.30-7.30		N = 7 (1, 1, 1, 2, 2, 2) N = 57 (5, 7, 15, 13, 11, 18 N = 63 (6, 5, 9, 13, 17, 24) N = 100/225 mm (9, 20, 33, 38, 29) N = 26 (7, 7, 6, 7, 6, 7) N = 31 (2, 4, 6, 8, 8, 9) N = 13 (5, 3, 3, 3, 3, 4) N = 21 (1, 1, 3, 5, 5, 8)	
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Sec. Sec.		5 (m)	Time (h)	Comme	ents			Water Strike	Dep	th	Sealed At	Rise	(n	nin)	Comments	"
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1	2.5 3.5 16	13.5 16 16	4 7 2	Hard Stra Hard Stra Boulder	ita Bori ita Bori	ng ng		GROUNI Date	H	lole	Casing	Dej	oth to (	Comme	ents	
NC	TALLAT	ION DE	TAILE					01-08-08 05-08-08		epth 2.00 2.00	2.00 2.00		- E	nd of shi	ift	
	Date	Tip Depti	h RZ To			Ту		05-08-08 06-08-08		5.60 5.00	6.00 6.00	4	5.10 E	End of shi Start of sh	ft ift	
1007	-08-08	15.00 Hand dug in	13.00	1 1000	.00	50mr		06-08-08 07-08-08		3.60 3.60	9.00			End of shi Start of sh		

REPORT NUMBER

13696

BOREHOLE NO. BH7 CONTRACT **Dublin Central Development - Draft** SHEET Sheet 2 of 2 **CO-ORDINATES** RIG TYPE Dando 150 DATE STARTED 05/08/2008 DATE COMPLETED 12/08/2008 **BOREHOLE DIAMETER (mm)** 200 **GROUND LEVEL (m AOD) BOREHOLE DEPTH (m)** 16.00 **BORED BY** J. O'Hara CLIENT **Dublin Central Developments Ltd** PROCESSED BY CASING DEPTH (m) 16.00 S. Letch **ENGINEER** AGL Consulting Ltd Samples Œ E Standpipe Elevation Ref. Number Sample Recovery Field Test Legend Details Depth Description Depth Depth (m) Type Results 0 0 0 0 10.00 10 Dense grey slightly clayey/silty sandy GRAVEL with (8, 7, 7, 6, 6, 6) AF4967 В 10.20-10.20 many cobbles and lenses of brown slightly sandy gravelly clay. Gravel is fine to coarse and subrounded 80.80 00 10.40 to subangular of limestone. N = 100Very dense grey slightly sandy GRAVEL with some 00000 (12, 15, 16, 21, 25, 38) В AF4968 11.00-11.00 cobbles. Gravel is fine to coarse and subrounded to 00.00 subangular of limestone. N = 100/225 mm (11, 20, 26, 33, 41) AF4969 В 12.00-12.00 12 6000 6000 6000 6000 N = 100/90 mm (25, 44, 56) AF4970 В 13.00-13.00 13 80.00 N = 100/185 mm В AF4971 14.00-14.00 (8, 11, 33, 48, 19) 200000 N = 100/150 mm AF4972 В 15.00-15.00 (17, 27, 39, 61) 0.00 9-8 15.80 Hard brown slightly sandy gravelly CLAY with some 15.90-15.90 16.00-16.00 AF4973 N = 100/90 mm 16.00 cobbles AF4974 16 (25, 40, 60) Obstuction - possible boulder End of Borehole at 16.00 m 18 19 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Casing Sealed Rise Time Time Comments From (m) To (m) Comments Depth Strike To (min) (h) 4.2 9 12.6 0.5 Boulder 1/10/08 Hard Strata Boring Hard Strata Boring 8 8 4 7 12.5 13.5 13.5 16 16 Hard Strata Boring **GROUNDWATER DETAILS** Hard Strata Boring Boulder GDT Hole Casing Depth to Water Date Comments Depth Depth GSL 12.50 12.50 13.50 07-08-08 12.50 End of shift Start of shift 12.50 13.50 INSTALLATION DETAILS

Date | Tip Depth | RZ Top | RZ Base 08-08-08 2.70 6.20 4.80 08-08-08 End of shift 13.50 16.00 16.00 13.50 16.00 16.00 Type 11-08-08 11-08-08 Start of shift End of shift 50mm SP 12-08-08 15.00 13.00 15.00 12-08-08 5.20 Start of shift End of shift 12-08-08 16.00 16 00 8 80 REMARKS Hand dug inspection pit excavated to 1.20m. Blowing gravels from 5.6m bgl to base of hole. Falling and rising head test completed. 90 BHI



REPORT NUMBER

13696

BOREHOLE NO. CONTRACT BH9 Dublin Central Development - Draft SHEET Sheet 1 of 2 **CO-ORDINATES RIG TYPE** Dando 150 **DATE STARTED** 15/07/2008 **BOREHOLE DIAMETER (mm) GROUND LEVEL (m AOD)** 200 DATE COMPLETED 23/07/2008 BOREHOLE DEPTH (m) 17.50 CLIENT **Dublin Central Developments Ltd BORED BY** J. McDonnell **ENGINEER** AGL Consulting Ltd CASING DEPTH (m) 17.50 PROCESSED BY S. Letch Samples Standpipe Details E  $\widehat{\Xi}$ Elevation Recovery Ref. Number Sample Type Field Test Description Legend Depth Depth ( Depth (m) Results - 0 MADE GROUND consisting of reinforced concrete MADE GROUND consisting of brown grey sandy 0.20 slightly gravelly clay with some cobbles and red brick. AF1908 В 1.00-1.00 (2. 2. 2. 1. 1. 3) N = 36 (4, 6, 7, 2, 10, 17) 2.00 8 Very dense grey brown slightly clayey/silty sandy AF1909 В 2.10-2.10 GRAVEL with many cobbles. Gravel is fine to coarse 30 0 and subrounded to subangular of limestone. 2000 AF1910 В 2.50-2.50 0000 N = 39AF1911 В - 3 3.00-3.00 (7, 9, 8, 10, 10, 11) 000 جي آ N = 28 (2, 3, 6, 7, 8, 7) AF1912 4.00-4.00 В 4 \$ 500 A N = 34 (3, 4, 7, 7, 9, 11) 5 AF1913 В 5 00-5 00 400 N = 27AF1914 В 6.00-6.00 6 (3, 3, 4, 8, 8, 7) 0000 000 AF1915 7.00-7.00 В (7, 18, 20, 25, 20, 12) - ए 800 N = 69AF1916 В 8 00-8 00 (6, 12, 16, 20, 20, 13) 0000 N = 18AF1917 В 9.00-9.00 9 000 (6, 6, 5, 5, 5, 3) 0.00 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Time Water Casing Sealed Rise Time From (m) To (m) Comments Comments Strike Depth To (h) At (min) 16.2 17 Boulder 5.50 5.50 No 3.10 5 Rapid 2 GDT **GROUNDWATER DETAILS** Depth to Water Hole Casing Date Comments IGSL Depth Depth 2.00 End of shift 2.00 16-07-08 16-07-08 17-07-08 2.00 7.00 7.00 Start of shift End of shift Start of shift GPJ 2.00 INSTALLATION DETAILS

Date Tip Depth RZ Top RZ Base 7.00 7.00 4.50 4.50 Type 22-07-08 12.00 13.50 50mm SP 13.50 REMARKS Hand dug inspection pit excavated to 1.20m. Falling and rising head tests completed. Standing from 24th to 28th July - No access BH LOG



GP.

# GEOTECHNICAL BORING RECORD

REPORT NUMBER

13696

BOREHOLE NO. **BH9** CONTRACT Dublin Central Development - Draft SHEET Sheet 2 of 2 **CO-ORDINATES RIG TYPE** Dando 150 DATE STARTED 15/07/2008 DATE COMPLETED 23/07/2008 BOREHOLE DIAMETER (mm) 200 **GROUND LEVEL (m AOD) BOREHOLE DEPTH (m)** 17.50 **BORED BY** J. McDonnell CLIENT **Dublin Central Developments Ltd** CASING DEPTH (m) 17.50 PROCESSED BY S. Letch **ENGINEER** AGL Consulting Ltd Samples (E) Ξ Standpipe Elevation Ref. Number Recovery Sample Type Field Test Legend Depth ( Description Depth Depth (m) Results Very dense grey brown slightly clayey/silty sandy GRAVEL with many cobbles. Gravel is fine to coarse 10.00-10.0 2000 80 and subrounded to subangular of limestone. 2000 (continued) 0000 No CPT as gravel blowing up casing N = 41 (11, 13, 11, 10, 10, 10 AF1919 В 11 00-11 00 000 م الم N = 43В AF1920 12.00-12.00 12 (7, 5, 8, 8, 13, 14) AF1921 В 13.00-13.00 13 (6, 6, 10, 18, 25, 25) 13.50 Hard dark brown slightly sandy gravelly CLAY with 0 occasional cobbles. N = 68 (6, 11, 15, 17, 19, 17) AF1922 В 14.00-14.00 Very dense grey brown slightly sandy GRAVEL with 0 14.20 14.40-14.40 14.50-14.50 AF1923 some cobbles. Gravel is medium to coarse and 14.50 0 Failed subrounded to subangular of limestone. 100 blows Hard dark brown slightly sandy gravelly CLAY with N = 45/150 mmAF1924 В 15.00-15.00 occasional cobbles. (20, 35, 20, 25) a Very dense grey brown slightly sandy GRAVEL with 15.90 8 S AF1925 В 16.00-16.00 16 some cobbles. Gravel is medium to coarse and 80 0 subrounded to subangular of limestone. Hard black slightly sandy gravelly CLAY with 16.50 occasional cobbles AF1828 В 16.80-16.80 N = 100 Obstuction - possible boulder 17.00 (8, 12, 20, 30, 30, 20) AF1829 В 17.10-17.10 17.50 End of Borehole at 17.50 m 18 19 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Rise Water Casing Sealed Time Time Comments From (m) To (m) Comments (h) Strike Depth To (min) 16.2 17 16.5 17.5 Boulder 1/10/08 **GROUNDWATER DETAILS** GDT Hole Casing Depth to Water Date Comments IGSL Depth Depth End of shift Start of shift End of shift 13.00 13.00 5.00 13.00 18-07-08 18-07-08 13.00 4.60 INSTALLATION DETAILS

Date Tip Depth RZ Top RZ Base 5.80 16.50 16 50 Type 21-07-08 16.50 Start of shift 22-07-08 13.50 12.00 13.50 50mm SP REMARKS Hand dug inspection pit excavated to 1.20m. Falling and rising BHLOG head tests completed. Standing from 24th to 28th July - No access

GS

GDT.

IGSL

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BH

## GEOTECHNICAL BORING RECORD

REPORT NUMBER

13696 BOREHOLE NO. CONTRACT **Dublin Central Development - Draft BH10** SHEET Sheet 1 of 2 **CO-ORDINATES RIG TYPE** Dando 150 30/07/2008 DATE STARTED **BOREHOLE DIAMETER (mm)** 200 DATE COMPLETED 13/08/2008 **GROUND LEVEL (m AOD) BOREHOLE DEPTH (m)** 15.45 CLIENT **BORED BY Dublin Central Developments Ltd** J. McDonnell CASING DEPTH (m) **ENGINEER** 15.45 PROCESSED BY AGL Consulting Ltd S. Letch Samples E Œ Standpipe Details Elevation Ref. Number Sample Type Recovery Field Test -egend Description Depth ( Depth Depth (m) Results - 0 MADE GROUND consisting of concrete. 0.10 MADE GROUND consisting of brown grey sandy slightly gravelly clay with some cobbles and red brick. AF1830 В 1.00-1.00 N = 6 (1, 1, 2, 1, 1, 2) AF1831 2 B 2 00-2 00 AF1832 В 3.00-3.00 N = 51Very dense grey slightly clayey/silty sandy GRAVEL with many cobbles. Gravel is fine to coarse and - 3 3.00 (8, 18, 16, 11, 17, 7) 4 20 subrounded to subangular of limestone. 200 0000 N = 30 (3, 5, 7, 7, 8, 8) AF1833 В 4.00-4.00 4 N = 50 (8, 8, 14, 14, 12, 10) AF1834 В 5.00-5.00 0 80 0000 Dense grey slightly clayey/silty sandy GRAVEL with many cobbles. GRAVEL is fine to coarse and 5.50 3 80 80 subrounded to subangular of limestone. 2000 AF1835 6 В 6.00-6.00 (4, 6, 6, 7, 7, 8) 0000 101 6.80 Very stiff black slightly sandy gravelly CLAY with 0 AF1836 7.00-7.00 occasional cobbles (3, 15, 18, 12, 11, 15) .0. 2000 7.50 Very dense grey slightly clayey/silty sandy GRAVEL with many cobbles. Gravel is fine to coarse and 30 subrounded to subangular of limestone. N = 100/225 mm (15, 24, 25, 30, 45) 200 AF1837 В 8 00-8 00 N = 52AF1838 В 9.00-9.00 9 (7, 9, 14, 15, 13, 10) D. HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Time Water Casing Sealed Rise Time From (m) To (m) Comments Comments Strike Depth (h) To (min) At Hard Strata Boring Hard Strata Boring 8 8 2 8.00 8.00 No 6.50 20 Moderate 14.5 15.4 15.45 Boulder **GROUNDWATER DETAILS** Depth to Water Hole Casing Date Comments Depth Depth 30-07-08 6.00 4.80 End of shift 6.00 08-08-08 08-08-08 11-08-08 6.00 6.00 4.80 6.10 Start of shift End of shift INSTALLATION DETAILS

Date | Tip Depth | RZ Top | RZ Base Type 8.00 8.00 4.55 Start of shift REMARKS Hand dug inspection pit excavated to 1.20m. Water added from 3.0m to aid drilling. Blowing gravels from 9.5m to 10.5m and 11.5m to 12.0m bgl. Falling and rising head test completed. Standing 5.5 days - stopped by Client due to Landowner request.



GPJ

13696

# GEOTECHNICAL BORING RECORD

REPORT NUMBER

13696

BOREHOLE NO. **BH10** CONTRACT **Dublin Central Development - Draft** SHEET Sheet 2 of 2 **CO-ORDINATES RIG TYPE** Dando 150 30/07/2008 DATE STARTED 200 DATE COMPLETED 13/08/2008 **BOREHOLE DIAMETER (mm)** GROUND LEVEL (m AOD) **BOREHOLE DEPTH (m)** 15.45 BORED BY J. McDonnell CLIENT **Dublin Central Developments Ltd** CASING DEPTH (m) 15.45 PROCESSED BY S. Letch **ENGINEER** AGL Consulting Ltd Samples Standpipe Details Depth (m) (H) Elevation Ref. Number Sample Type Recovery Field Test Legend Depth ( Description Depth (m) Results 10.00-10.00 0000 10 Very dense grey slightly clayey/silty sandy GRAVEL (9, 13, 16, 24, 19, 17) with many cobbles. Gravel is fine to coarse and subrounded to subangular of limestone. (continued) 0000 N = 100/160 mm AF1840 В 11.00-11.00 (13, 39, 50, 40, 10) 000 الم 60 BO N = 100/170 mm AF1841 В 12.00-12.00 12 (12, 30, 40, 45, 15) 10000 ABA N = 100/125 mm AF1842 В 13.00-13.00 (12, 23, 62, 38) 13.80 Hard black slightly sandy gravelly CLAY with N = 100/230 mm (4, 10, 20, 35, 40, 5) AF1843 В 14 00-14 00 14 occasional cobbles. N = 100/75 mm AF1844 В 15.00-15.00 15 (12, 43, 100) 15.40 15.45 AF1845 В 15.45-15.45 Obstuction - possible boulder End of Borehole at 15.45 m 16 19 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Rise Time Water Sealed Time Casing Comments From (m) To (m) Comments Strike Depth To (min) (h) Hard Strata Boring Hard Strata Boring 11 14.5 15.45 8 8 2 IGSL.GDT 1/10/08 154 Boulder **GROUNDWATER DETAILS** Depth to Water Hole Casing Comments Date Depth Depth 11.00 11.00 4.90 End of shift 11.00 14.50 14.50 15.45 11.00 14.50 14.50 15.45 12-08-08 4.60 Start of shift INSTALLATION DETAILS

Date Tip Depth RZ Top RZ Base 5.60 4.50 5.60 12-08-08 13-08-08 End of shift Start of shift End of shift Type 13-08-08 REMARKS Hand dug inspection pit excavated to 1.20m. Water added from 3.0m to aid drilling. Blowing gravels from 9.5m to 10.5m and 11.5m to 12.0m bgl. Falling and rising head test completed. Standing 5.5 days - stopped by Client due to Landowner request. LOG BH

REPORT NUMBER

13696 BOREHOLE NO. CONTRACT **BH12 Dublin Central Development - Draft** SHEET Sheet 1 of 2 **CO-ORDINATES** Dando 2000 **RIG TYPE DATE STARTED** 12/10/2008 **GROUND LEVEL (m AOD) BOREHOLE DIAMETER (mm)** 200 DATE COMPLETED 16/10/2008 **BOREHOLE DEPTH (m)** 13.60 CLIENT **Dublin Central Developments Ltd BORED BY** J. McDonnell **ENGINEER** AGL Consulting Ltd CASING DEPTH (m) 13.60 PROCESSED BY S. Letch Samples Standpipe Details (E E Elevation Sample Type Ref. Number Recovery Field Test Depth ( Description egend-Depth ( Depth (m) Results - 0 MADE GROUND consisting of brown slightly sandy gravelly clay with some red brick and concrete. AF4857 В 1.00-1.00 N = 14(2, 2, 3, 3, 4, 4) 2 AF4858 В 2.00-2.00 (2, 2, 2, 3, 3, 3) AF4859 В 3.00-3.00 (4, 8, 10, 8, 6, 6) 3.40 Firm becoming stiff brown slightly sandy gravelly CLAY with occasional cobbles. N = 17AF4860 В 4.00-4.00 - 4 (4, 3, 4, 4, 4, 5) AF4861 В 5.00-5.00 5 (4, 6, 8, 8, 9, 9) N = 49 (6, 6, 9, 10, 12, 18) 6 AF4862 В 6.00-6.00 6.00 Very stiff becoming hard black slightly sandy gravelly CLAY with occasional cobbles N = 100/200 mm (14, 20, 35, 35, 30) AF4863 В 7.00-7.00 AF4864 В 8.00-8.00 8 (6, 8, 12, 12, 14, 16) N = 55 (7, 8, 11, 14, 14, 16) AF4865 В 9.00-9.00 00 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Casing Sealed Rise Time Time From (m) To (m) Comments Comments Strike Depth At To (min) 7.5 Boulder **GROUNDWATER DETAILS** Casing Hole Depth to Water Date Comments Depth Depth 12-10-08 1.20 End of shift 13-10-08 14-10-08 1.20 7.00 7.00 1.20 7.00 7.00 Start of shift End of shift INSTALLATION DETAILS
Date Tip Depth RZ Top RZ Base Type 6.70 14-10-08 Start of shift 16-10-08 13.60 11.50 13.60 50mm SP **REMARKS** Hand dug inspection pit excavated to 1.20m. Night work - shift started at 1800hrs.

GDT 5/11/08 IGSL GPJ

BH LOG

13696

BOREHOLE NO. **BH12** CONTRACT **Dublin Central Development - Draft** SHEET Sheet 2 of 2 **CO-ORDINATES RIG TYPE** Dando 2000 DATE STARTED 12/10/2008 200 DATE COMPLETED 16/10/2008 **BOREHOLE DIAMETER (mm)** GROUND LEVEL (m AOD) BOREHOLE DEPTH (m) 13.60 BORED BY J. McDonnell CLIENT Dublin Central Developments Ltd 13.60 PROCESSED BY S. Letch **ENGINEER** CASING DEPTH (m) AGL Consulting Ltd Samples Standpipe E Œ Elevation Recovery Ref. Number Sample Type Field Test Depth ( Legend Depth ( Description Depth (m) Results 10.00-10.00 N = 100/50 mm AF4866 Very stiff becoming hard black slightly sandy gravelly (8, 42, 100) CLAY with occasional cobbles (continued) N = 100/90 mm AF4867 11.00-11.00 (10, 38, 80, 20) Very dense grey slightly clayey/silty sandy GRAVEL with occasional cobbles. Gravel is fine to coarse and 11.50 N = 68 (9, 11, 15, 16, 18, 19) subrounded to subangular of limestone. AF4868 12.00-12.00 12 12.50 Hard black slightly sandy gravelly CLAY with occasional cobbles N = 100/150 mm (22, 35, 40, 60) AF4869 В 13 00-13 00 13 13.50 13.60 Obstuction - possible boulder End of Borehole at 13.60 m 16 18 WATER STRIKE DETAILS HARD STRATA BORING/CHISELLING Water Casing Sealed Rise Time Time Comments From (m) To (m) Comments To (min) Strike Depth At (h) 13.5 13.6 Boulder No 10.50 Moderate GDT 5/11/08 20 11.50 11.50 GROUNDWATER DETAILS Depth to Water Casing Comments IGSL. Date Depth Depth 15-10-08 12.50 12.50 13.60 12.50 12.50 13.60 11.50 End of shift 15-10-08 16-10-08 11.50 13.00 Start of shift End of shift INSTALLATION DETAILS

Date | Tip Depth | RZ Top | RZ Base Type 50mm SP 16-10-08 13.60 11.50 13.60 BH LOG DCD REMARKS Hand dug inspection pit excavated to 1.20m. Night work - shift started at 1800hrs.

5/11/08

GDT

IGSL

GPJ

DCD

LOG

BH

13696

BOREHOLE NO. W2 CONTRACT Dublin Central Development - Draft SHEET Sheet 2 of 3 CO-ORDINATES **RIG TYPE** Dando 3000 DATE STARTED 25/09/2008 **BOREHOLE DIAMETER (mm)** DATE COMPLETED 10/10/2008 GROUND LEVEL (m AOD) 21.40 **BOREHOLE DEPTH (m)** BORED BY J. Edwards / J. McDonnell Dublin Central Developments Ltd CLIENT CASING DEPTH (m) PROCESSED BY **ENGINEER** AGL Consulting Ltd S. Letch Samples Standpipe Details Œ E Elevation Recovery Ref. Number Sample Type Field Test Legend Depth Description Depth Depth (m) Results AG361 10.00-10.00 Grey slightly clayey/silty sandy GRAVEL with many 0 10 300 cobbles. Gravel is medium to coarse and subrounded to 80 subangular of limestone. (continued) 200 0000 AG3612 11.00-11.00 Grey slightly clayey/silty sandy GRAVEL with many 11.20 11.40 cobbles and bands of dark grey clay. Gravel is medium to coarse and subrounded to subangular of limestone
Grey slightly clayey/silty sandy GRAVEL with many 80 200 AG3613 R 12 00-12 00 cobbles. Gravel is medium to coarse and subrounded to 12 subangular of limestone. AG3614 В 13.00-13.00 13 AG3615 В 14.00-14.00 AG3616 В 15.00-15.00 15 20 15.50 Brown slightly sandy gravelly CLAY with occasional 9 0 cobbles 0 · <u>a</u>. AG3617 16.00-16.00 В 16 3 9 16.40 Black slightly sandy gravelly CLAY with occasional cobbles Re-set up rig after rotary rig advanced to rockhead gravel falling behind hammer so must be cased off. 19 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Rise Time Sealed Water Casing Comments From (m) To (m) Comments Strike Depth To (min) (h) 7hrs Chiselling 3hrs Hard Strata Boring 7hrs Chiselling 3hrs Hard Strata Boring 6hrs Chiselling 4hrs Hard Strata Boring 5/11/08 10 10 10 2 3 12.2 14 16 14 16 16.2 16.2 16.4 Hard Strata Boring Boulder GDT **GROUNDWATER DETAILS** 1hr Chiselling 7hrs Hard Strata Boring 2hrs Chiselling 6hrs Hard Strata Boring 16.4 19.5 88 Hole Casing Depth to Water Date Comments IGSL 214 Depth Depth 11.00 11.00 12.20 End of shift Start of shift End of shift 29-09-08 11.00 4 80 30-09-08 11.00 4.50 INSTALLATION DETAILS 12.20 12.20 14.00 14.00 16.00 16.00 30-09-08 12.20 12.20 14.00 14.00 16.00 16.40 Tip Depth RZ Top RZ Base Type 01-10-08 01-10-08 4.80 5.00 Start of shift End of shift 02-10-08 02-10-08 03-10-08 4 50 Start of shift 5.00 4.50 4.90 End of shift Start of shift End of shift Hand dug inspection pit excavated to 1.20m. Water added from REMARKS 03-10-08 16.40 90 3.0m to aid drilling. Blowing gravels from 4.9m to 6m bgl. Casing size reduced from 300mm to 250mm diameter at 14.0m bgl. Casing left in borehole to allow rotary follow on. Re set up rig on 00/16/08 to advance hole after rotary rig 09-10-08 09-10-08 10-10-08 16.40 16.40 4.80 Start of shift 5.10 4.90 End of shift BHI Start of shif

GPJ

advanced to rockhead and gravel falling in behind hammer

201	NTRACT Dublin Central Development - Draft							BOREHOL	E NO	. W2	
								SHEET		Sheet 3 of 3	ı
	-ORDINATES OUND LEVEL (m AOD)	RIG TYP	PE OLE DIAMET	ER (m		Dando 30	00	DATE STA			
CLII	ENT Dublin Central Developments Ltd	BOREH	OLE DEPTH (	(m)	2	21.40		BORED BY	1	J. Edwards	J. McDo
NO	GINEER AGL Consulting Ltd	CASING	DEPTH (m)				Sou	PROCESS mples	ED B	Y S. Letch	_
(E)				on	(m	<u></u>	_		Zi.	Field Test	oipe
Deptn (m)	Description		Legend	Elevation	Depth (m)	Ref. Number	Sample	Depth (m)	Recovery	Results	Standpipe Details
20	Grey slightly clayey/silty sandy GRAVEL with m cobbles. Gravel is medium to coarse and subrosubangular of limestone.	any unded to			20.00						
	Obstuction - rockhead End of Borehole at 21.40 m			•	21.30 21.40						
22											
23											
24											
25											
26											
27											
28											
29											
HA	ARD STRATA BORING/CHISELLING		WATER	STRI	KE DET	AILS					
ron	m (m) To (m) Time (h) Comments		Water Strike		sing pth	Sealed At	Ri T		10000	Comments	
			GROUNI	DWAT	ER DET	AILS					
			Date		Hole Depth	Casing Depth	D	epth to Co	omme	ents	
NS	STALLATION DETAILS Date   Tip Depth   RZ Top   RZ Base   Ty	ype	10-10-08		21.40	21.40		A HARMAN AND	d of sh	ift	
	THE SPAIN THE TOP THE DUGGE										



26/11/08

GDT

IGSL

BH LOG DCD

# **GEOTECHNICAL BORING RECORD**

REPORT NUMBER

13696

BOREHOLE NO. **BH14** CONTRACT **Dublin Central Development - Draft** SHEET Sheet 1 of 2 CO-ORDINATES() **RIG TYPE** Dando 2000 DATE STARTED 09/11/2008 **BOREHOLE DIAMETER (mm)** 200 DATE COMPLETED 13/11/2008 GROUND LEVEL (m AOD) BOREHOLE DEPTH (m) 12.00 J. McDonnell CLIENT **Dublin Central Developments Ltd** BORED BY **ENGINEER** AGL Consulting Ltd 12.00 PROCESSED BY CASING DEPTH (m) S. Letch Samples Œ Ξ Standpipe Elevation Recovery Ref. Number Sample Type Field Test Legend Depth ( Depth Description Depth (m) Results 0 MADE GROUND consisting of granite cobblelock. 0.10 MADE GROUND consisting of concrete 0.20 MADE GROUND consisting of brown slightly sandy gravelly clay with some red brick and concrete. 1.00-1.00 N = 18(3, 3, 5, 5, 4, 4) AF4832 2.00-2.00 2 (2. 2. 3. 3. 3. 3) AF4833 N = 11 (2, 2, 2, 3, 3, 3) -3 FNV 3 00-3 00 AF4834 3.00-3.00 3.20 Stiff brown slightly sandy gravelly CLAY. 4.00-4.00 4.00-4.00 N = 22(3, 3, 5, 5, 6, 6) AF4835 N = 57 (8, 14, 16, 16, 15, 10) AF4836 В 5.00-5.00 5.00 5 0 Very stiff brown slightly sandy very gravelly CLAY. 0 ō N = 84В AF4837 6.00-6.00 6 (14, 20, 20, 24, 20, 20) 0 Very dense grey slightly clayey/silty sandy GRAVEL with occasional cobbles. Gravel is fine to coarse and 2000 6.50 80 subrounded to subangular of limestone. N = 842000 AF4838 В 7.00-7.00 (9, 14, 15, 19, 20, 30) 0000 000 N = 100/225 mm AF4839 В 8.00-8.00 8 (14, 21, 30, 30, 40) و المادة N = 100/275 mm AF4840 В 9.00-9.00 9 12, 16, 20, 20, 32, 28) 000 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Rise Water Casing Sealed Time To (m) Comments From (m) Comments (h) Strike Depth At To (min) 8.3 Boulder Moderate 6.60 6.60 No 5.00 5 **GROUNDWATER DETAILS** Depth to Water Hole Casing Comments Date Depth Depth 10-11-08 End of shift 6.50 6.50 11-11-08 12-11-08 13-11-08 6.50 9.70 9.70 Start of shift End of shift Start of shift 6.50 6.00 INSTALLATION DETAILS
Date Tip Depth RZ Top RZ Base 9.70 9.70 5.60 5.40 Type REMARKS Hand dug inspection pit excavated to 1.20m. Night work - shift started at 1800hrs to accommodate Moore Street traders. Shift finished at 2300hrs due to T2 licence restrictions. Standing 5 hours each day totalling 20 hours standing. 2 No. Falling and 1 allow rotary follow on.

REPORT NUMBER

COI	NTRACT		ublin Cent	ral Development - Dra	ft						BOREHOL	E NO.	BH14	
20.	ORDINA	TES	١		DIO 774	-			D 1 00	00	SHEET		Sheet 2 of 2	
					RIG TY		ren (		Dando 20 200	1	DATE STA			
			(m AOD)		_	OLE DEPTH		,	12.00	-	DATE COM			40
	ENT SINEER		ublin Cent GL Consult	ral Developments Ltd		DEPTH (m)			12.00		BORED BY J. McDonnell PROCESSED BY S. Letch			
	JINELIN	-	OL CONSUM	ang La	CASINO	DEF III (III)			12.00		nples	LDBI	S. Leteri	
Depth (m)			_	S		0	io	Depth (m)	ē	<u>o</u>		ery	Field Test	Standpipe
epth			L	Description		Legend	Elevation	epth	Ref. Number	Sample Type	Depth (m)	Recovery	Results	and
						Le	m m	ă				Re	N = 92	St
10	Very de occasio	nse g nal co	rey slightly bbles. Gra	clayey/silty sandy GR	AVEL with	2000			AF4841	В	10.00-10.00		N = 82 (9, 13, 16, 19, 22, 25)	
	subrour	ded 1	o subangu	lar of limestone. (cont	inued)	2000								
11						0000			AF4842	В	11.00-11.00		N = 100/225 mm	
11						8000			AF4842	В	11.00-11.00		(15, 19, 35, 31, 34)	W
						8-8-								
						00								
12	End of I	Boreh	ole at 12.0	00 m				12.00						
13														
4														
15														
16														
17														
18														
10														
													1	
19														
						1								
			Time	HISELLING		WATER	Cas		AILS Sealed	Rise	e Tim	е		_
	n (m) To	(m)	(h)	Comments		Strike	De		At	То			comments	
13	5	12	1.25	Boulder										
						GROUN	DWATI	ER DET	AILS					
						Date		Hole Depth	Casing Depth	De	pth to Co	mmen	its	
						13-11-08		12.00	12.00			d of shift		
	TALLAT Date	ON C	epth R7 T	op RZ Base	Туре									
		ں ہ	- Paris   142		. ,,,,,									
Es	INDIC	dand d	ua inenection	pit excavated to 1.20m. Ni	aht work - chiff									

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REPORT NUMBER

13696

BOREHOLE NO. **BH15** CONTRACT **Dublin Central Development - Draft** SHEET Sheet 1 of 3 **CO-ORDINATES RIG TYPE** Dando 150 DATE STARTED 15/09/2008 DATE COMPLETED 24/09/2008 200 BOREHOLE DIAMETER (mm) **GROUND LEVEL (m AOD) BOREHOLE DEPTH (m)** 21.20 BORED BY J. McDonnell CLIENT **Dublin Central Developments Ltd** 21.20 PROCESSED BY S. Letch **ENGINEER** AGL Consulting Ltd CASING DEPTH (m) Samples Standpipe Details E (H Elevation Recovery Ref. Number Sample Type Field Test -egend Description Depth Depth (m) Depth Results - 0 MADE GROUND consisting of tarmacadam. 0.20 MADE GROUND consisting of brown slightly sandy gravelly clay with some red brick, ash and concrete. AF4821 В 1.20-1.20 (1, 1, 1, 1, 1, 1) AF4822 В 2.00-2.00 - 2 (1, 2, 2, 2, 1, 2) N = 17 (4, 4, 4, 3, 2, 8) AF4823 В 3.00-3.00 3.50 O A B Very dense grey slightly clayey/silty sandy GRAVEL with occasional cobbles. Gravel is fine to coarse and 20 B subrounded to subangular of limestone. 200 AF4824 В 4 00-4 00 (12, 16, 25, 30, 27, 29) 0000 000 N = 100/150 mm AF4825 В 5.00-5.00 (35, 48, 52)N = 119 (15, 22, 30, 29, 27, 33 AF4826 В 6.00-6.00 AF4827 В 7.00-7.00 (4, 6, 4, 5, 4, 4) N = 56AF4828 В 8 00-8 00 (6, 9, 11, 16, 15, 14) N = 87AF4829 B 9 00-9 00 (9, 11, 16, 25, 20, 26) 8 - m-HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Rise Water Sealed Time Casing Comments From (m) To (m) Comments Strike Depth At To (min) (h) 0.5 Boulder 6.00 6.00 No 4.70 5 Moderate 3.9 Boulder 4.8 5.8 Boulder 0.5 Boulder Hard Strata Boring **GROUNDWATER DETAILS** GDT. 14.4 16.7 11 8 14.4 16.7 Depth to Water Hard Strata Boring Hole Casing Comments Hard Strata Boring Hard Strata Boring Date 18.5 IGSL Depth Depth 18.5 21 3.50 3.50 End of shift Start of shift 3.50 21 21.2 Boulder 16-09-08 3.50 INSTALLATION DETAILS

Date Tip Depth RZ Top RZ Base 16-09-08 17-09-08 6.00 6.00 End of shift Type 6.00 Start of shift BH LOG DCD REMARKS Hand dug inspection pit excavated to 1.20m. Water added from 3.5m to aid drilling



REPORT NUMBER

13696 BOREHOLE NO. **BH15** CONTRACT **Dublin Central Development - Draft** SHEET Sheet 2 of 3 **CO-ORDINATES RIG TYPE** Dando 150 DATE STARTED 15/09/2008 **BOREHOLE DIAMETER (mm)** 200 DATE COMPLETED 24/09/2008 **GROUND LEVEL (m AOD) BOREHOLE DEPTH (m)** 21.20 CLIENT **BORED BY Dublin Central Developments Ltd** J. McDonnell **ENGINEER** CASING DEPTH (m) 21.20 PROCESSED BY AGL Consulting Ltd S. Letch Samples Standpipe Details (m) E Elevation Ref. Number Recovery Depth ( Sample Field Test Legend Description Depth Depth (m) Type Results 0.00-10.00 000 (7, 10, 11, 11, 17, 15) 2/22 Very dense grey slightly clayey/silty sandy GRAVEL P with occasional cobbles. Gravel is fine to coarse and 0000 DD Ç NO 543 TVED: subrounded to subangular of limestone. (continued) 13/12 2022 0000 N = 47 (3, 5, 9, 9, 14, 15) AF4831 В 11.00-11.00 000 80 N = 69AF4832 В 12.00-12.00 12 080 (5, 7, 20, 15, 16, 18) N = 100/150 mm AF4833 13.00-13.00 В 13 (3, 11, 26, 74) 080 AF4834 В 14.00-14.00 -8-Hard black slightly sandy gravelly CLAY with 14.40 0 14.50-14.50 1% red AF4835 U 150 blow occasional cobbles N = 100/240 mmAF4836 15.50-15.50 В (11, 15, 20, 25, 45, 10) N = 100AF4837 В 16.50-16.50 (10, 15, 19, 24, 30, 27) N = 100/150 mm AF4838 В 17.50-17.50 (20, 29, 40, 60) N = 100/210 mmAF4839 B 18.50-18.50 (12, 26, 34, 37, 29) 19 N = 100/180 mm AF4840 19.50-19.50 В (12, 30, 36, 44, 20) HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Sealed Time Water Casing Rise Time From (m) To (m) Comments Comments (h) Strike Depth At To (min) Boulder Boulder 3.5 0.5 3.8 1/10/08 4 5 4.8 Boulder 5.8 11 14.4 Boulder Hard Strata Boring 0.5 **GROUNDWATER DETAILS** 14.4 16.7 GDT. Casing 8 Hard Strata Boring Hole Depth to Water 18.5 21 21.2 Date Comments 16.7 18.5 Hard Strata Boring Hard Strata Boring IGSL Depth Depth 17-09-08 11.00 11.00 End of shift 21 Boulder GPJ 18-09-08 11.00 11.00 5.50 Start of shift INSTALLATION DETAILS 18-09-08 19-09-08 14.40 14.40 14.40 14.40 5.80 5.80 End of shift Start of shift Tip Depth RZ Top RZ Base Type 16.70 16.70 18.50 16.70 16.70 18.50 19-09-08 6 40 End of shift 22-09-08 22-09-08 6.10 6.50 Start of shift End of shift 23-09-08 18 50 18.50 6.40 Start of shift REMARKS Hand dug inspection pit excavated to 1.20m. Water added from 3.5m to aid drilling BH LOG



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100	NTRACT	Dublin	Central	Developm	ent - Dra	ft						BOREHO SHEET	LE N	IO. BH15 Sheet 3 of 3	3
GRO	ORDINAT	/EL (m		Developm	ents I td		E DLE DIAME DLE DEPTI		mm) 2	Dando 15 200 21.20	50	DATE ST	MPL	ED 15/09/2008 LETED 24/09/2008 J. McDonne	
	SINEER		Consulting		onto Eta		DEPTH (m		2	21.20		PROCES			
Deptn (m)			Desc	ription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe
20	Hard blad occasiona	k slightl al cobble	y sandy g es <i>(contin</i>	gravelly CL nued)	AY with					AF4841	В	20.50-20.50		N = 100/175 mm (13, 29, 35, 42, 23)	
	End of Bo	orehole a	at 21.20 r	n					21.20						3.47
22															
23															
24															
25															
26															
27															
28															
29															
HA	RD STRA			ISELLING					IKE DE						
3		8	(n) 0.5 Bo	omments			Water Strike	Ca De	sing s	Sealed At	Ris To		me in)	Comments	
3 4 5 1	.8 5 .8 6 1 14	.4	1 Bo 0.5 Bo 8 Ha	oulder oulder oulder ord Strata Bori	ng		GROUN	IDWA	TER DE						
18	4.4     16.7     8     Hard Strata Boring       6.7     18.5     8     Hard Strata Boring       8.5     21     6     Hard Strata Boring       21     21.2     2     Boulder			Date 23-09-0		Hole Depth 21.20	Casing Depth 21.20	V	valei	omm					
	TALLATIO Date Ti	DN DET p Depth	AILS RZ Top	RZ Base	Ty	/ре									
	MADKE H	and dua ins	nection nit e	excavated to 1	20m Water	r added from									



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O	NTR/	ACT	D	ublin	Central De	velopme	ent - Drat	ft						HOLE N	0	OW	
:0-	ORD	INA	TES(	_)						LEVEL (m) METER (mm)				STARTE COMPLI		15/09	et 1 of 4 9/2008 9/2008
	ENT	ER			Central De onsulting Er	-	ents Ltd.		CLINATION LUSH	ON		90 Polymer Ge		ED BY ED BY			nnium ahony
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fractu Spacii (mm	ng ) 500	Legend	Non-intact zones (shaded)	Strata	description	Depth (m)	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
0									made gr	on Pit - d by driller as round consisting I and cobbles.							
2									HOLE D Observe madegre	TRIX OPEN DRILLING: ed by driller as ound consisting wood and clay.	1.20	DD C REC	PLAN N EIVED:	0 543 13/12	2/2		
3											4.20						
5							000000000000000000000000000000000000000		HOLE D	TRIX OPEN PRILLING: ed by driller as of gravel							
6							000000000000000000000000000000000000000										
В							000000000000000000000000000000000000000							H		XX///XXX///XXX///XXX///XXX///XXX///XXX///XXX///XXX///XXX///XXXX	
9							000000000000000000000000000000000000000										
_	/ARI		pection	on pit	t to 1.2m.		.,, 41			Headworks	N REM	ARKS					
J-18		JJ	, , , , , , , , , , , , , , , , , , , ,	le i						Headworks.							
											Hole	Casing	Depth to Water	Comm	ente		
										Date	Depth	Depth	Water	COMMIT	ionto.		
NS	T <b>ALI</b> Date		ON D			RZ Base		Гуре									



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COI	NTR	ACT	D	ublin	Central Developme	ent - Dra	-					DRILL SHEE	HOLE NO	)	OW1	2 of 4
CO-	ORE	OINA.	TES(	_)			_ c	GROUND LEVI CORE DIAMET				50.510.000	STARTE!		15/09/ 16/09/	
CLIENT Dublin Central Developments Ltd. INCLINATION FLUSH  ENGINEER AGL Consulting Engineers FLUSH											90 Polymer Gel		ED BY ED BY		Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm)  0 250 500	Legend	Non-intact zones (shaded)	Strata des	scription	Depth (m)	Disco	ontinuities		Elevation	Standpipe Details	SPT (N Value)
11						000000000000000000000000000000000000000		SYMMETRI HOLE DRIL Observed by returns of gr (continued)	LING:							
13						000000000000000000000000000000000000000		SYMMETRI HOLE DRIL	LING:	13.20						
14						0		Observed by returns of cla	y driller as ay and							
15						0				16.20						
17								SYMMETRI. HOLE DRIL Observed by returns of cla	LING: y driller as							
18																
19						0				19.20						
REN	IAR							IN	ISTALLATIO	N REMA	ARKS					
Han	d du	g ins	pecti	on pi	t to 1.2m.			455.57	eadworks.							
									ROUNDWA	Hole	Casing	Denth to				
									Date	Depth	Depth	Depth to Water	Comme	nts		
[	Date		Γip D	epth	RZ Top RZ Base		Туре									
16-	09-0 09-0	8	13.5	0	10.50 13.50 27.00 33.00	50	mm S	SP								



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Strata description   Polymer Gel   LOGGED BY   A Mahony	CONTI	RACT	D	ublin	Central De	evelopm	ent - Dra	_						DRILL SHEE	HOLE N	0	OW1 Sheet	3 of 4
ENGINEER AGI. Consulting Engineers  AGI. Consulting Engineers  Fracture Spacing (mm)  Page 1	CO-OF	RDINA	TES(	_)														
SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of a year and cobbles.  Symmetrix OPEN HOLE DRILLING: Observed by driller as returns of gravel and cobbles.  Symmetrix OPEN HOLE DRILLING: Observed by driller as returns of gravel and cobbles.  Symmetrix OPEN HOLE DRILLING: Observed by driller as returns of rock.  DPEN HOLE DRILLING: Observed by driller as returns of rock.										ON								
returns of weathered cock OPEN HOLE DRILLING: No recovery, observed by driller as returns of rock.	20	T.C.R.%	S.C.R.%	R.Q.D.%	Spaci (mm	ing n) 500			SYMME HOLE I Observe returns ( Cobbles SYMME HOLE I Observe returns ( Cobbles HOLE I	TRIX OPEN PRILLING: ad by driller a for folay and continued) TRIX OPEN PRILLING: ad by driller a for gravel and TRIX OPEN PRILLING:	s 20	.50	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
	24 25 26 27								OPEN H DRILLIN observe	IOLE IG: No recov	ery,							
tand dud inspection of to 1.7m	nand d	iug ins	pection	on pit	1.2m.					Headworks								
Hand dug inspection pit to 1.2m.  Headworks.										GROUNDV	VATER	DET	AILS					
Headworks.  GROUNDWATER DETAILS										Date			Casing Depth	Depth to Water	Comm	ents		
Headworks.  GROUNDWATER DETAILS  Date Hole Casing Depth to Water Comments											Dopt		- Spill					
Headworks.  GROUNDWATER DETAILS  Date Hole Casing Depth to Water Comments	ISTAI																	
GROUNDWATER DETAILS  Date Hole Depth Depth Depth Water Comments  NSTALLATION DETAILS	Date 16-00								)									
Headworks   Headworks   Headworks   GROUNDWATER DETAILS     Date	0-09-	-08	33.0		10.50 27.00	13.50 33.00		nm SF nm SF										



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00 01(21(2)								G	ROUND LEVEL (m)			DATE:	STARTE	Sheet 4 of 4 15/09/2008		
				- 17-17				_	ORE DIAMETER (mm)		00		COMPLI	ETED		-
CLIENT Dubilit Certifal Developments Ltd.							ts Ltd.	-	ICLINATION LUSH		-90 Polymer Gel	LOGG			Millen	
Downhole Depth (m)		T.C.R.%	S.C.R.%	%.D.%	Fracture Spacing (mm)		Legend	Non-intact zones (shaded)	Strata description	Depth (m)		ontinuities		Elevation	Standpipe Details	SPT (N Value)
31 32 33									OPEN HOLE DRILLING: No recover observed by driller as returns of rock. (continued)  End of Corehole at 33 (m)	33.00						
35 36 37 38																
	MAR nd du		specti	on pit	t to 1.2m.				INSTALLAT Headworks.  GROUNDW/			Depth to Water	Comm	ents		
INS	STAL	LAT	ON [	DETA	ILS											
16	Date 6-09-	08	Tip D 13.5 33.6	50	RZ Top RZ B 10.50 13.5 27.00 33.6	50	50n 50n	ype nm S	SP							



	NTR				Central D	evelopm	ent - D						DRILL SHEE	HOLE N	0	RC08 Sheet	
СО	-ORE	OINA.	res(	_)						LEVEL (m) METER (mm)		102		STARTE		13/09/2 14/09/2	
	ENT	ER			Central D				FLUSH	ON		-90 Polymer G		ED BY		Millenn A. Mah	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	n)	Legend	Non-intact zones (shaded)	De	scription	Depth (m)	Dis	continuities		Elevation	Standpipe Details	SPT (N Value)
REI	MAR	KS.							made gr	d by driller as ound consisting I, sand, brick	N REM	ARKS				XVITXVIIXVIIXVIIXVIIXVIIXVIIXVIIXVIIXVII	
			ectio	n pit	to 1.2m.					Headworks.							
										GROUNDWAT							
											Hole Depth	Casing Depth	Depth to Water	Comm	ents		
NS.	TALI	ATIO	ON D	ETAI	ILS												
	Date					RZ Base		Туре	9								
			13.0		6.00	13.00		0mm				1					



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CONTR	RACT	D	ublin	Central De	evelopme	nt - Dra	ft					DRILL	HOLE N	0	RC0	8
CO OB	DINIA	TEC	,					ROUND L	EVEL (m)			SHEET	STARTE	:D	Sheet 13/09	2 of 33
CO-OR	DINA	TES(	_)						METER (mm)	1	02		COMPLE			
CLIEN				Central De		nts Ltd.		NCLINATIO LUSH	ON		90 Polymer Ge	DRILL LOGG			Millen A. Ma	
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fractu Spacii (mm	ng 1) 500	Legend	Non-intact zones (shaded)	Des	scription	Depth (m)	Disc	continuities		Elevation	Standpipe Details	SPT (N Value)
1								made gre of gravel	on Pit - I by driller as bund consistin , sand, brick er. (continued						KVII KVII KVII KVIII KVII KVII KVII KVII	
						0 0		HOLE D	TRIX OPEN RILLING: d by driller as f gravelly clay oles	1.20					1,501,	
															711 KV 17 KV	
-															XVIIXVIIXVIIXVIIXVIIXVIIXVIIXVIIXVIIX XVIIXVII	
REMAI		nacti	on ni	t to 1.2m.					INSTALLAT	ION REMA	ARKS					
nano o	ug ins	pecti	on pr	tio 1.2M.					Headworks.							
									GROUNDWA	ATER DET						
									Date	Hole Depth	Casing Depth	Depth to Water	Comm	ents		
INSTA Dat					RZ Base		Гуре									
14-09	-08	13.0	00	6.00	13.00	50r	nm s	SP								
14-09	-08	32.5	0	26.50	32.50	50r	nm s	5P								



co	NTR	ACT	D	ublin	Central D	evelopm	ent - Dra	ft					DRILL SHEE	HOLE NO	)	RC08	3 of 33
00	ORE	INA	TES(	_)						_EVEL (m) VIETER (mm)	1	102	DATE	STARTEI COMPLE		13/09/	2008
	ENT	ER			Central D		ents Ltd.		NCLINATION	NC		.90 Polymer G		ED BY ED BY		Millenr A. Mał	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac (mi	cing m)	Legend	Non-intact zones (shaded)	De	scription	Depth (m)	Dis	continuities		Elevation	Standpipe Details	SPT (N Value)
2									HOLE D Observereturns of with cob	TRIX OPEN PRILLING: de by driller as of gravelly cla bles (continue)  TRIX OPEN PRILLING: de by driller as of gravelly cla	2.70					<u>KUTIKUTIKUTIKUTIKUTIKUTIKUTIKUTIKUTIKUTI</u>	
	MAR nd du		pectio	on pit	to 1.2m.					INSTALLA Headworks		ARKS					
										GROUNDW		TAILS					
										Date	Hole Depth	Casing Depth	Depth to Water	Comme	ents		
	TAL	17	ON D	epth	ILS RZ Top 6.00	RZ Base 13.00		Гуре nm \$			- DOKUI	20041					



REPORT NUMBER

0-0	ORD	INA	rec.																4 of 33
			E5(	_)				(	GROUND	LEVI	EL (m)				HEET ATE	STARTE	D	13/09	
				-/					CORE DIA				102			COMPLI		14/09	
LIE	NT		D	ublin	Central D	Developm	ents Ltd.	I	NCLINATI	ON			-90	D	RILLI	ED BY		Millen	nium
NGI		ER			onsulting E			- 1	LUSH				Polymer C			ED BY		A. Ma	hony
© Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac (mr	cing m)	Legend	Non-intact zones (shaded)		escrip	otion X OPEN	Depth (m)	Di	scontinu	uities		Elevation	Standpipe Details	SPT (N Value)
									HOLE D	DRILI ed bybf grad)	LING:							KUITKUITKVIIKVIITKUITKUITKVIITKVIITKUITKVIITKVI	
REM/			nocti	on ni	t to 1 2m						STALLAT	ON REM	MARKS						
and	au	y ins	pecti	on pr	t to 1.2m.					He	eadworks.								
										GF	ROUNDWA	TER DE	ETAILS						
											Date	Hole Depth	Casing Depth	Dept Wa	th to	Comm	ents		
				DETA		D7 D		Turne											
14-0	ate		13.0		RZ Top 6.00	13.00		Type nm :											



0	NTR	ACT	D	ublin	Central Developm	ent - Dra	ft					DRILLI SHEET	HOLE NO	)	RC08 Sheet 5	
0	-ORE	INA	res(	_)				GROUND L	EVEL (m) IETER (mm)	1	02		STARTE		13/09/2	
CLI	ENT		D	ublin	Central Developm	ents Ltd.	_	NCLINATIO		-	90	DRILL			Millenn	ium
	GINE	ER			onsulting Engineers		F	LUSH		F	Polymer Gel	LOGG	ED BY		A. Mah	ony
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm)	Legend	Non-intact zones (shaded)	SYMME	cription	Depth (m)	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
						0		returns o (continue	d by driller as f gravelly clay d)	4.20						
						000000000000000000000000000000000000000		HOLE D	by driller as							
															GII KKIII KKII KKII KKII KKII KKII KKII	
															VOITKUITKUITKUITKUITKUITKUITKUITKUITKUITKU	
RE	MAR	KS				000			INSTALLATI	ON REM	ARKS					
			pection	on pit	t to 1.2m.				Headworks.							
									GROUNDWA	TER DET	TAILS					
									Date	Hole Depth	Casing Depth	Depth to Water	Comme	ents		
	Date			epth	ILS  RZ Top RZ Base 6.00 13.00		Type			- Special						



REPORT NUMBER

-	_	/																
со	NTR	ACT	D	ublin	Central [	Developme	ent - Dra	ıft						DRILL SHEE	HOLE N	0	RC0	<b>B</b> 6 of 33
CO-	-ORI	OINA	TES(	_)						LEVEL (m) METER (mm	1)	1	102	DATE	STARTE		13/09/ 14/09/	2008
	ENT					Developme Engineers	nts Ltd.	.	INCLINATI FLUSH	ON			90 Polymer G		ED BY ED BY		Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa (m	cing m)	Legend	Non-intact zones (shaded)	De	escription		Depth (m)	Dis	continuities		Elevation	Standpipe Details	SPT (N Value)
5									HOLE D		s						XVITXVITXVITXVITXVITXVITXVITXVITXVITXVIT	
	MAR		nocti	an ni	t to 1 2-					INSTALLA		REMA	ARKS					
Han	ia du	g ins	pection	on pr	t to 1.2m.					Headworks	S.							
										GROUNDY	NATER	DET	AILS					
										Date	Hol Dep	е	Casing Depth	Depth to Water	Comm	ents		
	etter et et	Waren and																
			ON D			D7.D		Т										
	Date -09-0		13.0		RZ Top 6.00	RZ Base 13.00		Type	e SP									
14-	-09-0	8	32.5	ő	26.50	32.50	50	nm	SP									



REPORT NUMBER

/IGS																130	96
CONTR	ACT	D	ublin	Central D	evelopme	nt - Drai	t						DRILL	HOLE N	0	RC0	В
							_						SHEE				7 of 33
CO-OR	DINA.	TES(	_)					ROUND L	EVEL (m) IETER (mm)	)	1	02	Table 10. 10. 10. 10. 10. 10. 10. 10. 10. 10.	STARTE		13/09/ 14/09/	
CLIENT				Central D		nts Ltd.		NCLINATIC LUSH	N			90 Polymer Ge		ED BY		Millen A. Ma	
													12000				
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	n) 500	Legend	Non-intact zones (shaded)	Des	scription		Depth (m)	Disc	continuities		Elevation	Standpipe Details	SPT (N Value)
6								HOLE D	TRIX OPEN RILLING: department of gravel.								
REMAR	RKS					1-01			INSTALLA	ATION	REM	ARKS				HHH	
		pecti	on pi	t to 1.2m.					Headworks	S.							
									GROUND	VATE	R DE	TAILS					
									Date		lole epth	Casing Depth	Depth to Water	Comm	nents		
INSTAI	LAT	ON F	ETA	II S													
Date				RZ Top	RZ Base		Туре	9	5								
14-09- 14-09-	-08	13.0	00	6.00 26.50	13.00 32.50	501	nm :	SP									



REPORT NUMBER

_	-ORI		TES(		Central L	Developm	ent - Dra	0	ROUND LEVEL (m) DRE DIAMETER (mm)		102	SHEE DATE	HOLE NOTE TO STARTE COMPL	ED.	Sheet 13/09 14/09	8 of 33 /2008
	ENT					Developme Engineers	ents Ltd.	II	CLINATION .USH		-90 Polymer Ge	- 1	ED BY		Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa (m	cing m)	Legend	Non-intact zones (shaded)	Description	Depth (m)	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
7									SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravel. (continued)							
	MARI d du		pection	on pit	to 1.2m.				Headworks.	IN INCIVI	ANNO					
									GROUNDWAT	ER DF	TAILS					
									Date	Hole	Casing	Depth to Water	Comme	ents		
										epth	Depth	vvater				
													1			
	TALI Date		ON D			RZ Base	_	Гуре								



СО	NTR	ACT	D	ublin	Central D	evelopm	ent - Dra	ft				DRILL	HOLE NO	)	RC08	В
												SHEE				9 of 33
co	-ORE	OINA"	ΓES(	_)					GROUND LEVEL (m) GORE DIAMETER (mm)		102		STARTEI COMPLE		13/09/ 14/09/	
	ENT GINE	ER			Central D	and the Contract of the Contra			NCLINATION LUSH		-90 Polymer Ge	DRILL LOGG			Milleni A. Mal	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	m)	Legend	Non-intact zones (shaded)	Description	Depth (m)	Disc	continuities		Elevation	Standpipe Details	SPT (N Value)
8									SYMMETRIX OPEN HOLE DRILLING: Observed by driller as returns of gravel. (continued)							
	MAR nd du		pectio	on pit	t to 1.2m.				Headworks.	N REM	ARKS					
											FA 11 0					
									GROUNDWA	Hole	TAILS  Casing	Depth to		9		
									Date	Depth	Depth	Depth to Water	Comme	ents		
NS	TAL	LATIO	ON D	ETA	ILS											
	Date					RZ Base		Туре								
	-09-0		13.0		6.00 26.50	13.00 32.50	50	nm s	SP							



REPORT NUMBER

		ACT			Central D	evelopme	ent - Dra	_				SHEE				10 of 33
0	-ORI	DINA	TES(	_)					GROUND LEVEL (m) CORE DIAMETER (mm	1)	102	1 - 2 - 2 - 2	STARTE			/2008 /2008
	IENT GINE				Central Donsulting E		ents Ltd.		LUSH		-90 Polymer G		ED BY		Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	n) 500	Legend	Non-intact zones (shaded)	Description	Depth (m)	Dis	continuities		Elevation	Standpipe Details	SPT (N Value)
9									SYMMETRIX OPEN HOLE DRILLING: Observed by driller a returns of gravel. (continued)							
	MAR				1- 10				INSTALLA	ATION REM	MARKS					
aı	nd du	ig ins	pection	on pit	to 1.2m.				Headwork	3.						
									GROUND	WATER DE	TAILS					
									Date	Hole Depth	Casing Depth	Depth to Water	Comm	ents		
Je	TAI	LATI	ON D	FTA	II S											
	Date		Tip De			RZ Base		Гуре								
	-09-0 -09-0	08	13.0 32.5	0	6.00 26.50	13.00 32.50	50r	nm :	SP SP							



REPORT NUMBER

	NTR				Central D	evelopme	ent - Dra	_	GROUND	LEVEL ()				SHEE				11 of 33
:0	-ORE	OINA.	TES(	_)						LEVEL (m) METER (mm	1)	1	02		STARTE!		13/09/ 14/09/	
	ENT	ER			Central Donsulting E		ents Ltd	2	NCLINATI FLUSH	ON			90 <sup>P</sup> olymer Gel	DRILL LOGG			Milleni A. Mal	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mn	ing n)	Legend	Non-intact zones (shaded)	D€	escription		Depth (m)	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
10									HOLE I		s		A PLICE					
_	MAR nd du		pecti	on pi	t to 1.2m.	П				Headwork		XEIVI/	-nno					
										GROUND	WATER	DET	AILS					
										Date	Hol Dep		Casing Depth	Depth to Water	Comme	ents		
NC	TAL	LATI	ON F	ETA	11.6													
_	Date	LATI	Tip D			RZ Base		Туре	е									
	-09-0		13.0		6.00	13.00	50	mm mm	SP	1								



REPORT NUMBER

	ORE		TES(		Central D	evelopme	ent - Dra	(		_EVEL (m) METER (mn	1)	1	02	DATE :	HOLE NO STARTE COMPLE	D	Sheet 13/09/ 14/09/	12 of 33 2008
	ENT				Central Donsulting E		ents Ltd.	-	NCLINATION TUSH				90 olymer Gel	DRILLI	ED BY	100000000000000000000000000000000000000	Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac (mr	cing m)	Legend	Non-intact zones (shaded)	De	scription		Depth (m)	Disco	ontinuities		Elevation	Standpipe Details	SPT (N Value)
111									SYMME HOLE DObserver	TRIX OPEN RILLING: d by driller a f gravel. ed)  TRIX OPEN RILLING: d by driller a f gravelly cl	s 111s	.70						
	MAR						1			INSTALL	ATION R	EMA	RKS				LTT.	
ar	nd du	ig ins	pection	on pit	t to 1.2m.					Headwork	S.							
										GROUND	WATER	DET	AILS					
										Date	Hole Dept	,	Casing Depth	Depth to Water	Comme	ents		
	<b>TAI</b>	I A week	ON D	ET.														
-		. 0 1	UNL	EIA	ILO										1			
_	Date		Tip D		RZ Top	RZ Base	1	Туре	9									



	NTR/	ACT	D	ublin	Central D	evelopm	ent - Dra	ift						DRILL SHEET	HOLE N	0	RC0	<b>B</b> 13 of 33
CO	ORE	INA	ΓES(	_)					ROUND LI		)	102		DATE	STARTE COMPLI		13/09/ 14/09/	2008
	ENT	ER			Central Donsulting E				ICLINATIO	N		-90 Polyme	er Gel	DRILL LOGG			Millen A. Ma	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	n) <sub>500</sub>	Legend	Non-intact zones (shaded)	Des	cription	Denth (m)		Disco	ontinuities		Elevation	Standpipe Details	SPT (N Value)
12									HOLE DF	by driller a gravelly cla d)	s say.							
	MARI d du		pectio	on pit	to 1.2m.	+	-	+		INSTALLA		MARKS	l)					
		J		1-11						Headworks	·.							
										GROUND	т							
										Date	Hole Depth	Cas Dep	ing oth	Depth to Water	Comm	ents		
NG			D1 =															
	<b>TALI</b>	_ATI			ILS RZ Top	RZ Base		Туре										



REPORT NUMBER

	NTR	ACT			Central D	evelopmo	ent - Dra	(	GROUND			)		102	DATE	HOLE N T STARTE COMPL	ED .	13/09/	14 of 33 2008
	IENT GINE				Central Donsulting I		ents Ltd.		NCLINATION	ON				90 Polymer Ge		ED BY		Milleni A. Mal	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa (mi	cing m)	Legend	Non-intact zones (shaded)	De	escrij	ption		Depth (m)	Disc	ontinuities		Elevation	Standpipe Details	SPT (N Value)
13	MAR								HOLE D	DRIL ed by of gr eed)	X OPEN LING: y driller a: avelly cla	y.	PEMP	APKS					
			pecti	on pi	t to 1.2m.					-	eadworks		. X=1VI						
										GI	ROUNDV	VATER	R DET	TAILS					
											Date	Ho Der	le	Casing Depth	Depth to Water	Comm	ents		
h 1 6	T4.	1 A ====	ON 5	)ET 1															
NS	Date	LATI	ON L			RZ Base		Гуре	9										
14	-09-0 -09-0	80	13.0	00	6.00 26.50	13.00 32.50	50r	nm :	SP										



CLIE	ORD		D	ublin	Central I	20 0													
CLIE		INIA"			Contrair	Developm	ent - Dra	ft							DRILL	HOLE NO		RC08	3 15 of 33
NGI		MNA	TES(	_)						LEVEL (m) VIETER (m		1	102		DATE	STARTED COMPLE		13/09/	2008
(m)		ER			Central I				NCLINATIO LUSH	NC			90 Polymer		DRILLED BY LOGGED BY			Milleni A. Mal	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spa	300		Non-intact zones (shaded)	SYMME HOLE D Observe	TRIX OPE PRILLING: d by driller of gravelly of	as	Depth (m)		Disconti	nuities NO 5 : 13/	432/22	E-J India	Standpipe Details	SPT (N Value)
ENA	ADL	/C				4				INICTALI	ATION	DEM	DKC						
land			pectio	on pit	t to 1.2m.					INSTALL Headwork		KEMA	AKKS						
										GROUND	1			1 5-	nth t-				
										Date	Ho Der		Casing Depth		pth to /ater	Commer	nts		
JST	ΔΙΙ	ΔΤΙ	ח ואכ	FTA	II S														
	ALL ate	ATIC			RZ Top	RZ Base		Гуре											
14-0			13.0		6.00	13.00		nm S	P										



REPORT NUMBER

СО	NTRA	ACT	D	ublin	Central Developme	ent - Dra	_						DRILL SHEET	HOLE N	0	RC08 Sheet	3 16 of 33
СО	-ORE	OINA.	TES(	_)					LEVEL (m) METER (mm)	)		02		STARTE		13/09/ 14/09/	
	GINE	ER			Central Development onsulting Engineers	ents Ltd		LUSH	ON		-9 Po	0 olymer Ge		ED BY ED BY		Millen	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm)	Legend	Non-intact zones (shaded)	De	escription	Denth (m)		Disc	continuities		Elevation	Standpipe Details	SPT (N Value)
	15.00							HOLE D	INSTALLA	16.		DIVO				KIN	
	MAR nd du		pecti	on pi	t to 1.2m.				Headworks		IVIA	ikno					
									GROUNDV	VATER D	ET/	AILS					
									Date	Hole Depth		Casing Depth	Depth to Water	Comm	ents		
14	Date -09-0	08		epth	RZ Top RZ Base 6.00 13.00 26.50 32.50	50	Type mm mm	SP									



ONT	RAG	ст	D	ublin	Central D	evelopm	ent - Dra	ft						DRILL	HOLE N	0	RC0 Shee	8 t 17 of 33
0-01	RDII	NAT	ES(	_)						LEVEL (m) METER (mn	1)	1	02	DATE	STARTE		13/09	0/2008 0/2008
LIEN		۲ .			Central D				NCLINATION TUSH	ON			90 Polymer Ge		ED BY		Miller A. Ma	
Core Run Depth (m)	Cole Ivali Depair (iii)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac (mr	n)	Legend	Non-intact zones (shaded)	De	scription		Depth (m)	Dise	continuities		Elevation	Standpipe Details	SPT (N Value)
6 16.	1	00	0	0					gravelly predomi	wn sandy CLAY (gravi nantly fine, to sub-round	led)							N = 100/86 mm (10, 15, 30 60, 10)
EMA and			ectio	n pit	t to 1.2m.					Headwork		KEM/	AKKS					
										GROUND	NATE	R DET	AILS					
										Date	Н		Casing Depth	Depth to Water	Comm	ents		
											0	ge M. I	- Sept. II					
				ETA		D7.5		T.										
Da	te		ip De		RZ Top 6.00	RZ Base 13.00		Type										



REPORT NUMBER

CONTRAC	СТ	Di	ublin	Cen	tral D	evelop	ome	nt - Dra	ft						DRILLI SHEET	HOLE NO	0	RCO	18 t 18 of 33
CO-ORDIN	TAN	ES(	_)								LEVEL (m) METER (mi		1	02	DATE	STARTE COMPLI		13/09	9/2008 9/2008
CLIENT ENGINEER	۲					evelop ingine		nts Ltd.		NCLINATI FLUSH	ON			90 Polymer Ge	DRILLI LOGG				nnium ahony
	T.C.R.%	S.C.R.%	R.Q.D.%	0	Fract Spac (mn	ing n)	0	Legend	Non-intact zones (shaded)	De	escription		Depth (m)	Disc	continuities		Elevation	Standpipe Details	SPT (N Value)
	000	0	0							angular	own sandy CLAY (gravinantly fine, to sub-rour ally rounded	ided )	17.05						N = 55/31 mm (25, 45, 55)
REMARKS Hand dug		ectio	on ni	t to 1	2m						INSTALL		N REMA	ARKS					
, iana aug	ıı ıop	COLIC	on pi	0 1							Headwor	KS.							
											GROUND								
											Date		Hole epth	Casing Depth	Depth to Water	Comm	ents		
													2/	10					
INSTALLA					Ton	RZ B	260		Туре	9									
Date 14-09-08		13.0	00	6.	00	13.0	00	50	mm	SP									
14-09-08		32.5	0	26	.50	32.5	50	50	mm	SP									



TIAO	TD A	CT		ublin	Control	la ralanna	ont Dra							DBILL	HOLE NO		BCC	20
CONT	I KA	01	D	ubill	Central D	evelopm	ent - Dra							SHEE			RC(	et 19 of 33
0-0	RD	INAT	ES(	_)						LEVEL (m) METER (mn	1)	102			STARTE			9/2008 9/2008
CLIEN	NT		D	ublin	Central D	evelopm	ents Ltd.	_	NCLINATIO		,	-90			ED BY			nnium
NGIN	NEE	R			onsulting E				LUSH			Polyme	er Gel		ED BY			ahony
		T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac (mr	n)	Legend	Non-intact zones (shaded)	De	scription	Denth (m)		Disco	ontinuities		Elevation	Standpipe Details	SPT (N Value)
18.		100	0	0					predomi angular	wn sandy CLAY (grav nantly fine, to sub-roun ally rounded)	ied							N = 50/20 mm (25, 50, 50
EMA			-41		4- 4-2					INSTALL	ATION RE	MARKS						
and o	aug	ınsp	ectio	n pit	to 1.2m.					Headwork	3.							
										GROUND	WATER D	ETAILS		1/				
										Date	Hole Depth	Casi Dep	ng th	Depth to Water	Comme	ents		
	11	ATIC	D NC	ETA	ILS			Туре										
I <b>STA</b> Da		17	ip De	nath	RZ Top	RZ Base												