ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY

Infinis Energy Services Ltd.

Docks Way Landfill Site

Retro Drilling of Gas Wells

Construction Quality Assurance Plan

October 2015

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Infinis Energy Services Ltd.

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Construction Quality Assurance Plan

October 2015

Prepared for

Infinis Energy Services Ltd.

Prepared by

Egniol Environmental Ltd.
Tre Felin
Bangor
Gwynedd
LL57 4LH

Document Review

Version No.	Date of Review	Prepared By	Reviewed By	Approved By
1.0	01/10/2015	Russell Pearson	Richard Furniss	Richard Furniss
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4.0	21/10/2015	Russell Pearson	Richard Furniss	Russell Pearson

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DEFINITION OF TERMS

'Directed' means an oral or written confirmation that an action by the Contractor under the Specification is to be carried out

'CQA' Construction Quality Assurance

'NRW' Natural Resources Wales

'Verify' confirm orally or in writing that an action has been performed in accordance with the CQA Plan

'Record' writing/drawing in an approved format as evidence of work carried out

'Works' the permanent works as shown on the contract drawings

'Agree' agree details orally or in writing before an action is carried out

PARTIES AND RESPONSIBILITIES

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

The Employer – Newport City Council.

This is the person or company for whom the Works are constructed. The Employer is the Permit Holder for the Site.

The Main Contractor – Infinis Energy Services Ltd.

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

The Sub Contractors –

Drilling Works – Magpie Environmental Drilling Ltd.

This is the persons or companies appointed by the Main Contractor to execute the construction of the Works. He will be responsible for the Retro Drilling and subsequent installation works. All drilling operatives shall hold the relevant British Drilling Association (BDA) accreditation. Copies of this certification shall be made available by the Drilling Contractors on request.

Pipework Welding Works – TBC.

This is the persons or companies appointed by the Main Contractor to execute the butt fusion welding portion of the Works. He will be responsible for the butt fusion welding of the HDPE well casing. All welding operatives shall hold the relevant certification for butt fusion welding. Copies of this certification shall be made available by the Welding Contractors on request.

The Designer – Infinis Energy Services Ltd.

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

The CQA Inspector – Egniol Environmental Ltd.

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

1.0 INTRODUCTION

1.1 Description of Works

This CQA Plan appertains to the following works at Docks Way Landfill Site. The proposed works include the following activities:

- Installation of 8no. Landfill Gas Extraction wells by means of Retro Drilling in accordance with Tables 1 and 2 overleaf.

The 8no. wells are to be installed to uncapped waste surfaces at Docks Way Landfill Site.

1.2 Supervision

The Sub Contractor is required to have full-time supervision on site whilst any activities are being undertaken. Third party independant experienced CQA personnel will be present on site for all the drilling works to verify the Works are constructed in accordance with this CQA Plan. NRW will be informed 48 hours prior to Works commencing.

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

i Weather conditions
ii Site Hours (Time on/off site)
iii Depth of Drill (Record Sheet)
iv Type and depths of waste
v Drilling machinery employed inside hole
vi Lengths of individual pipework installed
vi Depth of stone installed
vii Depth of bentonite seal installed

1.3 Surveying

The proposed locations and details of each well to be installed are shown in Table 1 overleaf:

Table 1 – Proposed Well Locations and Drill Depths.

Proposed Well I.D.	Easting	Northing	Ground Level (mAOD)	Pit Base Level (mAOD)	Level Difference (m)	Minimum Stand Off (m)	Proposed Drill Depth (m)
1501	330878.214	184840.692	23.801	7.052	16.749	3.0	13.5
1502	330941.582	184812.177	23.514	5.315	18.199	3.0	15.0
1503	330891.517	184877.429	24.498	6.689	17.809	3.0	14.5
1504	330925.413	184867.260	24.971	5.623	19.348	3.0	16.0
1505	330974.660	184880.894	23.228	5.404	17.824	3.0	14.5
1506	330859.245	184867.490	24.156	7.900	16.256	3.0	13.0
1507	330910.819	184826.780	23.706	5.868	17.838	3.0	14.5
1508	330962.529	184848.966	24.076	5.059	19.017	3.0	16.0

All information supplied by Infinis Energy Services Ltd. via email 25.09.2015.

Table 2 – Well Casing Installation Details.

Proposed Well I.D.	Plain Pipework Below Ground Level (m)	Plain Pipework Above Ground Level (m)	Perforated Pipework (m)	Bentonite Seal (m)
1501	5.0	1.0	8.5	4.0
1502	5.0	1.0	10.0	4.0
1503	5.0	1.0	9.5	4.0
1504	5.0	1.0	11.0	4.0
1505	5.0	1.0	9.5	4.0
1506	5.0	1.0	8.0	4.0
1507	5.0	1.0	9.5	4.0
1508	5.0	1.0	11.0	4.0

All information supplied by Infinis Energy Services Ltd. via email 25.09.2015

The proposed locations are subject to change prior to the start of the works. All location and drill depth information shall be forwarded to NRW for approval prior to the commencement of the works. Where amendments are made to the proposed locations and/or proposed depths, the revised, approved, data shall be provided to all parties prior to the commencement of the works.

After the Contract, as-built drawings detailing the existing ground levels and levels drilled to at the gas well, along with a plan showing the location of the retro-drilled point will be supplied to the CQA Consultant. These drawings will be issued with a copy of the Validation Report.

1.4 Validation Report

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

2.0 RETRO DRILLING

2.1 Preparation of Working Area

The proposed drilling area shall be trimmed or filled to provide a firm base for the drilling rig where required. The Main Contractor shall set out the position of the proposed gas wells by placing a peg, marked with the well reference number, at each of the locations, with the ground level of each peg to be established by way of surveying prior to the commencement of the works. The Main Contractor shall also advise all relevant parties of the depth, which the Sub Contractor is to drill to following the agreement of existing ground levels. The proposed depth information shall be given in mAOD (Metres Above Ordnance Datum) and mBGL (Metres Below Ground Level).

Prior to the undertaking of any drilling works, the ground levels at the proposed locations shall be surveyed and checked. This information is to be recorded on the daily record sheet enclosed in Appendix 2.

2.2 Drilling Works

The Sub Contractor shall set up the drilling rig at the location identified by the Main Contractor or his representative and shall drill a hole through the waste using a 350mm diameter barrel auger sufficient to install a HDPE pipe of 160mm diameter (or other, where specified) to the proposed drilled depth. The Sub Contractor shall check the verticality of the borehole during the drilling operations on a regular basis, but at least every 5m depth, by using a spirit level on the rig mast. If the borehole goes off line by more than 5° from vertical then the hole will be aborted and re-drilled. All verticality checks will be recorded.

All wells to be drilled and installed during these works are designated as terminating within a "Low Risk Zone – Zone 1"; therefore it is anticipated that incremental drilling will not be required due to the minimum 3.0m stand off from basal level applied to each well by the Main Contractor based upon the available survey data for the relevant areas of site.

Initially the hole will be formed by augering in order to advance the hole quickly. If wet unconsolidated waste is encountered then bailing tools will be used. The actual selection of tool will be made once the condition and moisture level of the waste has been assessed from the drilling arisings.

In the event that the liquid levels encountered prevent the advancement of the borehole to the target depth, the Main Contractor will be informed by the CQA Inspector and a decision taken by the Main Contractor as to what depth the well shall be installed to, in line with the methodology described in Section 3 below; the outcome of this will be recorded by the CQA Inspector.

The Sub Contractor and CQA Inspector shall keep an up to date record of the exact length of drilling equipment in the borehole. This information shall be recorded by the CQA Inspector in his notebook and recorded in the Validation report.

The borehole depth shall be checked with a weighted, graduated tape from 3m above the target depth. The reduced level of the base of the borehole shall be calculated and compared to the target drill depth.

Only when the Sub Contractor has agreed the current drill depth and remaining drill distance with the CQA Inspector shall drilling re-commence.

When the target drill depth has been reached, the base of the borehole shall be cleaned out. The CQA Inspector shall observe the cleaning out operation and record the actual depth prior to giving approval for the installation of the new well casing.

If an obstruction is encountered during the drilling operation, the Main Contractor will be notified and a decision taken, dependant on the depth reached, if installation is to proceed at the depth attained or the borehole shall be backfilled with the arisings and sealed at the surface. In the event of this, a new location shall be identified by the Main Contractor and relevant ground levels/drill depth established prior to the re-commencement of drilling at the new location with the relevant information being supplied in writing to all parties.

Odour management shall be controlled in accordance with the Permit requirements and in close liaison with the Site Operators representatives; this may include, but not be limited to, the use of a de-odourising unit.

All arisings from the drilling operation will be placed in the active tip area by means of a 5T dumper or similar.

When drilling operations are completed at the end of each shift, the Sub Contractor shall seal the borehole with a bentonite seal to prevent gas emissions. No holes will be left open over the weekend period or overnight.

The installation of the new HDPE gas well casing will proceed as detailed in Section 3.

2.3 Over-drill Remediation Procedure

In the unlikely event of a borehole being drilled through the entire depth of waste and into the underlying basal liner, one of the following procedures will be used to re-seal the liner.

In the event of such an incident occurring, the Main Contractor shall inform the Employer immediately who will then inform NRW. The Main Contractor shall also compile an incident report identifying the cause of the over drill.

2.3.1 Remediation of dry wells using 324mm internal diameter steel casing

324mm internal diameter (ID) steel casing shall be inserted into the well to the level of the penetration of the liner to form a seal and reduce the risk of leachate migration.

The steel casing shall be dipped to evaluate the presence of any leachate. Should leachate be detected, the method detailed in section 2.3.2 should then be employed.

For dry wells, a mixture of bentonite and cement will be prepared, comprising two bags of bentonite and two of Portland cement. Mixing of these materials shall be thorough to allow for complete hydration of the bentonite.

The sealing mixture shall be poured into the borehole and the plunger tool lowered into the steel casing to force the mixture to the base of the well, displacing any leachate and forming a suitable seal at the base of the well.

Approximately 200 litres of the sealing mixture shall be placed into the borehole to produce a bentonite plug of approximately 1.8m in depth (based on steel casing with an approximate internal diameter of 324mm).

The plunger tool and drill rods shall be disconnected from the drill head, with the weight of these maintaining a pressure on the sealing mixture. Meanwhile, the steel casing shall be withdrawn by approximately 150mm to allow the sealing mixture to enter the area surrounding the base of the borehole and form a suitable seal.

The steel casing shall be withdrawn gradually in 300mm increments to a total no less than 1000mm to allow the sealing mixture to set.

Upon reaching this depth, the borehole and sealant shall be evaluated by all parties and NRW as to whether the steel casing can be retracted fully and if any further sealant is required to be added.

2.3.2 Remediation of wet wells using 250mm ID steel casing

Should leachate ingress into the base of the borehole be detected, the following remediation procedure shall be employed.

A mixture of 30% bentonite, 30% cement and 30% 20-40mm non calcareous stone shall be prepared as per the bentonite/cement mix in section 2.3.1 above.

As for the method detailed in section 2.3.1, steel casing shall be inserted into the borehole to the depth of the liner penetration. A plunger tool shall then be employed to bail the borehole and remove leachate.

The sealant mixture shall then be inserted into the steel casing and pushed to the base of the borehole using the plunger tool as per section 2.3.1. The steel casing shall be gradually removed from the borehole, with more sealant mixture being introduced as required and as agreed by all parties.

2.4 Abandoning Boreholes

If a well is abandoned for any reason, to prevent oxygen ingress into the site the well will be backfilled with gravel or other loose material and a 3.0m fully hydrated bentonite seal to ground level. Infinis will be informed of any wells which are to be abandoned and shall instruct all parties accordingly how to proceed.

No deviation from the marked wells will be allowed without specific written instruction from the Infinis representative.

3.0 GAS WELL INSTALLATION

3.1 Specification

The gas well shall consist of a Butt Fused HDPE pipe. The diameter of the HDPE pipe shall be 160mm, solid for the upper section (as detailed in Table 2 above); the remainder of the pipework length shall be perforated. Records of any butt fusion welding carried out shall be included within the CQA Report.

A fully automatic butt fusion welding machine shall be used which shall:

- automate trimming of pipe faces;
- automate determination of drag forces during all stages of jointing process;
- automate incorrect heater temperature lock out;
- automate heater plate ejection;
- automate bead formation control;
- warn of and record incomplete cooling times.

In addition, the machine shall be capable of recording and storing weld specific parameters such as heater temperature, bead pressure, heat soak time, fusion pressure and actual and target cooling times. It shall also record the date, time, operator and joint number. This data shall be retrievable by a data capture unit and a digital and printed copy supplied to the CQA Inspector on the following working day.

The lower section of the HDPE gas well liner shall be perforated and fitted with a push fit end cap, securely taped in place before installation of the gas well pipework to the annulus.

The annulus between the HDPE pipe and waste will be filled with 20 – 40 mm non-calcareous stone to a minimum height of 4.0m below ground level. The remaining length of the annulus will be grouted using hydrated bentonite. The bentonite will be hydrated upon installation within the well.

The gas well installation shall also be carried out in accordance with Drawing Reference 5571.GAS.D01, which is enclosed within Appendix 1 of this CQA Plan.

3.2 HDPE Pipe Installation

If the HDPE pipe does not achieve the target level, it shall be removed, the hole bailed and the casing re-inserted to the required depth as detailed in section 2.2 above.

The well casing shall be centred within the borehole and 20 – 40 mm non-calcareous stone shall be slowly introduced into the annulus between the well casing and borehole sides. The Sub Contractor shall place the gravel pack to a sufficient depth below ground level to allow for the installation of the hydrated bentonite seal to a depth as listed in Table 2 above.

The CQA Inspector shall monitor the stone installation at each well to ensure that bridging has not occurred; as part of this process, rods shall be placed into the annulus during stone placement to agitate the gravel to reduce the risk of bridging.

A bentonite seal shall be formed above the stone placed to ground level (i.e. above the 20-40mm stone) by installation of a fully hydrated bentonite seal to the annulus.

Prior to the installation of the hydrated Bentonite, at least one bag of dry bentonite shall be inserted into the borehole to form a blinding layer on top of the gravel pack to prevent downward movement of the hydrated Bentonite.

The CQA Inspector shall verify that the bentonite seal is installed as per the prescribed methods above and that it forms a suitable seal with the surrounding strata.

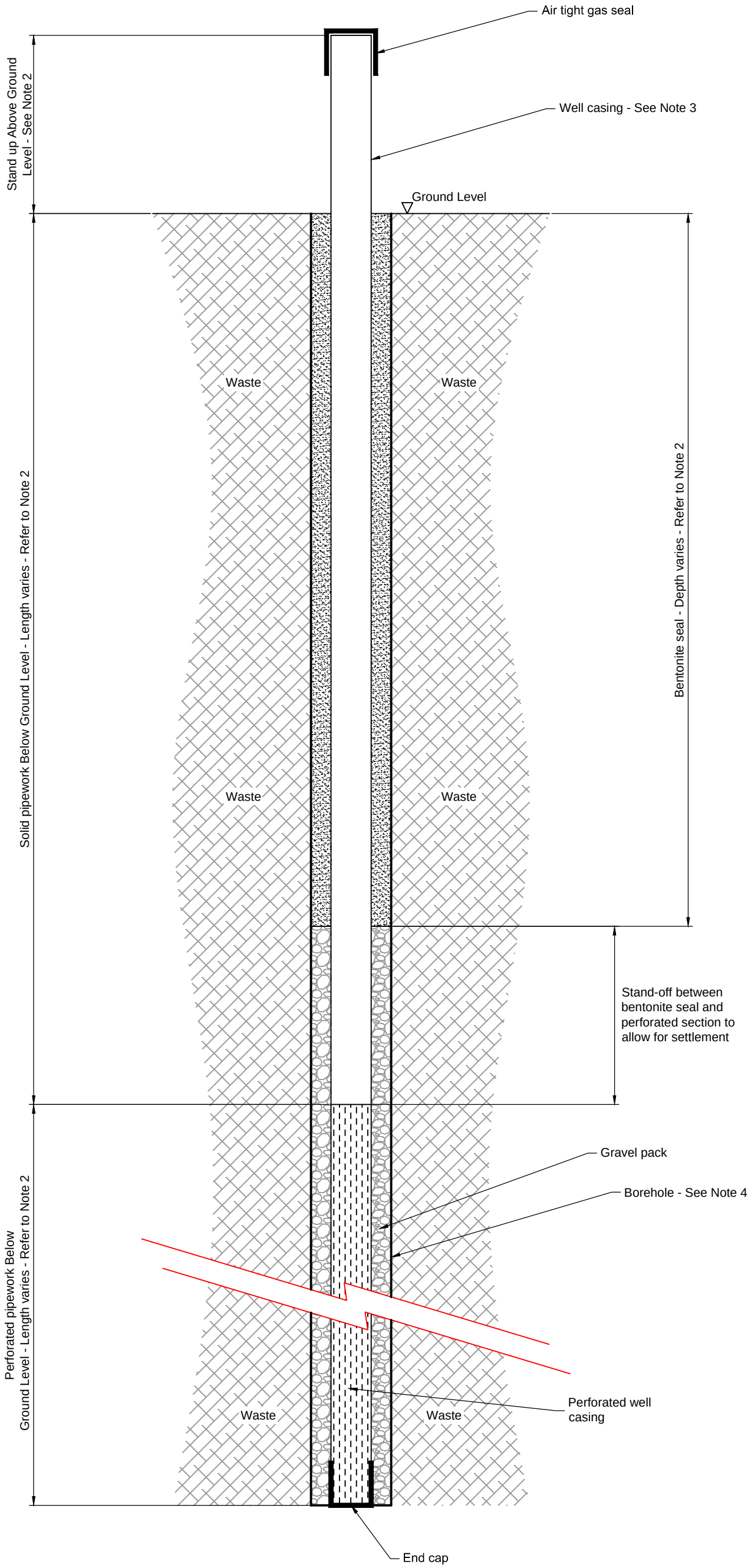
No borehole shall be left open over the weekend period or overnight as stated in Section 2.2 above.

On completion of the installation, headworks will be installed in accordance with accepted site procedures.

Datum levels and co-ordinate location is to be taken on top of each of the HDPE pipes upon completion.

APPENDIX 1

Gas Extraction Well for Waste Profile



Notes

1. Do not scale from this drawing.
2. For details of pipework installation lengths etc. Refer to Table 2 of the CQA Plan - ref: 5571 Docks Way Landfill Site, Retro Drilling of Gas Wells, Construction QualityAssurance Plan, October 2015.
3. Well casing diameter to be confirmed prior to start of works (refer to CQA Plan - ref: 5571 Docks Way Landfill Site, Retro Drilling of Gas Wells, Construction Quality Assurance Plan, October 2015).
4. Borehole to be constructed in accordance with the latest approved CQA Plan requirements.

Rev	Modifications	By	Chk	App	Date

Infinis Energy Services Ltd.

Docks Way Landfill Site

Gas Extraction Well Detail for Waste Profile

Drawn by	Checked by	Approved by
RP	GOJR	RF
Date	**Scale @ A3**	**Revision**
01.10.2015	Not To Scale	-

Issue: Information

Drawing Number: 5571.GAS.D01

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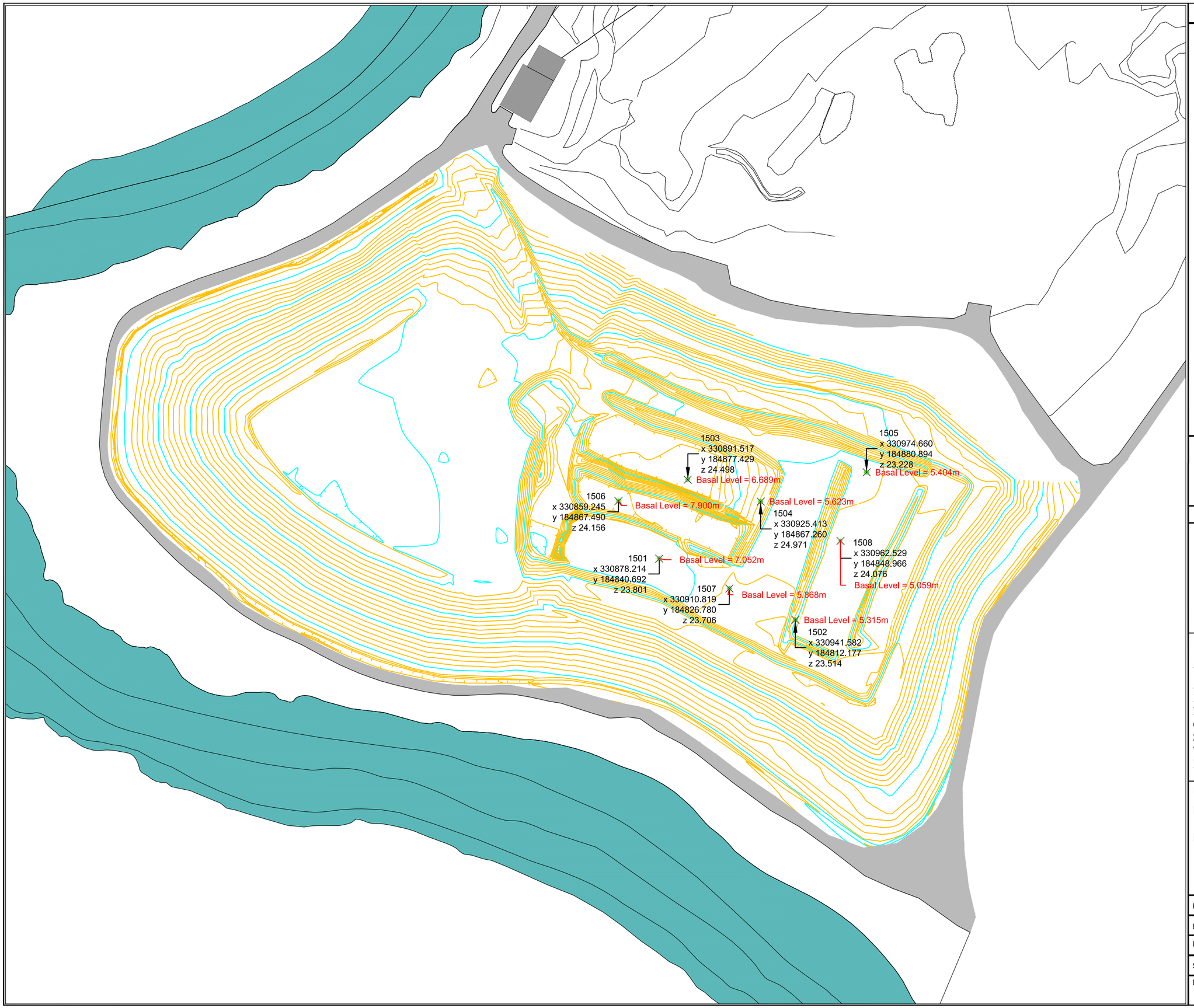

NOTES

A3

Rev	Details	Dr	Ch	Ap	Date

Streetscene
Andrew Morris CEng. MICE
Head of Streetscene
Newport City Council
Civic Centre, Newport
South Wales, NP20 4UR.
Telephone: 01633 656656
Email: streetscene@newport.gov.uk

Newport CITY COUNCIL
CYNGOR DINAS
Casnewydd

Project

Docsway WDS

Proposed Gas wells sep 2015

File No.		Status:			
Drawn	MDH	Checked		Approved	
Date		Date		Date	
Scales					
Drawing No.					

APPENDIX 2

CQA Inspector's Daily Report

Site Name:

Project:

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

For Egniol Environmental Ltd: _____

DRILLING REPORT					Well Number:
CQA INSPECTOR:-					
CLIENT:					Site:
Date:		Installation Details			Target Depth (m):
Drilling Rig type:		Solid AGL (m):			Actual Depth (m):
Extruder Dimensions:		Solid BGL (m):			Dip Level (mBGL):
Auger Dimensions:		Perforated BGL (m):			Dip Level (mBGL) after 24hrs:
Casing Dimensions:		Bentonite (m):			HDPE Casing Dimensions:
		Gravel (m):			

Depth From (m)	Depth To (m)	Interval (m)	DESCRIPTION	STRATA
			m	m
	+1.0	1	+1	+0.5
0.0	0.0	0	0	GL GL
0.0	1.0	1	0	0.5
1.0	2.0	1	1	1.5
2.0	3.0	1	2	2.5
3.0	4.0	1	3	3.5
4.0	5.0	1	4	4.5
5.0	6.0	1	5	5.5
6.0	7.0	1	6	6.5
7.0	8.0	1	7	7.5
8.0	9.0	1	8	8.5
9.0	10.0	1	9	9.5
10.0	11.0	1	10	10.5
11.0	12.0	1	11	11.5
12.0	13.0	1	12	12.5
13.0	14.0	1	13	13.5
14.0	15.0	1	14	14.5
15.0	16.0	1	15	15.5
16.0	17.0	1	16	16.5
17.0	18.0	1	17	17.5
18.0	19.0	1	18	18.5
19.0	20.0	1	19	19.5
20.0	21.0	1	20	20.5
21.0	22.0	1	21	21.5
22.0	23.0	1	22	22.5
23.0	24.0	1	23	23.5
24.0	25.0	1	24	24.5
25.0	26.0	1	25	25.5
26.0	27.0	1	26	26.5
27.0	28.0	1	27	27.5
28.0	29.0	1	28	28.5
29.0	30.0	1	29	29.5
30.0	31.0	1	30	30.5
31.0	32↓	1	31	31.5

DRILLING REPORT CQA INSPECTOR:-				Well Number:
CLIENT:				Site:
Date:		Installation Details		Target Depth (m):
Drilling Rig type:		Solid AGL (m):		Actual Depth (m):
Extruder Dimensions:		Solid BGL (m):		Dip Level (mBGL):
Auger Dimensions:		Perforated BGL (m):		Dip Level (mBGL) after 24hrs:
Casing Dimensions:		Bentonite (m):		HDPE Casing Dimensions:
		Gravel (m):		

Depth From (m)	Depth To (m)	Interval (m)	DESCRIPTION	STRATA
			m	m
32.0	33.0	1	32	32.5
33.0	34.0	1	33	33.5
34.0	35.0	1	34	34.5
35.0	36.0	1	35	35.5
36.0	37.0	1	36	36.5
37.0	38.0	1	37	37.5
38.0	39.0	1	38	38.5
39.0	40.0	1	39	39.5
40.0	41.0	1	40	40.5
41.0	42.0	1	41	41.5
42.0	43.0	1	42	42.5
43.0	44.0	1	43	43.5
44.0	45.0	1	44	44.5
45.0	46.0	1	45	45.5
46.0	47.0	1	46	46.5
47.0	48.0	1	47	47.5
48.0	49.0	1	48	48.5
49.0	50.0	1	49	49.5
50.0	51.0	1	50	50.5
51.0	52.0	1	51	51.5
52.0	53.0	1	52	52.5
53.0	54.0	1	53	53.5
54.0	55.0	1	54	54.5
55.0	56.0	1	55	55.5
56.0	57.0	1	56	56.5
57.0	58.0	1	57	57.5
58.0	59.0	1	58	58.5
59.0	60.0	1	59	59.5
60.0	61.0	1	60	60.5
61.0	62.0	1	61	61.5
62.0	63.0	1	62	62.5
63.0	64.0	1	63	63.5
64.0	65.0	1	64	64.5

Egniol Environmental Ltd

Butt Fusion Record Sheet

Landfill Site:
Project:

Date	Joint Number (from Welding Machine)	Pipework Type		Weld	Test Joints		Failed Joints		CQA Inspector	Remarks
		Diameter	SDR	Good Joint Produced (Y/N)	Good Joint Produced (Y/N)	Incorporated in Works (Y/N)	Retrim/ Reweld (Y/N)	Removed & stored (location)		

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Electro Fusion Record Sheet

Landfill Site:
Project:

Date	Joint Number	Pipe Diameter (mm)	Scraped	Clamped	Fitting Type						Heat Time (secs)		Cool Time (secs)		Status		CQA Inspector	Remarks
					cou	tee	red	sad	elb	other	Target	Actual	Target	Actual	Pass	Fail		

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egniol

North Wales Office:

Tre Felin

Bangor

Gwynedd

LL57 4LH

T: 01248 355 996

F: 01248 371 996

Cheshire Office:

Mere View Farm Offices

Park Lane, Pickmere

Near Knutsford, Cheshire

WA16 0LG

T: 01565 732 930

F: 01565 732 931

www.egniol.com