Installation Report: WR7250/05/001
September 2015

GAS MONITORING BOREHOLES
INSTALLATION REPORT

LEADENHAM LANDFILL SITE

Prepared for
FCC ENVIRONMENT (UK) LIMITED

STRATUS ENVIRONMENTAL LIMITED
4245 PARK APPROACH
THORPE PARK
LEEDS
WEST YORKSHIRE
LS15 8GB

Project Quality Assurance
Information Sheet

Gas Monitoring Boreholes Installation Report
LEADENHAM LANDFILL SITE

Report Reference	:	WR7250/05/001	***Report Status***	:	For Approval
			Report Date	:	September 2015

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LEADENHAM LANDFILL SITE

GAS MONITORING BOREHOLES INSTALLATION REPORT

1. INTRODUCTION

1.1 Stratus Environmental Limited (STRATUS) were requested by FCC Environment (FCC) to supervise the installation of 3No. gas monitoring boreholes at Leadenham Landfill Site.

1.2 The works were undertaken on the 19th August 2015. The purpose of this report is to provide an accurate as-built record of the installed monitoring boreholes.

1.3 The Stratus Construction Quality Assurance (CQA) Engineer provided full-time supervision throughout the duration of the installation period.

2. THE SITE

2.1 Leadenham Landfill Site is located off Quarry Lane, Leadenham and lies approximately fifteen kilometres east of Newark on Trent, at National Grid Reference SK 962 525.

3. BOREHOLE INSTALLATION

3.1 General

3.1.1 Sirius Drilling Services Limited undertook the monitoring borehole installation on behalf of FCC. The work comprised the installation of 3No. gas monitoring boreholes; sunk using a Commachio C62 tracked rotary drilling rig.

3.1.2 The borehole location plan is presented in **Appendix A**.

3.1.3 The drilling logs for each borehole are presented in **Appendix B**.

3.2 Gas Monitoring Borehole

3.2.1 The gas monitoring boreholes were drilled using a 150mm tri cone drilling bit for the full length of the bore.

3.2.2 The CQA Engineer checked the depth of the borehole prior to pipework installation to confirm target depth had been met. **Appendix B** presents the borehole details.

3.2.3 Each borehole was sunk to a depth corresponding with the gas response zone. Details of the exact depths for each borehole sunk are presented in **Appendix B.** The boreholes were installed with 63mm HDPE slotted pipework from the base of the borehole. The pipework from ground level to 1.8m below ground level consisted of 63mm HDPE solid pipe. The CQA Engineer witnessed all pipework installation.

3.2.4 Following installation of the pipework, the annulus was filled with 10mm diameter gravel to 2m below ground level.

3.2.5 A 200mm layer of sand was placed above the gravel to prevent the hydrated bentonite leaching into the gravel layer.

3.2.6 Bentonite pellets were hydrated and placed from a depth of 1.8m below ground level to the surface. The CQA Engineer confirmed the correct depths were installed.

3.2.7 The boreholes were finished with a standard lockable steel borehole cover. The borehole covers were concreted into the ground.

3.2.8 Following a review of the installation it was found that the gas sampling taps had been installed without a sufficient upstand. The steel security cover was removed and the gas pipes extended, to allow better access for sampling and monitoring. The steel cover was then replaced and concreted into the ground.

4. LIAISON WITH AUTHORITIES AND REPORTING

4.1 The Environment Agency was informed of the commencement of work on site and had the opportunity to visit the site throughout the works to check any aspects of the works.

4.2 As a visual record of the works, the CQA Engineer supervising the works kept on-going photographic records. **Appendix C** represents a selection of photographs showing different aspects of the construction works.

4.3 The CQA Engineer maintained daily records throughout the duration of the works. These daily records highlighted any problems encountered, solutions adopted, and detailed the day-to-day site operations. The daily records are presented in **Appendix D**.

5. CONCLUSIONS

5.1 The monitoring boreholes were installed to the correct depth and in the desired location.

APPENDIX A
AS-BUILT DRAWING SHOWING LOCATION OF MONITORING BOREHOLES

459600E 459700E 459800E 459900E 460000E 460100E 460200E 460300E 460400E 460500E 460600E 460700E

352500N 352400N 352300N 352200N 352100N 352000N 351900N

N

BH5
178m North

Springs

1.22m RH

1.22m TK H

Lagoon 3

Lagoon 2

Lagoon 1

BH10

BH4

BH21/15

BH22/15

BH9

LCP5A

LMP5A

W03

W103

W81

LMP3A

Cell 5

Cell 6 Sump

LMP6A

Cell 6

Cell 3 Sump

Cell 3

BH8

Lagoon Discharge

S.W. Lagoon

Pond

LMP4B

LCP4

Cell 4

LMP4A

Cell 1

Ground Water Collection Lagoon

Ground Water Collection Lagoon Input (Pipe)

BH01/04

Lagoon 4

Green Waste

Cell 2

BH23/15

FOTHERGATE ROAD

LFG14

LFG15

LFG13

BH35/04

BH7

Leadenham Heath

LFG12

BH19

BH18

Leachate Tank

LFG1

Hill Top Farms

Civic Amenity Site

LFG2

Weighbridge & Site Office

LFG3

Wheelwash

BH02/04

LFG4

Restored Landfill Area C

LFG11

BH04/04

LFG10

BH03/04

LFG5

LFG6

LFG7

Site Entrance

LFG8

LFG9

101.6m

BH14

GP

101.9m

Spring

Track

BH5

Not to Scale

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.

2. DO NOT SCALE FROM THIS DRAWING.

3. ANY ANOMALIES IDENTIFIED WITH THE DETAILS SHOWN ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF FCC ENVIRONMENT (UK) LIMITED PRIOR TO CONSTRUCTION WORKS COMMENCING.

LEGEND:

- Springs (not currently sampled)
- Landfill Gas Monitoring Point
- Landfill Gas Surface Monitoring Probe
- Combined Gas/ Groundwater Monitoring Point
- Gas Flare Stack
- Landfill Gas Extraction Point
- Landfill Gas Extraction/ Leachate Monitoring Point
- Condensate Unit (Knock-out Pot)
- Gas Manifold
- Groundwater Monitoring Borehole
- Groundwater Pumping Point
- Surface Water Monitoring Point
- Leachate Collection Point
- Leachate Monitoring Point
- Leachate Recirculation Point
- Leachate Collection Sump
- Leachate Discharge Sampling Point
- Leachate Detection Point
- Underdrainage Monitoring Point
- Settlement Monitoring Point
- Drain/ Dewatering Tank
- Valve
- As-built Cell Footprint

Revision:	Date:	Description:	By:	Chk:
A	05/11/15	New leachate wells added	LH	GW
-	-	-	-	-
-	-	-	-	-

Reference files:
Information taken from plans:
Site Survey: 714W236

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FCC Environment (UK) Limited
6 Stirlings Court, White Rose Way, Doncaster, DN4 5NU

Site: **LEADENHAM**
LANDFILL SITE

Drawing Title:
Environmental Monitoring Plan

Drawn By:	Checked By:	Date:	Scale:	Paper Size:
BS	MG	18.09.15	1:1500	A1
Status:	Revision:	Plan Number:		Drawing No:
FINAL	-	PLAN 4		714M259

Last Saved By: Ben Stone Date: 7-Sep-15 PM By: ben.stone Date: 18-Sep-15

APPENDIX B
BOREHOLE LOG

SIRIUS DRILLING SERVICES LIMITED — **Site Investigation Drill Log**

4245 Park Approach, Thorpe Park, Leeds, LS15 8GB Tel: 0113 264 9960 Fax: 0113 264 9962

SIRIUS DRILLING SERVICES

Borehole No BH 23-15

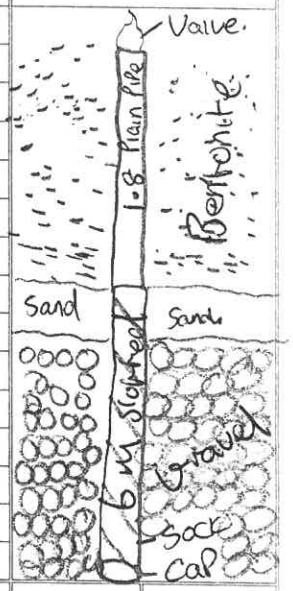
Job No 3194 — Contract Name Leadenham Landfill Site. — Crew Details R Edwards

Date 19/8/15 — Client Stratus — S. Woodhall.

Sheet 1 of 3 — Working Day N° Wednesday

Stratum Depth (m) From	Stratum Depth (m) To	Strata Description	Core Run From	Core Run To	Run Length (m)	Core recovery (m)	Flush Return %	Casing Depth (m)	Casing Size	Water Strikes (m)
000	0.5	overburden					100%			6 m
0.5	4.00	Limestone								
4.00	7.80	Mudstone. / cave wet at 6 m								
		6 m Slotted Pipe with Sock.								
		1.8 m Plain Pipe.								
		+ 1 Cap								
		- 1 Cover								
		- 1 Valve.								
		— backfilled with 4 Bags of Gravel.								
		½ Bag of Sand								
		2 Bags of Bentonite.								

Installation Detail



Remarks (standing, dayworks, testing etc)

Penetration Testing and Sampling

test	sample	Depth From	Depth To	Standard Penetration Tests 1	2	3	4	5	6	N		

Casing	Size	Depth

Flush Type Air

Rig Type Cb2.

Signed by SDS R. Edwards Date 19/8/15

Signed by Client ..... Date .....

SIRIUS DRILLING SERVICES LIMITED

Site Investigation Drill Log

4245 Park Approach, Thorpe Park, Leeds, LS15 8GB Tel: 0113 264 9960 Fax: 0113 264 9962

SIRIUS DRILLING SERVICES

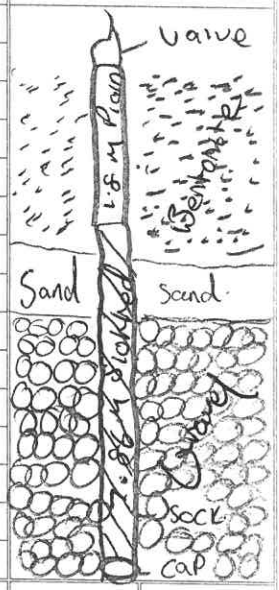
Borehole No BH22-15

Job No 3194 Contract Name Leadenham Landfill Site. Crew Details R. Edwards

Date 19/8/15 Client Stratus S. Woodhall.

Sheet 2 of 3 Working Day N° Wednesday

Stratum Depth (m) From	To	Strata Description	Core Run From	To	Run Length (m)	Core recovery (m)	Flush Return %	Casing Depth (m)	Casing Size	Water Strikes (m)	Installation Detail
							100%				
000	3.00	Overburden									
3.00	6.00	Limestone - traces of sand									
6.00	9.66	Mudstone.									
		7.86 M Slotted Pipe with Sock.									
		1.8 M Plain Pipe.									
		- Backfilled with 4 Bags of Gravel									
		½ Bag of Sand									
		2 Bags of Bentonite.									
		~~-~~ 1 Cover									
		× 1 Cap									
		× 1 Valve.									



Remarks (standing, dayworks, testing etc)

Penetration Testing and Sampling

test	sample	Depth From	Depth To	Standard Penetration Tests 1	2	3	4	5	6	N		

Casing	Size	Depth

Flush Type Air.

Rig Type C62.

Signed by SDS R. Edwards Date 19/8/15.

Signed by Client ..... Date .....

SIRIUS DRILLING SERVICES LIMITED

Site Investigation Drill Log

4245 Park Approach, Thorpe Park, Leeds, LS15 8GB Tel: 0113 264 9960 Fax: 0113 264 9962

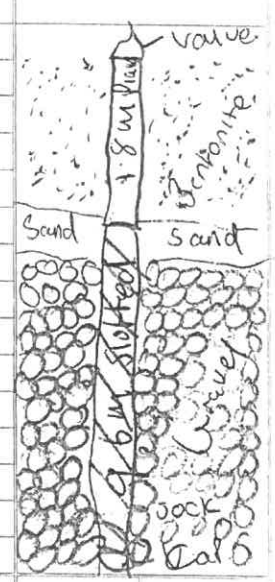
Borehole No BH21-15

Job No 3194 Contract Name Leadenham Landfill Crew Details R. Edwards

Date 19/8/15 Client Stratus. S. Woodhall.

Sheet 3 of 3 Working Day N° Wednesday

Stratum Depth (m) From	To	Strata Description	Core Run From	To	Run Length (m)	Core recovery (m)	Flush Return %	Casing Depth (m)	Casing Size	Water Strikes (m)	Installation Detail
000	350	overburden					0				
350	12.00	Fractured Limestone.		TOTAL							
		No flush.		23.4 6 m of slotted Pipe with Sock.							
				5.4 m of Plain Pipe.							
				× 3 covers							
	–	Backfilled with 6 Bags of		× 3 caps							
		Gravel.		× 3 valves							
	½	Bag of Sand		1½ Bag of Sand.							
	2	Bags of Bentonite.		14 Bags of Gravel							
	×	1 cover		6 Bags of Bentonite.							
	×	1 cap		2 Bags of Cement.							
	×	1 valve									
	–	9.6m slotted Pipe with sock									
		1.8m Plain Pipe.									



Remarks (standing, dayworks, testing etc)

All holes had a steel cover on and Concreted in.

Penetration Testing and Sampling

test	sample	Depth From	Depth To	Standard Penetration Tests 1	2	3	4	5	6	N

Casing	Size	Depth

Flush Type Air

Rig Type C62

Signed by SDS R. Edwards Date 19/8/15.

Signed by Client ...Date...

APPENDIX C
PHOTOGRAPHIC RECORD

PHOTOGRAPHS

Photograph 1 – Casagrande C62 drilling rig

Photograph 2 – Installing pipework into borehole by hand

PHOTOGRAPHS

Photograph 3 – Steel security cover with gas pipework

Photograph 4 – Drilling weephole into security cover

stratus environmental	Job Title Leadenham Gas Borehole Installation		Client FCC Environment	
	Approved ASC	Signature	Date Sep-15	Appendix C

PHOTOGRAPHS

Photograph 5 - BH21/15 completed installation

Photograph 6 - Pipework and sampling tap visible inside the steel security cover

stratus environmental	Job Title: Leadenham Gas Borehole Installation		Client: FCC Environment	
	Approved: ASC	Signature:	Date: Sep-15	Appendix C

PHOTOGRAPHS

Photograph 7 – Completed steel security cover to BH 22/15

Photograph 8 – Installing weephole to steel security cover

stratus environmental	Job Title: Leadenham Gas Borehole Installation		Client: FCC Environment	
	Approved: ASC	Signature:	Date: Sep-15	Appendix C

PHOTOGRAPHS

Photograph 9 – Completed Headworks

Photograph 10 – Installing weephole to steel security cover

stratus environmental	Job Title: Leadenham Gas Borehole Installation		Client: FCC Environment	
	Approved: ASC	Signature:	Date: Sep-15	Appendix C

APPENDIX D
DAILY RECORDS

Daily Site Record Sheet

Date:	19-08-15	Site:	Leadenham Landfill
Weather:	Sunny and Warm	CQA Plan Ref:	714M238

Visitors to Site:	Ryan Edwards Shaun Woodhall

Work Inspected and Progress on Site:

- Pre-work meeting with site manager and drilling operatives.
- Site reconnaissance to identify proposed borehole locations (BH21/15, BH22/15, BH23/15, BH02/04a) and any infrastructure in close proximity to locations.
- 1000 -1458: Drilling rig issues.
- 1458: Rig fixed and drilling started.

BH23/15 – Drilling completed

- Soils logging of in-situ material.
- Drill depth is 7.1m.
- Brownish yellow limestone from 0 to 4m depth.
- Blue grey clayey stone from about 4m depth.

Casing

- Cased well with 5.3m of 63mm perforated threaded HDPE pipe and endcap at the bottom section of the casing.
- Completed well with 1.8m of 63mm plain HDPE pipes.
- Gravel packed the annulus between the borehole and wells screen with none calcareous clean gravel (0mm-10mm) to 5.8m from bottom of the casing.
- During stone placement the installed 63mm diameter HDPE pipe was gently agitated to reduce the risk of bridging.
- Above the gravel about 0.2m of fine sand was placed to prevent bentonite bleed.
- Then about 0.5m bentonite cement saturated with water placed above the fine sand
- Completed casing with well saturated mixture of powder bentonite with water (slurry) to 0.6m depths from top of well.
- A lockable steel head cover of 200mm was cemented in place with concrete about 250mm thick and smooth trowel finished.
- Completed well with a bung and teffen valve at the top section of the plain HDPE pipe.

Quantity of materials used

- 4 bags of gravel
- ½ bag sand
- 2 bag bentonite

BH22/15 – Drilling completed

- Soils logging of in-situ material.
- Drill depth is 9.6m.
- Brownish yellow limestone from 0 - 6m depth.
- Blue grey clayey stone from 6 – 9.6m depth.

Casing

- Cased well with 7.8m of 63mm perforated threaded HDPE pipe and endcap at the bottom section of the casing.
- Completed well with 1.8m of 63mm plain HDPE pipes.
- Gravel packed the annulus between the borehole and wells screen with none calcareous clean gravel (0mm-10mm) to 8.3m from bottom of the casing.

- During stone placement the installed 63mm diameter HDPE pipe was gently agitated to reduce the risk of bridging.
- Above the gravel about 0.2m of fine sand was placed to prevent bentonite bleed.
- Then about 0.5m bentonite cement saturated with water placed above the fine sand
- Completed casing with well saturated mixture of powder bentonite with water (slurry) to 0.6m depths from top of well.
- A lockable steel head cover of 200mm was cemented in place with concrete about 250mm thick and smooth trowel finished.
- Completed well with a bung and teffen valve at the top section of the plain HDPE pipe.

Quantity of materials used
- 4 bags of gravel
- ½ bag sand
- 2 bags bentonite

BH21/15 – Drilling completed
- Soils logging of in-situ material.
- Drill depth is 11.5m.
- Fractured/weathered limestone from 0 - 3m.
- Grey clayey stone from 3 – 11.5m depth.

Casing
- Cased well with 9.6m of 63mm perforated threaded HDPE pipe and endcap at the bottom section of the casing.
- Completed well with 1.8m of 63mm plain HDPE pipes
- Gravel packed the annulus between the borehole and wells screen with none calcareous clean gravel (0mm-10mm) to 10.2m from bottom of the casing.
- During stone placement the installed 63mm diameter HDPE pipe was gently agitated to reduce the risk of bridging.
- Above the gravel about 0.2m of fine sand was placed to prevent bentonite bleed.
- Then about 0.5m bentonite cement saturated with water placed above the fine sand.
- Completed casing with well saturated mixture of powder bentonite with water (slurry) to 0.6m depths from top of well.
- A lockable steel head cover of 200mm was cemented in place with concrete about 250mm thick and smooth trowel finished.
- Completed well with a bung and teffen valve at the top section of the plain HDPE pipe.

Quantity of materials used
- 6 bags of gravel
- ½ bag sand
- 2 bags of bentonite

BH02/04a – Did not drill

The lead driller considered well location not ideal for drilling because of close proximity to the motoring road, will require traffic management system in place to construct borehole.

List of Plant	Hours of Operation	Comments
1 x Casagrande C6 XP rotary Drilling Rig 25 x Bulk bags 12 x Slotted pipes 8 x Plain pipes	0800 - 1700	

Prepared by:	O. C. AJURUCHI	Signed:	O.C. AJURUCHI