



ENGINEERING
ENVIRONMENTAL
HEALTH & SAFETY



Infinis Energy Services Ltd.

Ruabon Landfill Site

Retro Drilling of Gas Wells

Construction Quality Assurance Plan

December 2014



5317

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Construction Quality Assurance Plan

December 2014

Prepared for

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Document Review

Version No.	Date of Review	Prepared By	Reviewed By	Approved By
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2.0	09.12.14	Richard Furniss	Russell Pearson	Richard Furniss

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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 Permit Holder – FCC Environment Ltd.

This is the person or company for whom the Works are constructed.

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 drillings 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 Ruabon Landfill Site. The proposed works include the following activities:

- Installation of 5no. Landfill Gas Extraction wells by means of Retro Drilling in accordance with Table 1 below.

All 5no. proposed Landfill Gas Extraction wells are to be installed to capped and restored areas of site. All works are to be carried out in accordance with this CQA Plan and FCC Environment Ltd.'s document "*IMS-3-02-LNF: On Waste Drilling Procedure*".

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 Ground level to top of drill location
- iv Depth of Drill (Record Sheet)
- v Type and depths of waste
- vi Drilling machinery employed inside hole
- vii Lengths of individual pipework installed
- viii Depth of stone installed
- ix 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 Locations and Drill Depths.

Infinis Well I.D.	Easting	Northing	Ground Level (mAOD)	Base Level (mAOD)	Level Difference (m)	Stand Off from Base (m)	Proposed Drill Depth (m)
PW_RUAW1401	330101.449	344387.946	134.445	113.494	20.951	3.451	17.5
PW_RUAW1402	330099.684	344441.235	133.0	112.579	20.421	3.421	17.0
PW_RUAW1403	330209.624	344426.562	128.106	108.947	19.159	3.159	16.0
PW_RUAW1404	330275.011	344471.365	121.305	111.0	10.305	3.305	7.0
PW_RUAW1405	330183.827	344519.835	130.278	110.153	20.125	3.125	17.0

All information supplied by Infinis Energy Services Ltd. via email 20.11.2014

Table 2 – Well Casing Installation Details.

Infinis Well I.D	Plain Casing Below Ground Level (m)	Plain Casing Above Ground Level (m)	Perforated Casing (m)	Depth of Bentonite Seal (m)	Stone Volume (m ³) (Approx.)
PW_RUAW1401	5.0	1.0	12.5	3.0	1.104
PW_RUAW1402	5.0	1.0	12.0	3.0	1.065
PW_RUAW1403	5.0	1.0	11.0	3.0	0.989
PW_RUAW1404	4.0	1.0	3.0	3.0	0.304
PW_RUAW1405	5.0	1.0	12.0	3.0	1.065

All information supplied by Infinis Energy Services Ltd. via email 20.11.2014

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 Infinis 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, Infinis will be informed by the CQA Inspector and a decision taken by Infinis 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 Permit Holder 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 406mm diameter steel casing

406mm diameter 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 380mm).

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 406mm diameter 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 above, 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 the ingress of oxygen or rain water into the waste mass and egress of pollutants from the waste mass, the capping system shall be repaired.

The restoration soils shall be excavated to a safe profile. The soil material will be handled and stockpiled to prevent any deterioration. The void caused by the drilling operation shall be backfilled with gravel or loose fine soils to a depth of 500mm below the surface of the capping system. The remaining void, to the level of the capping system, shall be filled with hydrated bentonite in accordance with section 3.2.

Replacement of the restoration soils shall be replaced in such a manner to limit any damage to the underlying geomembrane. The surface of the restoration soils shall be graded into the surfacing surround soil contours.

Infinis will be informed of any wells which are to be abandoned.

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 butt fusion welded end cap.

The annulus between the HDPE pipe and waste will be filled with 20 – 40 mm non-calcareous stone to a minimum height of 3.0m 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 5150.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.

An assessment of the theoretical volume of stone to be placed to well installations is shown in Appendix 3 and is equivalent to the volume of the annulus between the pipework and the borehole side. The CQA Inspector shall record the theoretical amount of stone installed to each well on his daily report sheets.

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 slurry to the annulus; the bentonite slurry shall be prepared using bentonite powder and be mixed prior to its installation within 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.

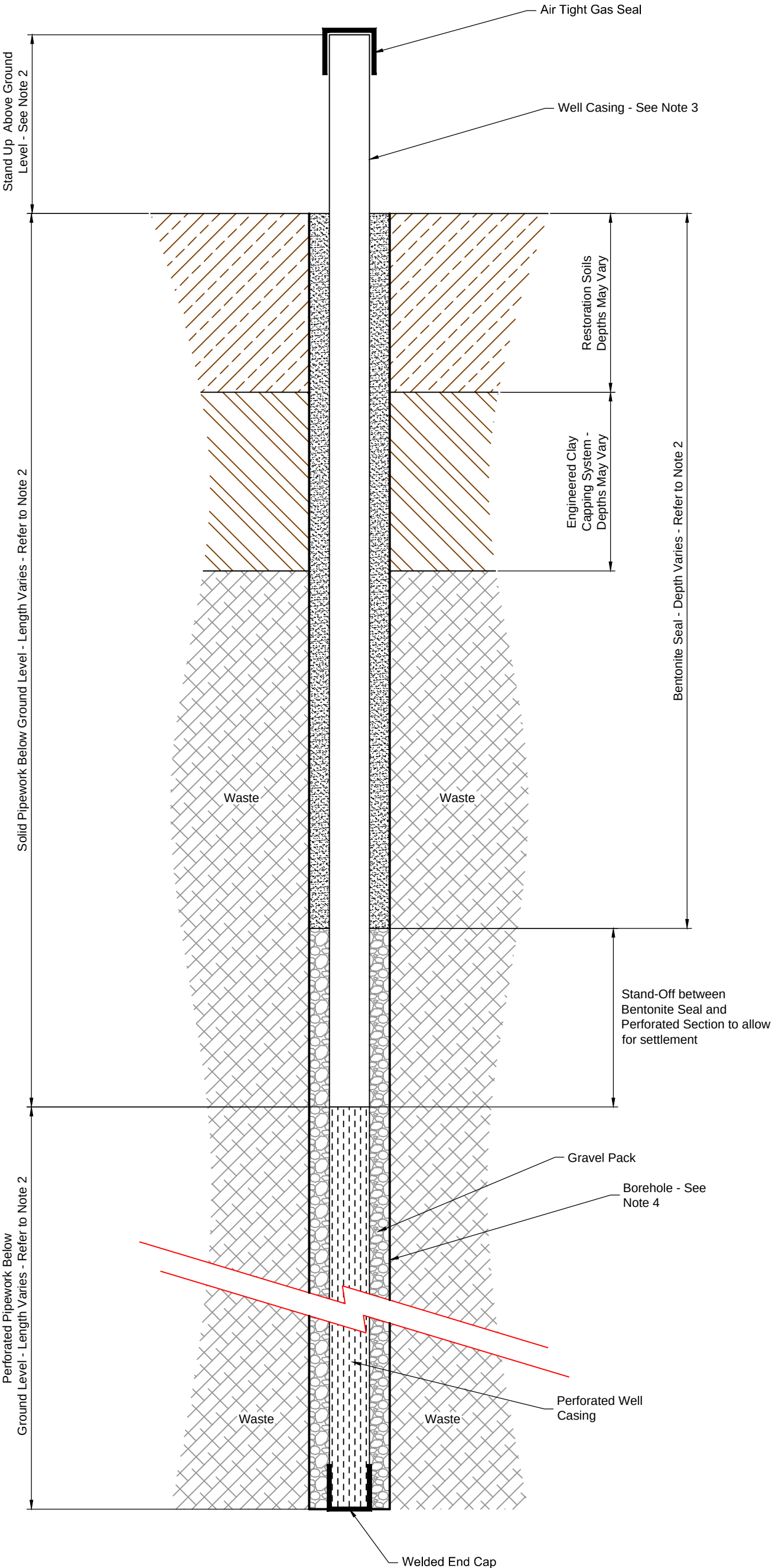
No borehole shall be left open over the weekend period or overnight as stated in Section 2.2 above.

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 Completed Capping Works



- 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: Ruabon Landfill Site, Retro-Drilling of Gas Wells, Construction Quality Assurance Plan, Dec 2014.
 3. Well casing diameter to be confirmed prior to start of Works (Refer to CQA Plan - Ref: Ruabon Landfill Site, Retro-Drilling of Gas Wells, Construction Quality Assurance Plan, Dec 2014).
 4. Borehole to be constructed in accordance with the latest approved CQA Plan requirements.

REV	MODIFICATIONS	BY	CHK	APP	DATE
Infinis Energy Services Ltd.					
Ruabon Landfill Site					
Gas Extraction Well Detail for Completed Capping Works					
DRAWN BY DMD		CHECKED BY RF		APPROVED BY RF	
DATE 02.12.2014		SCALE @ A3 NTS		REVISION -	
ISSUE Information					
DRAWING NUMBER 5317.GAS.D01					

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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: _____

CQA Inspector's Weekly Report

Landfill Site: _____
Project: _____

Week Ending	
Weather Conditions	
Progress	
Testing Undertaken	
Problems Encountered	
Next Weeks Programme	
Health & Safety	Reported Accidents : Reported Near Misses : Welfare Facilities :
Visitors to Site	

For Egniol Environmental Ltd.

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

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

Butt Fusion Record Sheet



Landfill Site:

Project:

[illegible]

Electro Fusion Record Sheet

Landfill Site:

Project:

[illegible]

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