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Infinis Energy Services Ltd.

Docks Way Landfill Site

Retro Drilling of Gas Wells

Construction Quality Assurance Plan

February 2018

6717

Infinis Energy Services Ltd.

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Construction Quality Assurance Plan

February 2018

Prepared for

Infinis Energy Services Ltd.

Prepared by

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Document Review

Version No.	Date of Review	Prepared By	Reviewed By	Approved By
1.0	1.0	Steven Lowe	Richard Furniss	Steven Lowe

Contents

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/Cyfoeth Naturiol Cymru

'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 – Newport City Council.

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 – Dragon Drilling (Landfill) 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. The CQA Inspector 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 6no. Landfill Gas Extraction wells by means of Retro Drilling in accordance with Tables 1 and 2.

There are a total 6no. wells to be drilled in areas of uncapped waste. All works are to be carried out in accordance with this CQA Plan.

1.2 Supervision

The Sub Contractor is required to have full-time supervision on site whilst any activities are being undertaken. Third party independent 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 and on record sheets 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 shall be supplied by the Main Contractor to the CQA Consultant and Permit Holder prior to the commencement of the Works. These shall also be forwarded to NRW for approval along with a plan drawing showing the locations of the proposed wells.

After the project, as-built drawings detailing the location and ground levels at each newly installed gas well will be forwarded to the CQA Consultant. These drawings will be included within the Validation Report for the Works.

Table 1 - Proposed locations and drill depths.

Well ID	Easting	Northing	Ground Level (mAOD)	Pit Base Level (mAOD)	Level Difference (m)	Stand Off (m)	Proposed Drill Depth (m)
DWYW1801	330817.715	184893.282	30.914	6.328	24.586	21.586	21.0
DWYW1802	330847.098	184886.163	30.876	6.901	23.975	20.975	20.0
DWYW1803	330876.186	184877.168	30.809	7.671	23.138	20.138	20.0
DWYW1804	330904.827	184867.422	30.450	6.776	23.674	20.674	20.0
DWYW1805	330887.539	184907.899	21.950	7.715	14.235	11.235	11.0
DWYW1806	330851.472	184922.907	21.275	6.120	15.155	12.155	12.0

Note: Drilling location information supplied by Infinis Energy Services Ltd. via email 01.02.2018.

Table 2 – Well Casing Installation Details

Well ID	Plain Casing Below Ground Level (m)	Perforated Casing (m)	Plain Casing Above Ground Level (m)	Depth of Bentonite Seal (m)	Stone Volume (m^3) (Approx.)
DWYW1801	5.0	16.0	1.0	4.5	1.256
DWYW1802	5.0	15.0	1.0	4.5	1.180
DWYW1803	5.0	15.0	1.0	4.5	1.180
DWYW1804	5.0	15.0	1.0	4.5	1.180
DWYW1805	4.0	7.0	1.0	3.5	0.571
DWYW1806	4.0	8.0	1.0	3.5	0.647

Note: Drilling location information supplied by Infinis Energy Services Ltd. via email 01.02.2018.

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.

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, including the following, where relevant:

- CQA Report text detailing all aspects of the installation and methodology and validation of compliance with this CQA Plan (unless otherwise specified);
- Details and discussion of any deviations from this CQA Plan;
- CQA Inspectors Daily Reports;
- CQA Inspectors Drilling Log Reports;
- Photographic Log of the installation works;
- Updated Site Layout Plan (unless otherwise to be provided by the Main Contractor at a later date).

Record sheets shall be compiled for inclusion within the validation report and include the following (or similar), where relevant to the wells being installed:

- Borehole Reference Number;
- Plant in use;
- Details of temporary casing used (where used);
- Records of verticality of boreholes;
- Depths to each change of stratum;
- Records of leachate encountered;
- Brief descriptions of each stratum;
- Details of installation;
- Details of stability of the hole;
- Details of backfilling.

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 report sheet enclosed in Appendix 2.

The Main Contractor shall liaise with NRW should there be any anticipated disruption, or unplanned disruption, to the gas extraction system during the period of the works. The CQA Inspector shall liaise with the Main Contractor to ensure the gas extraction system within the region of the drilling works is reduced accordingly, to reduce the risk of oxygen ingress into the waste mass.

2.2 Drilling Works

The Drilling 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 barrel auger of 350mm in diameter sufficient to install a High Density Polyethylene (HDPE) pipe of 160mm 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.

2.2.1 Drilling Works

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 Drilling 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 5.0m 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 Drilling Sub-Contractor has agreed the current drill depth and remaining drill distance with the CQA Inspector shall drilling re-commence.

Upon reaching the target depth, drilling shall halt and the depth confirmed with the Main Contractor; the base of the borehole shall be then 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.

2.2.2 Obstructions

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, following the requisite checks on the proposed depths and the new location.

2.2.3 Additional Information

Odour management shall be controlled in accordance with the Permit requirements and in close liaison with the Site Operators representatives; this shall include, but not be limited to, the use of a de-odourising unit which is to be operational and correctly positioned whilst drilling is being undertaken.

All arisings from the drilling operation will be disposed of to the active tip face of site; all arisings are to be covered with daily cover soils at the end of each shift to minimise odours.

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, the procedure included in Appendix 3 shall be observed and followed.

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.

3.0 GAS WELL INSTALLATION

3.1 Specification

3.1.1 Pipework

The gas well shall consist of a Butt Fused HDPE SDR11 pipe. The diameter of the HDPE pipe shall be 160mm, solid for the upper section; the remainder of the pipework length shall be perforated, with a push fit end cap installed to the base of the perforated section. 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 securely fitted end cap.

3.1.2 Backfilling of the Annulus

The annulus between the HDPE pipe and waste will be filled with 20-40mm non-calcareous stone to a height below ground level sufficient to install a hydrated granular bentonite seal. The remaining length of the annulus will be grouted using a pre-mixed hydrated bentonite slurry. A blinding layer of dry bentonite will also be added to the top of the gravel prior to the installation of the hydrated slurry.

During the drilling works, the CQA Inspector shall liaise closely with the Drilling Sub-Contractor and the Main Contractor to establish the depth of restoration soils present at each well location where a capping system is present with the aim of ensuring that the bentonite seal extends into the waste mass at each relevant location.

The gas well installation shall also be carried out in accordance with Drawing Reference SD.INF.002 as enclosed within Appendix 1 of this CQA Plan.

3.2 Well 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.

3.2.1 Gravel Installation

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 Drilling 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 or as otherwise amended by the Main Contractor.

An assessment of the theoretical volume of stone to be placed to well installations is shown in Table 2 and is equivalent to the volume of the annulus between the pipework and the borehole side. The CQA Inspector shall record the amount of stone installed to each well on his daily report sheets to allow for comparison to the theoretical installation volume, based on the achieved drill depth.

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.

3.2.2 Installation of the Bentonite Seal

A bentonite seal shall be formed above the stone placed (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 outside of the annulus. The hydrated mixture shall generally consist of 2-3 bags of bentonite powder mixed with approximately 150 litres of water prior to installation within the annulus. The process will be repeated as required to provide the required depth of seal to each well.

The CQA Inspector shall monitor the installation of the bentonite slurry at each well to ensure that bridging of the seal does not occur; as part of this process, rods shall be placed into the annulus during placement to agitate the bentonite (as required) to reduce the risk of bridging.

Prior to the installation of the hydrated Bentonite, at least two bags 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.

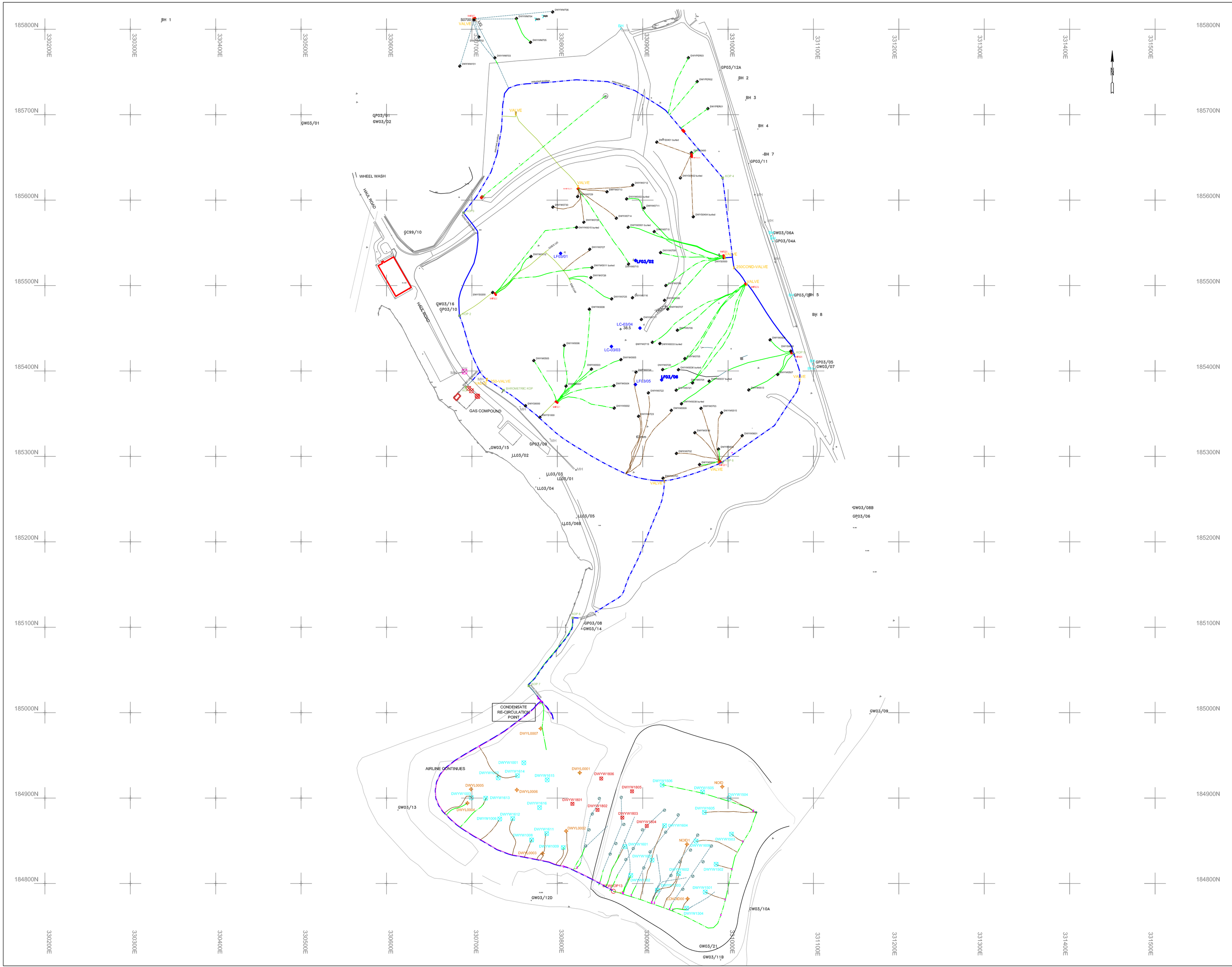
3.2.3 Additional Information

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

Following completion of the gas well installation works, a temporary end cap shall be securely fitted to each well. Headworks will be installed at a later date in accordance with accepted site procedures to allow for connection of the wells to the existing gas collection system on site.

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

APPENDIX 1



LEGEND

Monitoring Points

- Landfill Gas Monitoring Borehole
- Landfill Gas Surface Monitoring Point
- Combined Gas/ Groundwater Monitoring Point
- Gas Flare Stack
- Landfill Gas Extraction/ Leachate Monitoring Point
- Condensate Unit (Knock-out Pot)
- Groundwater Monitoring Borehole
- Groundwater Pumping Point
- Surface Water Monitoring Point
- Leachate Collection Point
- Leachate Monitoring Point
- Leachate Recirculation Point
- Valve
- Strategic Monitoring Point
- KOP
- PEG
- Manifold
- Finn Drains
- Pinwell

Gas Wells

- Gas Well 63Ø
- Gas Well 90Ø
- Gas Well 110Ø
- Gas Well 120Ø
- Gas Well 160Ø
- Gas Well 180Ø
- Gas Well 225Ø
- Gas Well 250Ø >
- Proposed Gas Well
- Underground / Assumed Gas Well

Wells (3rd Party Survey Data)

- Gas Well
- Leachate Well
- Knock Out Pot

Infrastructure Pipework

Above ground Pipe	Underground Pipe
32	32mm Gas Pipe
55	55mm Gas Pipe
63	63mm Gas Pipe
90	90mm Gas Pipe
110	110mm Gas Pipe
120	120mm Gas Pipe
125	125mm Gas Pipe
160	160mm Gas Pipe
180	180mm Gas Pipe
200	200mm Gas Pipe
250	250mm Gas Pipe
280	280mm Gas Pipe
315	315mm Gas Pipe
355	355mm Gas Pipe
400	400mm Gas Pipe
450	450mm Gas Pipe
500	500mm Gas Pipe
650	650mm Gas Pipe
L	Leachate Pipe
A	Airline Pipe
A/D	Air and Discharge Pipe
D	Discharge Pipe
CON	Condensate Pipe
LR	Leachate Recirculation Pipe
	Assumed Pipe

Notes:

1. All dimensions are in metres unless otherwise stated.
2. All survey co-ordinates related to local site co-ordinate system - positions and levels checked against site control.
3. For ground levels and depths to base of proposed wells please refer to spreadsheet; '6372_PW06 - Dockisway - Proposed Wells List - January 2018.xls'.
4. For ground levels and tops of as-built well levels please refer to spreadsheet; '6372_G803 - Dockisway - Gas Well Co-ordinates and levels - January 2017.xls'.
5. Background mapping copied from plan: 'INF-DOCKSWAY-GS-02B.dwg'

Disclaimer

THIS INFORMATION SHOULD NOT BE REGARDED AS ACCURATE AND SHOULD BE USED FOR GUIDANCE PURPOSES ONLY.

UTEC STARNET

GARD ID Prefix: DWY

Files/ Information used: INF-DOCKSWAY-GS-02B

REVISIONS

No	Description	By	Chk'd	Date

Project:

DOCKSWAY
LANDFILL SITE

Title:

Proposed Wells Plan

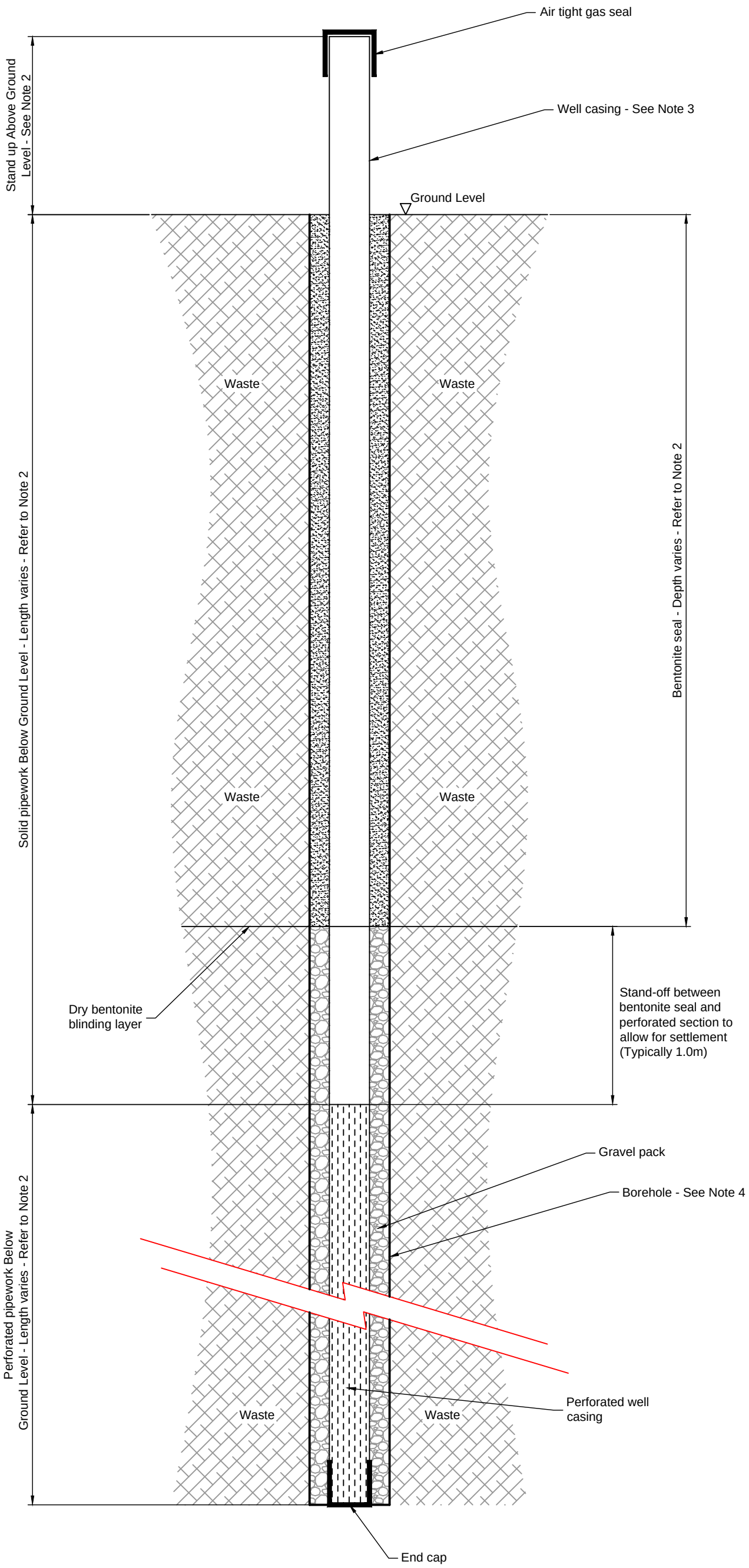
Drawn By	A.M.	Date	31/01/18
Chk'd By	J.M.	Date	31/01/18
Scale 1:	2000	Sheet Size	A1

Infinis Limited
First Floor
500 Pavilion Drive
Northampton Business Park
Northampton
NN4 7YJ

infinis

Drawing No: 6372_PW06

Detail B: Gas Extraction Well for Waste Profile



Notes

1. Do not scale from this drawing.
2. For details of pipework installation lengths etc. Refer to Tables 1 and 2 of the approved CQA Plan.
3. Well casing diameter to be confirmed prior to start of works (Refer to the latest approved CQA Plan).
4. Borehole to be constructed in accordance with the latest approved CQA Plan requirements.

Rev	Modifications	By	Chk	App	Date

Infinis Energy Services Ltd.

Gas Well Standard Detail

Gas Extraction Well Detail for Waste Profile

Drawn by	Checked by	Approved by
DMD	RF	RF
Date	**Scale @ A3**	**Revision**
23.02.2015	Not To Scale	F

Issue: Information

Drawing Number: SD.INF.002

ENGINEERING ENVIRONMENTAL HEALTH & SAFETY

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APPENDIX 2

CQA Inspector's Daily Report

Site Name:

Project:

Date		
Weather (include Wind Direction & Strength during Drilling Works)	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		
Issues Encountered (and Remedial Actions Taken)		
Comments		

For Egniol Environmental Ltd: _____

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

DRILLING REPORT					Well Number:
CQA INSPECTOR:-					Site:
CLIENT:					Peg Level (mAOD):
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

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)		

Egniol Environmental Ltd

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		

APPENDIX 3

CONTINGENCY ARRANGEMENTS FOR SEALING OF

CONTAINMENT ENGINEERING IN THE EVENT OF

LINER PERFORATION DURING DRILLING OPERATIONS

Introduction

The retrodrilling of leachate wells and gas wells in a landfill site will inevitably pose some risk to the containment engineering, as it is imperative that the borehole is located within the drainage layer but does not penetrate the liner. The drainage layer would normally be 300mm thick and referral to as built drawings, and survey levels should be undertaken prior to drilling operations commencing.

The method statement and environmental risk assessment contain procedures which minimise the chance of liner perforation. This document is intended to be a written contingency plan for immediate implementation should liner perforation occur.

1. Mobilisation and Setup

1.1 Prior to the commencement of drilling the following, additional, items will be located in the immediate vicinity of the drilling rig:-

i) Bentonite, at least 4 bags

ii) 4 bags of Portland cement

iii) Plunger tool

2. Liner Identification

2.1 Drilling operations in the vicinity of the liner would be carried out in accordance with zone 2 or zone 3 procedures, in the method statement, as

agreed with the Environment Agency (EA). Consequently the Flight auger will be advanced in 300mm or 150mm increments.

2.2 It is anticipated that, if a FML liner has been perforated, that a section of the liner will be recovered to the surface along with waste, conditioning agent if being used and possibly clay. The material will be inspected by the Lead Driller and CQA Engineer for confirmation that the material recovered is a section of the liner.

2.3 If the Lead Driller and CQA Engineer are of the opinion that the material is containment engineering then drilling operations will be immediately suspended.

2.4 The CQA Engineer will notify the client, Dragon Drilling and the EA that there is a possibility that liner has been perforated and that the repair contingency plan has been activated.

3. Repair Contingency Plan

3.1 The Ø406mm steel casing will have penetrated the FML and be embedded into the underlying strata, which may be clay. The steel will form a seal with the surrounding strata, which will limit leachate migration through the perforation.

3.2 A bentonite/cement mix will be prepared in the bentonite mixer, comprising two bags of bentonite and two of Portland cement.

3.3 On completion of hydration and thorough mixing, a procedure that would normally take less than 5 minutes, the mix will be poured into the steel casing.

3.4 The plunger tool will be attached to the drill head using drilling rods. The plunger tool is a circular steel plate with a rubber edge seal which ensures intimate contact between the plunger tool and the wall of the steel casing. The tool has a flap valve which is closed when the tool is lowered into a liquid and opens when the tool is withdrawn.

3.5 By lowering the plunger tool into the steel casing, using the drill head, the bentonite/cement will be delivered directly to the perforation under pressure. This will displace any leachate contained in void spaces and enable the bentonite/cement to permeate into voids that may be present.

3.6 The volume of bentonite/cement added will be approximately 200ltres. The ID of the steel casing will be Ø380mm and the theoretical depth of the plug will be approximately 1.8m.

3.7 The plunger tool will then be disconnected from the drill head and the weight of the plunger tool and drilling rods will maintain pressure on the bentonite.

3.8 The casing connector will then be used to connect the drill head to the top of the Ø406mm steel casing. The steel casing will be withdrawn by 150mm and the bentonite will enter any voids due to pressure caused by the weight of the plunger tool.

3.9 After a period of 30 minutes the steel casing will be withdrawn by a further 300mm allowing the bentonite/cement plug to be in contact with the surrounding waste.

3.10 Depending on the amount of bentonite that has been injected into the perforation, and surrounding waste, further bentonite/cement may be added to the borehole after the plunger tool has been fully removed. The flap valve on the tool will open on the upward movement of the tool preventing a vacuum condition.

3.11 The steel casing will continue to be removed, in 300mm increments every 30 minutes, with the addition of further bentonite if necessary until the casing has been retracted by at least 1000mm.

3.12 Review of the situation will be undertaken by the client, Dragon Drilling, the CQA Engineer and the EA regarding the removal of the steel casing and addition of further bentonite and cement.

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