DISCHARGE OF PRE-OPERATIONAL AND IMPROVEMENT CONDITIONS

LEADENHAM LANDFILL SITE
QUARRY LANE
POTTERGATE
LEADENHAM
LINCOLNSHIRE
LN5 0QF

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DISCHARGE OF PRE-OPERATIONAL AND IMPROVEMENT CONDITIONS – LEADENHAM LANDFILL SITE, QUARRY LANE, POTTERGATE, LEADENHAM, LINCOLNSHIRE, LN5 0QF

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Prepared for : Lincwaste Limited

Prepared by : Sirius Environmental Limited
The Beacon Centre for Enterprise
Dafen
Llanelli
SA14 8LQ

Written by :

Michael Knott BSc (Hons) MSc FGS AIEMA AssocMCIWM
Environmental Consultant

Reviewed by :

Dylan Thomas BSc (Hons) PGDip MCIWM
Principal Environmental Consultant

Approved by :

Mark Griffiths BSc (Hons) MSc CEnv MCIWM CGeol
Environmental Director

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SUPPORTING STATEMENT

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1.0 INTRODUCTION

1.1 Scope and Background

1.1.1 Sirius Environmental Limited (Sirius) has been commissioned by Lincwaste Limited, part of the FCC Group of Companies ('FCC'), to prepare a report to the support the discharge of Pre-Operational Measures and Improvement Conditions associated with Environmental Permit EPR/XP3789NK held for Leadenham Landfill Site, Quarry Lane, Pottergate, Leadenham, Lincolnshire, LN5 0QF. The site location can be seen on **Drawing Reference ESID1**.

1.1.2 Operations at the site are authorised by Environmental Permit EPR/XP3789NK. The most recent variation of the Environmental Permit for Leadenham Landfill Site (EPR/XP3798NK/V013) was issued on 18th June 2020 and contained the previously set pre-operational conditions related to the Northern Area.

1.1.3 This report (and associated drawings and appendices) has been prepared to address the outstanding Pre-Operational Measures and Improvement Conditions associated with EPR/XP3798NK/V013.

2.0 SUMMARY OF OUTSTANDING PRE-OPERATIONAL MEASURES AND IMPROVEMENT CONDITIONS

2.1 Pre-Operational Measures For Future Development

2.1.1 As previously discussed, indicated the most recent variation of the Environmental Permit for Leadenham Landfill Site (EPR/XP3798NK/V013) was issued on 18th June 2020 and contained the previously set pre-operational conditions related to the Northern Area. The following Pre-Operational Measure was contained within Table S1.4 of this document:

- **Pre-Operational Measure 1:** *The operator shall:*
  - *Install groundwater boreholes around areas of future landfill development in the Northern Development Area.*
  - *Submit in writing for Environment Agency approval, a revised drawing (with referencing of new boreholes) and monitoring schedule to obtain background data over a period of at least 12 months (unless otherwise agreed in writing).*
  - *Undertake background monitoring in accordance with the Agency's written approval.*
  - *Submit in writing for Environment Agency approval, control and trigger levels for groundwater, based on the outcome of background monitoring around future landfill phases.*

- **Pre-Operational Measure 2:** *Unless otherwise agreed in writing, the operator shall submit a report in writing for the Environment Agency approval that includes details of the following:*

  - *The design of the interface lining system (ILS) over the temporary waste slopes on the northern and western side of the Southern Development Area;*
  - *A leachate squeezing analysis;*
  - *A method for monitoring the settlement of the lining system over the existing waste in the Southern Development Area. The proposed method should be submitted to the Environment Agency at least three months prior to construction;*
  - *Incorporation of the details for installation of any agreed monitoring system into the design drawings and CQA plan for the construction of the lining system over the old waste in the Southern Development Area;*
  - *Trigger levels to be set for the monitoring of the lining system; and*
  - *An action plan for exceedance of trigger levels.*

<u>Discharge of Pre-Operational Measure 1</u>

2.1.2 FCC have confirmed that sufficient background groundwater monitoring has been undertaken to satisfy the requirements of Pre-Operational Measure 1.

2.1.3 Groundwater monitoring boreholes around the northern, eastern and western periphery of the Northern Development Area were installed in August 2020. A copy of the Construction Quality Assurance Validation Report (prepared in November 2020) containing borehole logs and installation details is presented in **Appendix 1**.

2.1.4 In accordance with Pre-Operational Measure 1, the required monitoring schedule was agreed with the Environment Agency.

2.1.5 Additionally, FCC have agreed with the Environment Agency a reduced monitoring period of 6-months, with monitoring having commenced on 24th November 2020. A copy of this written agreement from Helen Dale (Regulatory Officer - EPR Installations North) dated 14th July 2020 is presented in **Appendix 2**.

2.1.6 Accordingly, FCC are seeking to set compliance limits for the groundwater monitoring boreholes around the Northern Development area and discharge Pre-Operational Measure 1.

2.1.7 Further details on the collected background groundwater monitoring data and corresponding proposed groundwater compliance limits are presented in **Section 3.0** of this report.

Discharge of Pre-Operational Measure 2

2.1.8 FCC have confirmed that the appropriate actions have been taken to discharge Pre-Operational Measure 2.

2.1.9 Accordingly, it is considered that the discharge of this Pre-Operational Condition has been addressed and as such is not considered further in this report.

2.2 Discharge of Improvement Programme Requirements

2.2.1 As previously discussed, the most recent variation of the Environmental Permit for Leadenham Landfill Site (EPR/XP3798NK/V013) was issued on 18th June 2020 and contains two Improvement Programme Requirements. Both of the Improvement Programme Requirements relate to monitoring borehole BH9A and comprise of the following:

- **Improvement Condition 1 (IC1)** – *The Operator shall:*
  - *Monitor, on a monthly interval, the new groundwater monitoring point BH9A and collect a statistically significant data set covering a minimum period of 12 months.*
  - *Undertake the monitoring in accordance with the Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003).*
  - *Establish the background concentrations and propose compliance limits for the parameters specified in schedule 3, table S3.4 and the corresponding control levels.*
  - *Submit a written report on the proposed compliance limits and action levels to the Environment Agency for approval.*
  - *The operator shall undertake the monitoring in accordance with the Environment Agency's written approval.*

- **Improvement Condition 2 (IC2)** – *The Operator shall:*
  - *Monitor, on a monthly interval, the new gas monitoring point BH9A and collect a statistically significant data set covering a minimum period of 12 months.*
  - *Undertake the monitoring in accordance with the Environment Agency Guidance LFTGN03 'Management of Landfill Gas' (September 2004).*
  - *Establish the background concentration of methane and carbon dioxide and propose compliance limit for methane and action levels for methane and carbon dioxide in accordance with Industry Code of Practice 'Perimeter soil gas emissions criteria and associated management' (January 2011, v1.01).*

- *Submit a written report on the gas compliance limit and action levels to the Environment Agency for approval.*
- *The operator shall undertake the monitoring in accordance with the Environment Agency's written approval.*

Discharge of Improvement Condition 1

2.2.2 FCC have confirmed that sufficient monitoring data has been collected to derive appropriate compliance limits and satisfy the requirements of Improvement Condition 1.

2.2.3 Accordingly, FCC are seeking to set groundwater compliance limits for BH09A and discharge Improvement Condition 1.

2.2.4 Further details on the collected background groundwater monitoring data and corresponding proposed groundwater compliance limits are presented in **Section 3.0** of this report.

Discharge of Improvement Condition 2

2.2.5 Accordingly, FCC are seeking to set perimeter ground gas compliance limits for BH09A and discharge Improvement Condition 1.

2.2.6 Further details on the collected background ground gas monitoring data and corresponding proposed ground gas action levels and/or compliance limits are presented in **Section 4.0** of this report.

3.0 DERIVATION OF GROUNDWATER COMPLIANCE LIMITS

3.1 General

3.1.1 In accordance with the requirements stipulated in Pre-Operational Measure 1 and Improvement Condition 1 of EPR/XP3798NK/V013 background groundwater conditions were recorded for the agreed durations.

3.1.2 Following statistical analysis of the collected monitoring data using the methodology outlined in the Environment Agency Research and Development document "Techniques for the Interpretation of Landfill Monitoring Data Guidance Notes, Report No. P1-471". The collected monitoring data was used to derive appropriate groundwater compliance limits.

3.2 Groundwater Levels

3.2.1 Groundwater level readings in the monitoring boreholes installed around the periphery of the Northern Development Area (BH04A, BH30, BH31, BH32, BH33, BH34, BH35, BH36 and BH37) were collected over a 6-month period between November 2020 and May 2021. The recorded groundwater levels and associated hydrograph are presented in **Appendix 3**.

3.2.2 Examination of the Northern Development Area groundwater hydrograph indicates that groundwater levels recorded in BH30, BH36 and BH37 are c. 2m higher than those recorded in other boreholes around the Northern Development Area. This observation strongly correlates with the existing hydrogeological conceptual site model for Leadenham Landfill Site which was developed on the understanding that groundwater levels were elevated in the southern portion of Leadenham Landfill Site (the Western and Southern Development Areas) compared to the Northern Development Area and that groundwater flows in a northerly direction.

3.2.3 It is also noted that despite being located on a similar location along the transect of Leadenham Landfill Site, groundwater levels in BH04A are lower than those of the existing monitoring point BH04. This observation also correlates with the existing hydrogeological conceptual site model for Leadenham Landfill which states that the Site is located on a groundwater divide aligned along the southwest/northeast axis of the site. The conceptual site model considered that groundwater levels decreased to the west and east of this axis as well as to the northeast (as discussed above). The observed decrease in groundwater levels away from the quarry voids between two boreholes located at similar positions along the landfill site's transect further supports the accepted hydrogeological conceptual site model.

3.2.4 A visual depiction of the conceptualised groundwater flow regime at Leadenham Landfill Site is presented in **Drawing Reference ESID11**.

3.2.5 Examination of groundwater levels recorded in individual boreholes identified that groundwater levels remained largely stable throughout the monitoring period, albeit with the indication of minor seasonal groundwater variations, with groundwater level fluctuations of c. 1m – 2m observed.

3.2.6 Groundwater level readings in the monitoring borehole BH09A installed along the northwest edge of the Western Development Area were collected between June 2019 and March 2021. The recorded groundwater levels and associated hydrograph are also presented in **Appendix 3**.

3.2.7 Examination of the BH09A groundwater hydrograph indicates that the recorded groundwater levels strongly correlate to those of the surrounding monitoring boreholes and to BH09; which BH09A replaced in May 2019. Consequently, the monitoring data suggests that BH09A has been installed correctly and functioning as intended. It is also noted that recorded groundwater levels in BH09A are higher than the levels recorded in the Northern Development Area, further supporting the existing hydrogeological conceptual site model.

3.2.8 A statistical summary of the recorded groundwater levels around the Northern Development Area and in BH09A are presented in **Table 1**. For comparative purposes, groundwater monitoring records for BH04 and BH09 are also presented.

Table 1: Summary of Groundwater Levels (mAOD) recorded around the Northern Development Area and in BH09A

Borehole ID	Min	Max	Range
Northern Development Area			
BH04A	81.45	82.01	0.56
BH30	82.95	83.92	0.97
BH31	81.72	82.40	0.68
BH32	81.13	83.28	2.15
BH33	81.10	82.65	2.16
BH34	80.93	82.06	1.13
BH35	82.14	82.76	0.32
BH36	83.30	84.18	0.88
BH37	82.61	84.32	1.71
Western Development Area			
BH09A	82.95	85.54	2.59
Existing Boreholes (For Comparative Purposes)			
BH04	82.67	83.63	0.96
BH09*	82.11	84.27	2.16

* Borehole BH09 replaced by BH09A in May 2019

3.3 Groundwater Quality Summary

3.3.1 Groundwater quality has been monitored in the Northern Development Area boreholes and BH09A between November 2020 and May 2021 and June 2019 to March 2021 respectively. The monitoring data and timeseries charts are presented in **Appendix 4** alongside statistical analysis for the following determinands:

- Ammoniacal Nitrogen;
- Chloride;
- Nickel;
- Mecoprop;
- Toluene; and
- Cadmium.

3.3.2 A statistical summary of the monitoring data is presented in **Table 2**. It is considered prudent to highlight that in instances where below Limit of Detection (LoD) concentrations were recorded these results were converted to 75% of the LoD Value for inclusion in statistical analysis.

Table 2: Statistical Summary of Groundwater Quality in Boreholes BH04A, BH30-BH37 and BH09A

Borehole ID	Statistic	Ammoniacal Nitrogen (mgN/l)	Chloride (mg/l)	Nickel (mg/l)	Mecoprop (µg/l)	Toluene (µg/l)	Cadmium (mg/l)
BH04A	Min	<0.01	16	<0.001	<0.02	<1	<0.00002
	Mean	0.05	67	0.004	<0.02	<1	0.00003
	95%ile	0.14	120	0.005	<0.02	<1	0.00005
	Max	0.14	123	0.006	<0.02	<1	0.00008
	St. Dev.	0.05	38	0.002	-	-	0.00002
	Count	14	14	14	1	1	14
BH30	Min	<0.01	33	0.002	<0.02	<1	<0.00002
	Mean	0.04	36	0.004	<0.02	<1	0.00002
	95%ile	0.15	38	0.007	<0.02	<1	0.00004
	Max	0.3	38	0.008	<0.02	<1	0.00005
	St. Dev.	0.08	1	0.002	-	-	0.00001
	Count	14	14	14	1	1	14
BH31	Min	<0.01	29	0.002	<0.02	<1	<0.00002
	Mean	0.01	31	0.003	<0.02	<1	0.00002
	95%ile	0.04	33	0.007	<0.02	<1	0.00005
	Max	0.08	36	0.01	<0.02	<1	0.00005
	St. Dev.	0.02	2	0.002	-	-	0.00001
	Count	14	14	0.14	1	1	14
BH32	Min	<0.01	21	0.006	<0.02	<1	<0.00002
	Mean	0.13	25	0.010	<0.02	<1	0.00003
	95%ile	0.34	28	0.014	<0.02	<1	0.00008
	Max	0.4	32	0.015	<0.02	<1	0.00011
	St. Dev.	0.1	3	0.003	-	-	0.00003
	Count	14	13	14	1	1	14
BH33	Min	<0.01	18	0.001	<0.02	<1	<0.00002
	Mean	0.03	34	0.003	<0.02	<1	0.00002
	95%ile	0.13	53	0.005	<0.02	<1	0.00006
	Max	0.2	57	0.006	<0.02	<1	0.00008
	St. Dev.	0.05	13	0.001	-	-	0.00002
	Count	14	13	14	1	1	14
BH34	Min	<0.01	43	0.001	<0.02	<1	<0.00002
	Mean	0.01	59	0.002	<0.02	<1	0.00002
	95%ile	0.02	71	0.005	<0.02	<1	0.00004
	Max	0.02	76	0.006	<0.02	<1	0.00006
	St. Dev.	0.01	8	0.001	-	-	0.00001
	Count	14	14	14	1	1	14
BH35	Min	<0.01	155	<0.001	<0.02	<1	<0.00002
	Mean	0.02	189	0.001	<0.02	<1	0.00002
	95%ile	0.04	213	0.002	<0.02	<1	0.00005
	Max	0.05	217	0.002	<0.02	<1	0.00006
	St. Dev.	0.01	22	0.001	-	-	0.00001
	Count	14	14	14	1	1	14
BH36	Min	<0.01	91	<0.001	<0.02	<1	<0.00002
	Mean	0.03	109	0.001	<0.02	<1	0.00002

Borehole ID	Statistic	Ammoniacal Nitrogen (mgN/l)	Chloride (mg/l)	Nickel (mg/l)	Mecoprop (µg/l)	Toluene (µg/l)	Cadmium (mg/l)
	95%ile	0.07	122	0.003	<0.02	<1	0.00005
	Max	0.08	123	0.004	<0.02	<1	0.00006
	St. Dev.	0.02	9	0.001	-	-	0.00001
	Count	14	14	14	1	1	14
BH37	Min	<0.01	74	0.003	<0.02	<1	<0.00002
	Mean	0.03	172	0.006	<0.02	<1	0.00004
	95%ile	0.08	300	0.009	<0.02	<1	0.00010
	Max	0.11	302	0.015	<0.02	<1	0.00013
	St. Dev.	0.03	69	0.003	-	-	0.00003
	Count	14	14	14	1	1	14
BH09A	Min	0.4	26	0.013	<0.02	<1	<0.00002
	Mean	1.96	107	0.042	<0.02	<1	0.00006
	95%ile	2.64	179	0.137	<0.02	<1	0.00015
	Max	2.7	204	0.138	<0.02	<1	0.00019
	St. Dev.	0.74	49	0.043	-	-	0.00006
	Count	13	13	13	2	2	13

3.3.4 Ammoniacal Nitrogen concentrations have remained largely consistent across the monitoring periods in each of the groundwater monitoring boreholes with no overall increasing or decreasing trends. It is noted that ammoniacal nitrogen concentrations within BH09A are elevated relative to the concentrations recorded on the Northern Development Area boreholes. Upon closer comparison with the ammoniacal nitrogen concentrations recorded in BH09 (the borehole BH09A replaced) a strong correlation between the two datasets is observed.

3.3.5 A short period of relatively elevated ammoniacal nitrogen concentrations is observed in BH32 between late December 2020 and late February 2021. During this period ammoniacal nitrogen concentrations in this borehole increased to a maximum of 0.4mgN/l before returning to lower levels where concentrations remained for rest of the monitoring period. Given the lateral distance between BH32 and existing waste deposits and that none of the other monitoring boreholes (included those located adjacent to BH32) recorded similar increases, it is considered that the observed increase in BH32 is the result of a localised variation in background groundwater chemistry.

3.3.6 A short-lived increase in ammoniacal nitrogen concentrations is also recorded in BH04A between March 2021 and April 2021. During this time ammoniacal nitrogen concentrations in BH04A increased from 0.01mgN/l to 0.14mgN/l before reducing to 0.04mgN/l.

3.3.7 Chloride concentrations in the assessed groundwater monitoring boreholes have also remained largely stable across the monitoring periods. However, unlike ammoniacal nitrogen, BH04A displayed an increasing chloride concentration trend.

3.3.8 The observed increasing trend in BH04A saw chloride concentrations increase from 16mg/l in December 2020 to 123mg/l in May 2021. As demonstrated in **Drawing Reference 714M259J**, BH04A is located c.150m west and north of the Northern and Western Development Areas, respectively. Comparison of this trend against monitoring boreholes located alongside the periphery of the Western Development Area and those in the Northern Development Area in the

vicinity of BH04A did not show the same increasing trend. Consequently, in it considered that the observed chloride concentrations within BH04A are the result of either an external influence unrelated to existing landfill operations and/or natural geochemical variations within the lithology in which the monitoring boreholes are installed.

3.3.9 A clear delineation in chloride concentrations is also noted between groundwater monitoring boreholes installed along the periphery of the Northern Development Area. It is noted that chloride concentrations in monitoring boreholes located along the northwest and northern boundaries of the Northern Development Area void (BH04A, BH30 – BH34) are noticeably lower than those recorded in boreholes along the eastern boundary (BH35 – BH37). Average chloride concentrations along the northwest and northern boundaries are typically between c.30mg/l and 60mg/l compared to between c.110mg/l and 190mg/l along the eastern boundary.

3.3.10 Comparison against chloride concentrations for existing monitoring boreholes installed at Leadenham Landfill Site (as presented in **Document Ref:. WR7770/07**) indicates that groundwater monitoring boreholes on the eastern side of the groundwater divide indicate higher mean chloride concentrations than those on the western side of the groundwater divide. These increased chloride levels are observed in upgradient boreholes (BH14 – mean chloride concentration of 69.1mg/l), perimeter boreholes (BH05/04 – mean chloride concentration of 88.5mg/l) and off-site downgradient monitoring boreholes (BH07 – mean chloride concentration of 101.8mg/l).

3.3.11 As all groundwater monitoring installations around the perimeter of the Northern Development Area were installed according to the same methodology and into undisturbed underlying geology.

3.3.12 Examination of the site layout and depositional arrangement presented in **Drawing Reference WR7770/09/03** and the hydrogeological flow regime presented in **Drawing Reference ESID11** against borehole positioning presented in **Drawing Reference 714M259J** identified that monitoring boreholes installed along the north-eastern boundary of the Northern Development Area void (BH33 and BH34) are hydraulically disconnected from the existing waste deposits in the Western and Southern Development Areas. It is also noted that boreholes installed along the western boundary of the Northern Development Area (BH04A, BH30, BH31 and BH32) are down or cross-gradient of the Western Development Area. Similarly, it is noted that boreholes installed along the eastern boundary of the Northern Development Area void (BH35, BH36 and BH37) are also downgradient of the Southern Development Area.

3.3.13 The strong correlation between the boreholes installed along the western and northern boundaries of the Northern Development Area alongside the comparable chloride concentrations recorded in monitoring boreholes located in the immediate vicinity of the Western Development Area, suggest that BH04A and BH30 – BH34 are not influenced by existing waste deposits and are depicting background concentrations.

3.3.14 With regards to the monitoring boreholes installed along the eastern boundary of the Northern Development Area void (BH35, BH36 and BH37), upon comparison with existing monitoring boreholes, it is considered that the background concentrations of chloride contained within groundwater present on the eastern side of the groundwater divide is higher than that present in the groundwater on the western side of the groundwater divide. Additionally, it is

noted that there is the potential for an external source to influence the monitoring boreholes along the eastern boundary of the Northern Development Area which is not present along the northwestern and northern boundaries.

3.3.15 An examination of the land-use surrounding the boreholes located along the eastern boundary of Leadenham Landfill Site (including BH35-BH37) identified the presence of historic waste deposition activities in the unlined Southern Development Area and Pottergate road; which runs parallel to the eastern boundary of Leadenham Landfill Site. It is considered that both of these locations have the potential to act as external sources of chloride to augment the relatively elevated concentrations recorded present on the eastern side of the groundwater divide.

3.3.16 Comparison of the chloride concentrations recorded in BH09A against those recorded in BH09 once again show strong correlation. It is noted that chloride concentrations initially peaked at 204mg/l in December 2020, however, concentration subsequently dropped to a level comparable to that recorded in BH09.

3.3.17 A degree of stability was observed in the recorded nickel concentrations with the majority of recorded concentrations falling below 0.01mg/l with the maximum recorded concentration of 0.015mg/l. As with the recorded ammoniacal nitrogen concentrations, no overall increasing or decreasing trends were observed in the nickel time-series plots, although some low magnitude fluctuations were observed. Such a fluctuation was observed in BH04A , with concentrations decreasing from 0.005mg/l to 0.001mg/l before increasing back to 0.005mg/l. As with chloride concentrations these nickel fluctuations are considered to be the result in natural geochemical variations within the lithology in which the monitoring boreholes are installed.

3.3.18 A similar relative increase in nickel concentrations was observed in BH32 occurring across the same period of time as the previously noted increase in ammoniacal nitrogen concentrations. Once again, concentrations increased around late December 2020 and returned to original levels by the middle of March 2021. As with the ammoniacal nitrogen concentration no other boreholes displayed a similar increase. Given the lateral distance between BH32 and existing waste deposits and that none of the other monitoring boreholes (included those located adjacent to BH32) recorded similar increases, it is also considered that the observed increase in BH32 is the result of a localised variation in background groundwater chemistry.

3.3.19 No concentrations above LoD values were recorded for either mecoprop or toluene. However, comparison with groundwater quality records for existing monitoring boreholes confirms that the absence of these determinands above LoD levels across the Leadenham Landfill Site.

3.3.20 Cadmium concentrations follow a similar trend to recorded nickel concentrations. Recorded cadmium concentrations in the assessed monitoring boreholes do not exceed 0.00019mg/l across their respective monitoring periods, with a significant number of concentrations below 0.00006mg/l. Small level fluctuations are observed within the time-series plots; however, these are considered to be the result of natural geochemical variations influenced by the surrounding geology.

3.3.21 Overall, the background groundwater quality recorded in the boreholes presented in **Table 2**, compares favourably to the groundwater quality recorded in the other monitoring boreholes installed at Leadenham Landfill Site. As such

it is considered that the boreholes presented in **Table 2** largely depict background groundwater quality uninfluenced by existing landfill activities. The only exception to this is the chloride concentrations recorded in BH35 – BH37 where there is some indication that an external factor is influencing these boreholes. Examination of likely sources suggests that the historic landfill in the Southern Development Area is a possible source with run-off from the adjacent road network also a possible factor.

3.4 Groundwater Compliance Limits

3.4.1 Where suitable to do so, ammoniacal nitrogen and nickel groundwater compliance limits for the Northern Development Area boreholes; BH04A, BH30, BH31, BH32, BH33, BH34, BH35, BH36 and BH37, and BH09A have been derived from the mean concentrations plus three standard deviations. Due to the observed concentration variations between individual boreholes, it is considered prudent for individual compliance limits for these determinands to be set for each monitoring borehole.

3.4.2 The use of mean concentrations plus three standard deviations is considered appropriate to derive compliance limits for these determinands as it allows for compliance limits to be derived from location specific monitoring data rather and also provides a buffer zone above the maximum recorded concentrations to account for elevated natural concentrations which might have not been detected in the recorded dataset.

3.4.3 However, it has been noted that in some instances, particularly in boreholes where monitoring data has been confined to a small standard deviation, such an approach does not allow for a sufficient buffer zone to accommodate natural background variations not observed in the dataset. In such circumstances, the proposed compliance limit would be below a number of the higher concentrations recorded. If the mean plus three standard deviation approach was applied to such boreholes, then there is a possibility that background concentrations (uninfluenced by any waste activities) could exceed the compliance limit and as a result in a perceived non-compliance. In such situations it is considered prudent to set compliance limits at 20% above the maximum recorded concentration for that determinand in the corresponding borehole.

3.4.4 This approach should provide a more representative buffer zone to capture the higher background concentrations not observed in the monitoring records whilst also ensuring a compliance limit will not facilitate the degradation of background groundwater quality.

3.4.5 With regards to compliance limits for chloride, mecoprop, toluene and cadmium, in light of the strong correlation between the concentrations presented in **Table 2** and those recorded in existing monitoring boreholes, it is considered appropriate to adopt the existing EA approved site-wide compliance limits for these determinands. This approach has been proposed to maintain consistency with existing groundwater protection and compliance arrangements in place at Leadenham Landfill Site.

3.4.6 As with groundwater compliance limits for ammoniacal nitrogen and nickel, it has been noted that the existing chloride groundwater compliance limit does not allow for a sufficient buffer zone to accommodate natural background variations not observed in the dataset. Accordingly, compliance limits in these instances have been derived using the aforementioned mean plus three standard deviation methodology.

3.4.7

3.4.8 **Table** 3 below summarises the proposed compliance limits for the Northern Development Area boreholes and BH09A.

Table 3: Proposed Groundwater Compliance Limits for Northern Development Boreholes and BH09A

Borehole ID	Determinand					
	Ammoniacal Nitrogen (mgN/l)	Chloride (mg/l)	Nickel (mg/l)	Mecoprop (µg/l)	Toluene (µg/l)	Cadmium (mg/l)
Northern Development Area						
BH04A	0.2[1]	250[3]	0.01[1]	0.24[3]	4[3]	0.002[3]
BH30	0.36[2]	250[3]	0.01[1]	0.24[3]	4[3]	0.002[3]
BH31	0.1[2]	250[3]	0.012[2]	0.24[3]	4[3]	0.002[3]
BH32	0.43[1]	250[3]	0.019[1]	0.24[3]	4[3]	0.002[3]
BH33	0.24[2]	250[3]	0.008[2]	0.24[3]	4[3]	0.002[3]
BH34	0.04[1]	250[3]	0.008[2]	0.24[3]	4[3]	0.002[3]
BH35	0.06[2]	255[1]	0.004[1]	0.24[3]	4[3]	0.002[3]
BH36	0.09[1]	250[3]	0.005[2]	0.24[3]	4[3]	0.002[3]
BH37	0.12[1]	379[1]	0.018[2]	0.24[3]	4[3]	0.002[3]
Western Development Area						
BH09A	4.18[1]	250[3]	0.171[1]	0.24[3]	4[3]	0.002[3]

1 Compliance Limit determined using mean + 3 standard deviations (as presented in **Table 2**)
2 Compliance Limit determined using maximum recorded concentration + 20% (as presented in **Table 2**)
3 Compliance Limit determined in accordance with previously approved and adopted Compliance Limits for Leadenham Landfill Site

3.4.9 As with all compliance limits adopted for Leadenham Landfill Site. The compliance limits presented in

3.4.10 **Table** 3 will reviewed at regular intervals alongside future monitoring datasets and updated as required.

4.0 DERIVATION OF PERIMETER GAS ACTION LEVELS AND COMPLIANCE LIMITS

4.1 General

4.1.1 In accordance with the requirements stipulated in Improvement Condition 2 of EPR/XP3798NK/V013 background gas conditions were recorded at BH09A for the agreed durations.

4.1.2 Following statistical analysis of the collected monitoring data using the methodology outlined in the Environment Agency Research and Development document "Techniques for the Interpretation of Landfill Monitoring Data Guidance Notes, Report No. P1-471". The collected monitoring data was used alongside the Industry Code of Practice on Perimeter Soil Gas (ICoP); accepted as a reasonable approach by the EA in their position statement issued August 2011, to derive appropriate perimeter gas action levels and compliance limits.

4.1.3 In addition to discharging Improvement Condition 2, perimeter gas action levels and compliance limits will be derived for selected boreholes around the perimeter of the Northern Development Area. The selected boreholes are:

- BH04A;
- BH30;
- BH31;
- BH32;
- BH33; and
- BH34

4.1.4 There are no proposals to derive perimeter gas action levels and compliance limits for BH35, BH36 or BH37. This is due to the presence to existing perimeter gas compliance points in the immediate vicinity of these three boreholes. The existing perimeter gas compliance points of LFG14, LFG15, and LFG16 are in the immediate vicinity of BH37, BH36 and BH35 respectively.

4.2 Gas Quality Summary

4.2.1 Perimeter gas quality has been monitored in the selected Northern Development Area boreholes and BH09A between November 2020 and May 2021 and April 2019 to June 2021 respectively. The monitoring data and timeseries charts are presented in **Appendix 5** alongside statistical analysis for the following determinands:

- Carbon Dioxide; and
- Methane.

4.2.2 Time-series charts and full datasets for all other monitored parameters (incl. oxygen and atmospheric pressure) are also presented in **Appendix 5**.

4.2.3 A statistical summary of the monitoring data is presented in **Table 4**. It is considered prudent to highlight that in instances where below Limit of Detection (LoD) concentrations were recorded these results were converted to 75% of the LoD Value for inclusion in statistical analysis.

Table 4: Statistical Summary of Perimeter Gas Quality in Boreholes BH04A, BH30-BH34 and BH09A

Borehole ID	Statistic	Carbon Dioxide (%v/v)	Methane (%v/v)
Northern Development Area			
BH04A	Min	<0.1	0
	Average	1.0	0
	95%ile	2.5	0.1
	Max	2.9	0.1
	St. Dev.	1.0	0
	Count	13	13
BH30	Min	0.2	0
	Average	0.4	0
	95%ile	0.6	0.1
	Max	0.7	0.1
	St. Dev.	0.2	0
	Count	13	13
BH31	Min	0.6	0
	Average	4.3	0
	95%ile	6.2	0.1
	Max	6.4	0.1
	St. Dev.	1.6	0
	Count	13	13
BH32	Min	<0.1	0
	Average	4.3	0
	95%ile	8.7	0.1
	Max	8.8	0.1
	St. Dev.	3.5	0
	Count	13	13
BH33	Min	<0.1	0
	Average	0.1	0
	95%ile	0.1	0.1
	Max	0.1	0.1
	St. Dev.	0.1	0
	Count	13	13
BH34	Min	<0.1	0
	Average	0.2	0
	95%ile	0.3	0.1
	Max	0.3	0.1
	St. Dev.	0.1	0
	Count	13	13
Western Development Area			
BH09A	Min	<0.1	0
	Average	0.4	0
	95%ile	1.0	0
	Max	1.2	0
	St. Dev.	0.4	-
	Count	26	25

4.2.4 In addition to the aforementioned statistical and histogram analysis, long term time-series charts were generated and examined to identify whether the sub-surface environmental should be classified as stable/unstable and confirm whether there are any long-term trends recorded for any of the monitored determinands.

4.2.5 Examination of the time-series charts and statistical analysis generated for all boreholes identifies that carbon dioxide concentrations recorded within all boreholes fluctuate within a narrow band of concentrations (between 0 and 3%). It was noted that carbon dioxide concentrations within boreholes BH31 and BH32 show relatively higher carbon dioxide concentrations that those recorded in other analysed monitoring borehole, however, these also fell within narrow concentration bands of 2.5% to 6% and 5% to 9% respectively.

4.2.6 Examination of the methane time-series plots generated for all boreholes identifies that no methane was detected above 0.1% throughout the monitoring periods. Statistical analysis identified that the 0.1% concentrations detected in the Northern Development Area boreholes were statistically significant and hence retained in the dataset. The statistical analysis did identify that the 0.1% methane concentration in BH09A as an outlier and as such it was removed from the dataset. This outlier assessment was supported by the observations that these elevated methane concentrations were one-off readings with concentrations immediately returning to non-detectable levels.

4.2.7 The examination of the selected monitoring borehole time-series charts and statistical analysis indicated a stability in recorded perimeter gas concentrations. Accordingly, it is considered that the datasets for each borehole qualify as stable datasets.

4.3 Perimeter Gas Compliance Limits and Action Levels

4.3.1 Perimeter gas compliance limits and action levels for the selected monitoring boreholes will be derived in accordance with the ICoP guidance document. The derivation of these limits will be accomplished using the recorded perimeter ground gas datasets recorded in each individual borehole and account for the geographical position of each borehole in relation to surrounding sensitive human receptors.

4.3.2 It is important to note that each borehole presented in **Table 4** will be assigned both a methane action level and compliance limit.

4.3.3 It is proposed based on the guidance presented in the ICoP that no compliance limits are set or included in the permit and that the action limits are included in the site Gas Management Plan along with a revised action plan for breaches of the carbon dioxide action limit.

4.3.4 Following the analysis of the selected monitoring borehole datasets which included the visual examination of time-series charts and statistical outlier assessment, it was considered that the recorded datasets represent a stable sub-surface environment. Accordingly, it is considered that the corresponding methane and carbon dioxide action level and compliance limit derivation criteria presented in the ICoP can be applied.

4.3.5 Due to the stability of the analysed datasets; as demonstrated in the time-series plots presented in **Appendix 5** and the datasets presented in **Table 4**, the action levels for carbon dioxide in the perimeter boreholes are set at either 1.0% or 2.0% above the T_{max} carbon dioxide concentration. The proposal of carbon dioxide action levels 1.0% or 2.0% above corresponding T_{max} concentrations

was informed by the ICoP guidance which states that where T_{max} concentrations are below 5% action levels should be set 1% higher that measured T_{max} concentrations and that T_{max} concentrations between 5% and 10% should be set 2% higher than measured T_{max} concentrations.

4.3.6 Due to the stability of the analysed datasets; as demonstrated in the time-series plots presented in **Appendix 5** and the datasets presented in **Table 4**, the action levels for methane in the perimeter boreholes are set at 0.5% above the background (T_{max}) methane concentration in accordance with the ICoP guidance.

4.3.7 In addition to methane action levels, compliance limits for methane will also be applied to the assessed monitoring boreholes. In accordance with the ICoP guidance, the methane compliance limits will be set at 1.0% above the T_{max} methane concentration.

4.3.8 The proposed carbon dioxide action levels and methane action levels and compliance limits for the assessed monitoring boreholes are presented in **Table 5** alongside T_{max} concentration recorded in each individual perimeter borehole.

Table 5: Proposed action levels and compliance limits for carbon dioxide and methane in boreholes BH04A, BH30-BH34 and BH09A

Borehole ID	Carbon Dioxide (%v/v)		Methane (%v/v)		
	T_{max} Concentration	*Action Level*	*T_{max} Concentration*	*Action Level*	*Compliance Limit*
Northern Development Area					
BH04A	2.9	3.9	0.1	0.6	1.1
BH30	0.7	1.7	0.1	0.6	1.1
BH31	6.4	8.4	0.1	0.6	1.1
BH32	8.8	10.8	0.1	0.6	1.1
BH33	0.1	1.1	0.1	0.6	1.1
BH34	0.3	1.3	0.1	0.6	1.1
Western Development Area					
BH09A	1.2	2.2	0	0.5	1

4.4 Adoption of The Proposed New Action Levels and Compliance Levels into the Leadenham Landfill Site Gas Management Plan

4.4.1 FCC have confirmed that the proposed carbon dioxide action levels and methane action levels and compliance limits presented in **Table 5** will be fully adopted into Leadenham Landfill Site's Gas Management Plan. Accordingly, the Gas Management Plan has been updated to include direct reference to action levels and compliance limits for both methane and carbon dioxide.

4.4.2 The revised Leadenham Landfill Site Gas Management Plan further states the investigation process that will be employed should any breaches of action levels or compliance limits are recorded.

4.4.3 A copy of the revised Gas Management Plan for the Leadenham Landfill Site has been included alongside in Appendix 6 of the Supporting Statement to the application (**Document Ref:. WR7770/05**).

5.0 REVISIONS TO ENVIRONMENTAL MONITORING SCHEDULE

5.1 General

5.1.1 Considering the proposals to discharge Pre-Operational Measure 1 and Improvement Conditions 1 & 2 it is considered prudent to revise certain aspects of the Environmental Monitoring Schedule presented in Schedule 3 of Environmental Permit EPR/XP3789NK.

5.1.2 The proposed revisions primarily relate to the inclusion of additional groundwater and perimeter gas monitoring points (and associated compliance limits) in Table S3.4 (Groundwater – emission limits and monitoring requirements), and Table S3.5 (Landfill gas in external monitoring boreholes – limits and monitoring requirements).

5.1.3 The proposed revisions for each of the above Tables with Schedule 3 are presented and discussed in **Section 5.2**.

5.2 Revised Environmental Monitoring Schedule Proposals

Table S3.4 (Groundwater – emission limits and monitoring requirements)

5.2.1 Following the derivation of groundwater compliance limits for the monitoring boreholes presented in

5.2.2 **Table** 3 it is considered appropriate to incorporate these aspects into Table S3.4 of Environmental Permit EPR/XP3798NK.

5.2.3 The new groundwater monitoring points and associated compliance for inclusion within Table S3.4 of EPR/XP3798NK are presented in **Table 6**.

Table 6: Leadenham Landfill Site – Groundwater – emission limits and monitoring requirements

Monitoring Point Reference	Parameter	Limit (including unit)	Reference Period	Monitoring Frequency	Monitoring standard or method
BH04A as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	181mgl/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.20mg/l			
	Nickel	0.01mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH30 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	46mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.36mg/l			
	Nickel	0.01mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH31 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	44mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.012mg/l			
	Nickel	0.1mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			

Monitoring Point Reference	Parameter	Limit (including unit)	Reference Period	Monitoring Frequency	Monitoring standard or method
BH32 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	39mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.43mg/l			
	Nickel	0.019mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH33 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	73mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.24mg/l			
	Nickel	0.008mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH34 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	91mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.04mg/l			
	Nickel	0.008mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			

Monitoring Point Reference	Parameter	Limit (including unit)	Reference Period	Monitoring Frequency	Monitoring standard or method
BH35 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	255mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.06mg/l			
	Nickel	0.004mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH36 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	136mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.09mg/l			
	Nickel	0.005mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			
BH37 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Chloride	379mg/l	Spot Sample	Quarterly	As specified in Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 – Environmental Risk Assessment for permits, Annex J3, version 2.1, Dec 2011) or such other subsequent guidance as may be agreed in writing with the Environment Agency.
	Ammoniacal Nitrogen	0.12mg/l			
	Nickel	0.018mg/l			
	Cadmium	0.002mg/l			
	Mecoprop	0.24µg/l		Annually	
	Toluene	4µg/l			

5.2.4 In addition to their incorporation into Table S3.4, the groundwater monitoring boreholes presented in

5.2.5 **Table** 3 will be incorporated into the existing groundwater monitoring schedule presented in Table 3.7 of Environmental Permit EPR/XP3798NK. Due to the position of the additional boreholes down and/or cross-gradient to the Leadenham Landfill Site it is considered that they will be monitoring in accordance with the corresponding parameters and monitoring frequencies.

Table S3.5 (Landfill Gas in External Monitoring Boreholes – Limits and Monitoring Requirements)

5.2.6 Following the derivation of perimeter gas compliance limits and action levels for the monitoring boreholes presented in **Table 5** it is considered appropriate to incorporate these aspects into Table S3.5 of Environmental Permit EPR/XP3798NK.

5.2.7 The new groundwater monitoring points and associated compliance for inclusion within Table S3.4 of EPR/XP3798NK are presented in **Table 7**.

Table 7: Leadenham Landfill Site – Landfill gas in external monitoring boreholes – limits and monitoring requirements

Monitoring Point Ref./Description	Parameter	Limits (including units)	Monitoring Frequency	Monitoring Standard or Method
Northern Development Area – Group 2 BH04A, BH30, BH31, BH32, BH33 and BH34 as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Methane	1.1 %v/v	Monthly	As per LFTGN03 (v1.0, 2004) or such other subsequent guidance as may be agreed in writing with the Environment Agency. Record whether the ground is: Waterlogged Frozen Snow Covered
	Carbon Dioxide	No Limit		
	Oxygen			
	Atmospheric Pressure			
	Differential Pressure			
BH09A as shown on Environmental Monitoring Plan, drawing number 714M259, Revision J, dated 21/04/2021	Methane	1 %v/v		
	Carbon Dioxide	No Limit		
	Oxygen			
	Atmospheric Pressure			
	Differential Pressure			

TerraConsult

November 2020
Report No 4847-R2-1

LEADENHAM LANDFILL
INSTALLATION OF GAS & GROUNDWATER MONITORING BOREHOLES

VALIDATION REPORT

Prepared For

FCC Environment Ltd

LEADENHAM LANDFILL INSTALLATION OF GAS & GROUNDWATER MONITORING BOREHOLES

VALIDATION REPORT

Date: November 2020

Carried Out For:

FCC Environment Ltd

Prepared By:

TerraConsult Ltd
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

Tel: 01925 291111
Facsimile: 01925 291191
E-mail: mailbox@terraconsult.co.uk

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DISCLAIMER

This consultancy contract was completed by TerraConsult Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, the degree of manpower and resources allocated to the project as agreed.

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LEADENHAM LANDFILL SITE

VALIDATION REPORT
INSTALLATION OF GAS & GROUNDWATER MONITORING BOREHOLES

CONTENTS

LEADENHAM LANDFILL SITE

VALIDATION REPORT
INSTALLATION OF GAS & GROUNDWATER MONITORING BOREHOLES

1 INTRODUCTION

1.1 General

TerraConsult Ltd (TCL) was commissioned by FCC Environment Ltd to provide supervision and Construction Quality Assurance (CQA) of the drilling and installation of 6nr. combined gas and groundwater monitoring boreholes (BH04A and BH30-BH34) and 3nr groundwater monitoring boreholes (BH35-BH37) at Leadenham Landfill Site, Leadenham, Lincolnshire, LN5 0QF.

1.2 Introduction

The monitoring boreholes are located at the position shown on the attached Drawing Ref. 4847D001-1.

TerraConsult Ltd was commissioned by FCC Environment Ltd to:

a) Supply a suitably qualified and experienced CQA Engineer to oversee the construction quality aspects of the works and to delegate responsibilities for quality assurance on site to a CQA Inspector. The CQA Engineer was J. Waterworth, BSc C.Geol, FGS;

b) Supply a suitably qualified and experienced CQA Inspector together with all necessary site sampling and testing equipment. The CQA Inspector was P. Feeney;

c) Prepare and submit a validation report following the completion of the works using site records and field data.

This report describes the drilling and installation works of 9nr. environmental monitoring boreholes. Records of the works and of the quality assurance monitoring carried out are presented within the report which provides validation of the works as having been carried out in accordance with the agreed Design. The Contractor for the works was ANTS Group Ltd.

The CQA Inspector supervised the site works on a full-time basis, reporting to and supervised by the CQA Engineer and maintained a daily record of the

progress of the Works. The records made are attached at Appendix A. A photographic record of the works is attached at Appendix H.

1.3 Summary of Works Completed

The fieldwork was undertaken during the period of 17th to 27th August 2020.

The works carried out comprised of the following elements:

- Drilling of 6nr. combined gas and groundwater monitoring boreholes and 3nr groundwater monitoring boreholes; and
- Installation of 6nr. combined gas and groundwater monitoring boreholes and 3nr. groundwater monitoring boreholes to facilitate long term site perimeter monitoring.

2 FIELDWORK

2.1 General

The groundwater and gas monitoring boreholes were drilled by use of rotary drilling techniques by ANTS Group Ltd.

2.2 Setting out & Surveying

The borehole locations were set out by FCC Environment Ltd. The CQA Inspector and FCC Environment Manager agreed that the borehole set out positions were correct in relation to the location given on Drawing Ref. 4847D001-1 and QA Plan prior to the start of the drilling works. A copy of the drilling release form is attached at Appendix F.

2.3 Drilling

The monitoring boreholes were drilled using a Beretta tracked drilling rig.

The monitoring boreholes were installed with a slotted well screen to observe the response zone and facilitate gas and groundwater monitoring. The slotted screen for each borehole was placed from and to the following depths below ground level (bgl):

BH04A: 3.00mbgl to 21.00mbgl
BH30: 3.00mbgl to 25.5mbgl
BH31: 3.60mbgl to 25.60mbgl
BH32: 3.00mbgl to 27.00mbgl
BH33: 3.00mbgl to 24.00mbgl
BH34: 3.00mbgl to 27.00mbgl
BH35: 16.00mbgl to 19.00mbgl

BH36: 16.50mbgl to 19.50mbgl
BH37: 16.00mbgl to 19.00mbgl

3 SUPERVISION OF DRILLING

3.1 General

The CQA Inspector provided full time supervision of the drilling works ensuring compliance with the requirements of the QA Plan. Daily records were maintained by the CQA Inspector, copies of which are provided at Appendix A.

3.2 Target Location Set Ups

The CQA Inspector was present during the setup of the drilling rig at each borehole location, ensuring that the rig was in the correct position. The boreholes were drilled at the locations set out in the QA Plan.

Details of the drilling contractor's documentation to demonstrate the requisite experience / qualifications for the proposed activity and records relevant to the plant used to progress the borehole are attached at Appendix B4.

3.3 Progress and Depth Control

The CQA Inspector accurately measured the depth of the borehole on a regular basis and provided close supervision of the drilling works to ensure that the borehole end design depth was achieved.

The CQA Inspector ensured that the Drilling Contractor 'made safe' the borehole and rig at the end of each day. On completion of the borehole drilling, monitoring pipework was installed. The monitoring boreholes were fitted with suitable end caps. A lockable steel cover was installed in accordance with the Specification to protect the borehole from damage and vandalism.

3.4 Inspection of Driller's Records

Copies of the Driller's records were given to the CQA Inspector at the end of each day. The details were checked to ensure that they were consistent with the records kept by the CQA Inspector. The completed CQA Inspector's borehole installation records are included at Appendix C.

3.5 Sampling & In-Situ Testing

No *in situ* testing was carried out during the borehole drilling. The drill arisings were spread around the localised area and blended into the existing contours.

3.6 Monitoring Borehole Installation

Gas and Groundwater Borehole BH04A

Borehole BH04A was installed with a single plain 90mm HDPE standpipe between ground level and 3.00mbgl. An 18.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.00mbgl and the base of the borehole at 21.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Gas and Groundwater Borehole BH30

Borehole BH30 was installed with a single plain 90mm HDPE standpipe between ground level and 3.00mbgl. A 22.50m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.00mbgl and the base of the borehole at 25.50mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Gas and Groundwater Borehole BH31

Borehole BH31 was installed with a single plain 90mm HDPE standpipe between ground level and 3.60mbgl. A 22.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.60mbgl and the base of the borehole at 25.60mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl,

the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Gas and Groundwater Borehole BH32

Borehole BH32 was installed with a single plain 90mm HDPE standpipe between ground level and 3.00mbgl. A 24.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.00mbgl and the base of the borehole at 27.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Gas and Groundwater Borehole BH33

Borehole BH33 was installed with a single plain 90mm HDPE standpipe between ground level and 3.00mbgl. A 21.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.00mbgl and the base of the borehole at 24.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Gas and Groundwater Borehole BH34

Borehole BH34 was installed with a single plain 90mm HDPE standpipe between ground level and 3.00mbgl. A 24.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 3.00mbgl and the base of the borehole at 27.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Groundwater Borehole BH35

Borehole BH35 was installed with a single plain 90mm HDPE standpipe between ground level and 16.00mbgl. A 3.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 16.00mbgl and the base of the borehole at 19.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Groundwater Borehole BH36

Borehole BH36 was installed with a single plain 90mm HDPE standpipe between ground level and 16.50mbgl. A 3.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 16.50mbgl and the base of the borehole at 19.50mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

Groundwater Borehole BH37

Borehole BH37 was installed with a single plain 90mm HDPE standpipe between ground level and 16.00mbgl. A 3.00m length of slotted HDPE well screen, forming the response zone was installed at a depth between 16.00mbgl and the base of the borehole at 19.00mbgl.

Filter gravel (3-6mm) was placed around the slotted sections of pipework to backfill the annulus within the response zone. The slotted well screen was supplied and installed wrapped with a 300 micron filtration geotextile. A hydrated bentonite seal using bentonite granules was installed to 0.20m bgl, the remainder of the borehole annulus was completed using concrete as part of the construction of the headworks.

ANTS Group Ltd installed a lockable pedestal cover on the borehole after completion.

The delivery record for the materials used is attached at Appendix B1. The installed pipework was supplied by Marston Geotechnical Ltd. (90mm OD SDR11 perforated with 300 micron Geosock and 90mm OD plain pipe products). Push fit end caps were installed to the base of all HDPE casing and gas valves were installed to the top of the HDPE casing for BH04A and BH30-BH34). The pipework information is attached at Appendix B3.

A bentonite seal was placed above the response zone to prevent the ingress of any perched water into the installation from above.

The QC information relating to the bentonite used is attached at Appendix B2. Construction details of the monitoring borehole are included at Appendix B, C and D.

3.7 Non-Compliances

Any non–compliances with the Specification which occurred during the construction of the lining system are detailed on record sheets presented at Appendix G together with the actions taken to rectify the problem and meet the requirements of the Specification.

4 CONCLUSION

TerraConsult are satisfied that the combined gas and groundwater monitoring boreholes BH04A and BH30-BH34 and groundwater boreholes BH35-BH37 installed at Leadenham Landfill Site, as recorded on the borehole installation records, have been drilled and installed in accordance with the position shown on Drawing Ref. 4847D001-1 and the requirements of the agreed Specification and QA Plan.

DRAWINGS

Exploratory Hole Location Plan

TerraConsult

N

Legend Key

Locations By Type - RO

AGS		Project: Leadenham Landfill - Monitoring Well Instalaltion	Drawing No:
Issue:	DRAFT	Project No: 4847	4847D001-1
Scale:	1:2500	Client: FCC Environment	

APPENDIX A

Daily Records

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	17-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	hot and sunny thunderstorm and rain at 16.00,		
List of Visitors			
1. Garry Raffle	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site drillers introduced myself to staff induction.
8.00-9.30 site walk over.
09.30-10.30 deliveries and mob rig to location.
10.30-16.00 Drilling from ground level to 14.80m open holed from 12.00 to14.80m no casing.
1.6.00 left site due to needing extra casing and thunder storm.

Problems Encountered

N/A

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	10.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
Berreta rig No4	**BH32**	**FD**		
Water bowser				
Telehandler				

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	18-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	hot and sunny.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.35 to 10.00 drilled and cased off to 18.00m casing 15.00m.
10.00-12.00 sorted water supply with quarry whilst waiting for OD heights at location 32.31.30. and 4A.
12.30-15.00 open holes to 27.00m cleaned out bore hole several flushes to ensure pip installed at correct depth.
15.00-17.30 install slotted pipe to 27.00m to 3.00m and plain from 3m to ground level.

Problems Encountered

10.00-12.00 waiting to get od height to complete the bore holes.

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	10.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
Berreta rig No4	**BH32**	**FD**	**2.00 hr**	
Water bowser				
Telehandler				

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	19-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
8.45-17.00 drillers arrived on site drilled BH31 GL to 25m and cased off to 12.00m.

Problems Encountered

N/A

Miscellaneous Plant and Workers Used

1Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	10.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH31**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	20-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-17.00 drillers arrived refuelled and flush out well three times install pipe work and finish well at BH31
12.00-17.00set up on BH30 drilled BH30 GL to 25.50m and cased off to 12.00m.

Problems Encountered

Driller did not take into account of the sub on his rock roller so over drilled to 25.60 so the top seal was 3.6m and not 3m.

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH31 and BH30**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	21-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and strong wind heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-17.00 drillers arrived refuelled and flush out well three times install pipe work and finish well at BH30
10.00-15.00set up on BH4A drilled BH30 GL to 21.00m and cased off to 4.50m.

Problems Encountered

Driller did not take into account of the sub on his rock roller so over drilled to 25.60 so the top seal was 3.6m and not 3m.

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH30 and BH4A**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	24-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and strong wind heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-08.30 drillers arrived refuelled and move to other side of site to BH37.
8.30-14.30 drill BH37 to 19m install water well and move to BH36.
14.30-15.00 start BH36 drilled to 15.00 top ram not working on the rig had to strip down and repair.

Problems Encountered

Breakdown 15.00-17.00.

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH30 and BH4A**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	25-08-2020
Client	FCC Enviroment	**Site**	Leadenham
Project	4847		
Weather	Overcast and strong wind heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-08.30 drillers arrived refuelled working on BH36.
8.30-14.30 15.00m to 19.50minstall water well and move to BH36.
14.30-15.00 start BH35 drilled to 19.00m installed and set rig on BH33

Problems Encountered

N/A

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH30 and BH4A**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	26-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and strong wind heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-13.30 drillers arrived refuelled working on BH33 gl to 21.00m and installed.
14.00-17.00 set up on BH34 gl to 15.00m.

Problems Encountered

N/A

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH30 and BH4A**	**FD**		

TerraConsult

Staff Member	Phil Feeney	**Day/Date**	27-08-2020
Client	FCC Environment	**Site**	Leadenham
Project	4847		
Weather	Overcast and strong wind heavy rain.		
List of Visitors			
1.	2.	3.	4.
5.	6.	7.	8.

Details of Site Work and CQA Work :

Progress / Works Completed

07.30 On site
7.30-13.30 drillers arrived refuelled working on BH34 15.00 to 27.00m and installed.

Problems Encountered

N/A

Miscellaneous Plant and Workers Used

Contract Personnel	Position	On Site		Contract Personnel	Position	On Site
Ants	Lead driller Second Man	7.30		Phil Feeney	CQA	06.45

Plant	Area Working in	Hours worked	Standing	Breakdowns
SM400 **Water bowser** **Telehandler**	**BH30 and BH4A**	**FD**		

APPENDIX B

QC/Delivery information

B1 Materials Delivery Record
B2 Bentonite Information
B3 HDPE Pipework Specification
B4 Plant and Personnel Records

B1 Materials Delivery Record

ORDER ACKNOWLEDGEMENT

Order No. ORD77882
Date 11/08/2020
Page 1
Division DRILLING
Telephone +44 (0)1359 271167

Marton Geotechnical Services Ltd
Geotechnical Centre, Rougham Industrial Estate, Rougham, Bury St Edmunds, Suffolk, IP30 9ND, England
t +44(0)1359 271167 f +44(0)1359 271168 orders@mgs.co.uk www.mgs.co.uk

Invoice To:
ANTS GROUP LTD
Unit 5 Singer Way
Kempston

Bedfordshire
MK42 7AW

Deliver To:
ANTS C/O
LEADENHAM LANDFILL SITE
POTTERGARE
LEADENHAM
LINCS
LN5 0QF

Account No: AN18 **Your Order No:** ANT10497DP

Part No.	W/H	Description	Despatch Date	Quantity
ADSV09007430A63D	01	90MM X 3M DUROSCREEN 11 FT SL2 GR300	14/08/2020	60
ADSV09007430A00-	01	90MM X 3M DUROCASING 11 FT	14/08/2020	25
SC113	01	8" X 0.6M SEC COVER SL	14/08/2020	9
C42-155	01	QUARTZ FILTER MEDIA 3-6 mm 25KG BAG	14/08/2020	200
C42-025	01	25KG BAG BENTONITE POWDER	14/08/2020	80
C15-007	01	90MM/PQ MDPE PUSH ON CAP (YELLOW)	14/08/2020	2
C16-052	01	74mm (64-78) RUBBER BUNG + VALVE	14/08/2020	9
ADSV09007410A00-	01	90MM X 1M DUROCASING 11 FT	14/08/2020	10
DELSTAR		DELIVERY STAR	14/08/2020	1

VAT Analysis

Code	Goods	Rate	VAT
1	3801.45	20.00	760.29

Total Goods

VAT

Total Due

Raised By: DARREN

DOC186811

VAT Reg. No. GB 496 8091 91
For full terms & conditions visit or click: https://www.mgs.co.uk/terms-conditions/

B2 Bentonite Information

Bentonite

Powder

Berkbent 163 is a free flowing powder of premium grade high quality sodium carbonate activated Bentonite, specially formulated to provide rapid development of viscosity and gel strength for drilling and civil engineering slurries.

When dispersed in water, Berkbent 163 swells to many times its volume, rapidly forming a thixotropic gel.

PROPERTIES

Colour:	Light yellowish grey
Odour:	None
pH:	9 - 10
Specific Gravity:	800 to 950kg/m3
Moisture content %	10-14
% by weight passing BS410	
150 micron sieve	min 95%
Swelling*	
30 mins	27
1 hour	29
2 hours	30
24 hours	32
48 hours	34

- Test procedure - 10g Bentonite inserted into a 100 ml capacity 30 mm ID glass cylinder.
- Total swelling volume (mls) recorded with time. 100 ml water added to each cylinder

Packed in 25Kg paper bags, 40 bags per pallet.

Applications

- Sealing landfill gas wells
- Borehole sealing
- Grouting
- Isolating instrumentation and sampling

Features

- Easy to use
- Easy to mix
- High gel strength
- Stable suspension
- Rapid build up of viscosity
- Suitable for immediate use after mixing
- Can be used with traditional mixing equipment

Specifications may change without prior notice

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Bentonite

Granules

~ 2-12mm

~ 1-6mm

High quality activated Bentonite in granule form with high swelling characteristics. A granular product with good handling properties and low dust content.

Available in two grades

~ 1-6mm Fast swelling

~ 2-12mm Slow swelling

Simple to use it can be poured straight into boreholes without the need for mixing equipment.

Where groundwater is not present then water must be added to provide the necessary swelling and sealing.

Packed in 25Kg paper bags, 40 bags per pallet.

Applications

~ Sealing landfill gas wells

~ Borehole sealing

~ Grouting

~ Geothermal wells

~ Isolating instrumentation and sampling

Features

~ Granular Form

~ Easy to use and hadle

~ Dust free

~ High swelling capacity

~ Low permeability

~ High plasticity

~ Different swelling rates available

Specifications may change without prior notice

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Quartz Filter Media

Premium Grade Sand

Quartz is a natural mineral mainly composed of silica which is then washed, sieved, dried and bagged. It is neutral, slightly angular and has a beige / light grey colour.

Good quality filter media is essential for monitoring and extraction wells in order to retain most of the formation material and to maximise hydraulic response.

A well screen slot size is selected to retain about 90% of the filter media itself. The filter media should be well sorted to assure good porosity and hydraulic conductivity near the screen. Good quality filter media should have a uniformity co-efficient of approximately two and made from predominantly silica.

Applications

- Extraction boreholes
- Groundwater monitoring
- Dewatering

Features

- Excellent porosity
- Wide range of sizes
- Washed, dried & bagged
- Bulk density 1.5 T/m3
- Density 2.65 gr/cm^3
- 25Kg bags

Quartz Filer Media Grading
0.5 - 1mm
1 - 2mm
2 - 4mm
3 - 6mm

Chemical Analysis	
SiO_2	>96%
CaO	0.83%
K_2O	0.86%
Al_2O_3	Max 2%
Fe_2O_3	0.25%
MgO	0.27%
Na_2O	0.33%

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B3 Pipework Specification

HDPE Well Screen

DuroScreen & DuroCasing

Product

- Ground water monitoring
- Contaminated soil monitoring
- Landfill gas recovery
- Landfill leachate extraction

Features

- Pipe manufactured to DIN 8074/75
- Available slotted or perforated
- Resistant to aggressive chemicals
- High strength, tough and durable
- Flush threaded joints
- Slot sizes - 0.5, 1.0, 2.0 mm
- Lengths - 1.0, 2.0,3.0 metres
- Standard colour black

	SERIES 17/SDR17.6/PN6			SERIES 11 /SDR11/PN10		
Outside Diameter mm	Wall thickness mm	Inside diameter mm	Weight Kg/m	Wall thickness mm	Inside diameter mm	Weight Kg/m
50	-	-	-	4.6	40.8	0.70
63	-	-	-	5.8	51.4	1.05
90	5.1	79.8	1.39	8.2	73.6	2.12
110	6.3	97.4	2.08	10.0	90.0	3.14
125	7.1	110.8	2.66	11.4	102.2	4.08
140	8.0	124.0	3.34	12.8	114.4	5.11
160	9.1	141.8	4.35	14.6	130.8	6.67
180	10.2	159.6	5.48	16.4	147.2	8.42
200	11.4	177.2	6.79	18.2	163.6	10.40
225	12.8	199.4	8.55	20.5	184.0	13.10
250	14.2	221.6	10.60	22.8	204.4	16.20
280	15.9	248.2	13.20	25.5	229.0	20.30
315	17.9	279.2	16.70	28.7	257.6	25.70
355	20.1	314.8	21.20	32.3	290.4	32.60
400	22.7	354.6	26.90	36.4	327.2	41.40
450	25.5	399.0	34.00	40.9	368.2	52.40
500	28.3	443.4	41.90	45.4	409.2	64.60
560	31.7	496.6	52.50	50.8	458.4	81.10
630	35.7	558.8	66.50	57.2	515.6	102.50

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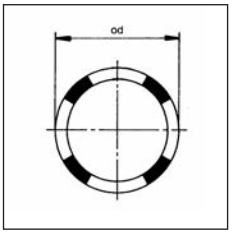
HDPE Well Screen

DuroScreen & DuroCasing

Specifications

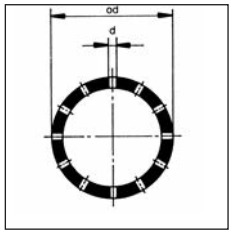
FULLY SLOTTED

DIAMETER	NO SLOTS
63 - 90	2
110 - 140	3
160 - 225	4
250 - 280	5
315 - 355	6
400 - 450	8



Axial spacing 15 mm

FULLY PERFORATED (10% open area)



Hole diameter: 12 mm
Axial spacing 30 mm

DIAMETER	ROWS
63-110	5 - 8
125 - 180	9 -12
200 - 250	15 -18
280 - 315	24
355 - 400	30
450	30
500	34
560	38
630	42

(others available on request)

OPEN AREA RATING OF SCREENS ACCORDING TO SLOT DIMENSION

OD (mm)	ROWS	Slot 0.5mm	Slot 1mm	Slot 1.5mm	Slot 2mm	Slot 3mm
63	2	2.0%	4.0%	6.1%	8.1%	12.1%
90	2	1.7%	3.3%	5.0%	6.6%	9.9%
110	3	2.3%	4.6%	6.9%	9.3%	13.9%
125	3	2.1%	4.3%	6.4%	8.6%	12.8%
140	3	2.0%	4.0%	6.0%	8.0%	12.0%
160	4	2.4%	4.8%	7.2%	9.5%	14.3%
180	4	2.2%	4.5%	6.7%	9.0%	13.4%
200	4	2.1%	4.2%	6.4%	8.5%	12.7%
225	4	2.0%	4.0%	5.9%	7.9%	11.9%
250	5	2.2%	4.5%	6.7%	8.9%	13.4%
280	5	2.0%	4.0%	6.0%	8.0%	11.9%
315	6	2.2%	4.4%	6.7%	8.9%	13.3%
355	6	2.1%	4.1%	6.2%	8.2%	12.4%
400	8	2.5%	5.1%	7.6%	10.2%	15.3%
450	8	2.3%	4.5%	6.8%	9.1%	13.6%

MATERIAL

PROPERTY	STANDARD	UNIT	VALUE PE80
Density	ISO 1183	g/cm	0.94
Melt Flow Index (190/5)	ISO 1133	g/10min	0.9
Tensile stress at yield	ISO 527	MPa	20
Elongation at yield	ISO 527	%	10
Elongation at break	ISO 527	%	>600
Impact strength (notched)	ISO 179	kJ/m²	12
Modulus of elasticity	ISO 527	MPa	750

Specifications may change without prior notice

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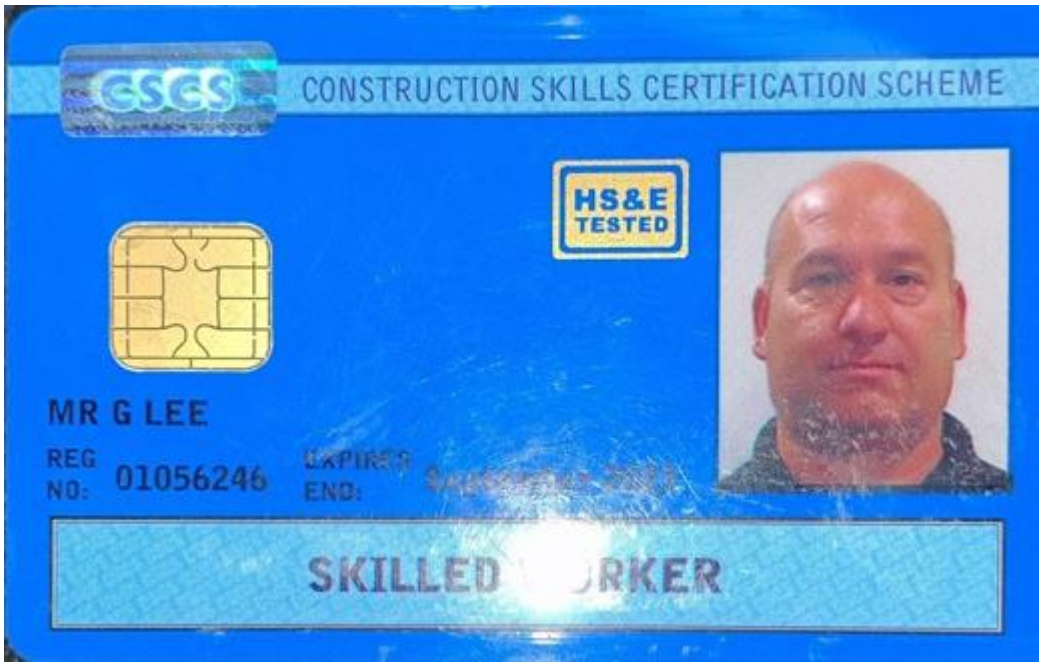
B4 Plant and Personnel Records


CSCS
CONSTRUCTION SKILLS CERTIFICATION SCHEME
HS&E TESTED
MR G LEE
REG NO: 01056246
EXPIRES END:
SKILLED WORKER


CSCS
Tel: 0344 994 4777 www.cscs.uk.com
Registration No:01056246
Land Driller Support Operative NVQ Level 2
Cards issued by CSCS do not confirm the holder's right to work in the UK.
The cardholder has demostrated knowledge of Health and Safety awareness as laid out in the CSCS Scheme Requirements.

APPENDIX C

Monitoring Borehole Installation Records

TerraConsult

BOREHOLE DRILLING AND INSTALLATION RECORD

Site:	Leadenham Landfill
Project:	Installation of Gas & Groundwater Boreholes
Job No:	4847

LOCATION FROM SPECIFICATION				PROPOSED BOREHOLE FROM SPECIFICATION			ACTUAL BOREHOLE DRILLED ON SITE				Comments
Date	Borehole reference	Groundlevel (m OD)	Site base level (m OD)	BH depth from GL (m OD)	BH depth (m bgl)	BH diameter (mm)	BH depth from GL (m OD)	BH depth (m bgl)	BH diameter (mm)	Groundlevel (m OD)	
17/08/2020	BH32	93.574	70.000	66.575	27.00	200.00	66.575	27.00	200	93.575	N352620.850 E496490.267
19/08/2020	BH31	93.883	70.000	68.283	25.60	200.00	68.283	25.60	200	93.883	N352560.100 E49357.143
20/08/2020	BH30	94.245	70.000	68.745	25.50	200.00	68.740	25.50	200	94.245	N352521.290 E496318.730
21/08/2020	BH4A	88.800	70.000	69.200	19.00	200.00	68.800	21.00	200	88.800	N352547.985 E496195.850
24/08/2020	BH37	100.035	19.000	81.350	19.00	200.00	81.350	19.00	200	100.035	N352342.125 E496544.440
25/08/2020	BH36	100.410	19.500	80.910	19.50	200.00	80.910	19.50	200	100.410	N352457.788 E496636.610
25/08/202	BH35	98.402	19.000	79.402	19.00	200.00	79.402	19.00	200	98.402	N352534.230 E496694.470

	INSTALLATION												Comments
Borehole reference	Base of BH pipework (m OD)	Installed pipework depth (m bgl)	Depth to top of perforated pipe bgl (m)	Depth to bottom of perforated pipe bgl (m)	Depth to top of gravel filter bgl (m)	Sand bleed layer thickness (m)	Depth to bottom of gravel filter bgl (m)	Depth to top of seal bgl (m)	Depth to bottom of seal bgl (m)	Length of stick-up (m)	Total pipe length (m)	Pipe diameter OD (mm)	
BH32	66.575	27.00	3.00	27.00	3.00	0.20	27.00	0.00	2.80	0.30	27.30	90	
BH31	68.283	25.60	3.60	25.60	3.60	0.20	25.60	0.00	3.40	0.30	25.90	90	
BH30	68.745	25.50	3.00	25.50	3.00	0.20	25.50	0.00	2.80	0.30	25.80	90	
BH4A	69.200	20.00	3.00	20.00	3.00	0.20	20.00	0.00	2.80	0.30	20.30	90	
BH37	81.035	19.00	16.00	19.00	15.50	0.20	18.69	0.00	15.30	0.30	19.30	90	
BH36	80.910	19.50	16.50	19.50	16.00	0.20	19.50	0.00	15.80	0.30	19.80	90	
BH35	79.402	19.00	16.00	19.00	13.50	0.20	19.00	0.00	13.30	0.30	19.30	90	

m = metres OD = Above Ordnance Datum GL = Ground Level bgl = below ground surface level BH = Borehole

TerraConsult

BOREHOLE DRILLING AND INSTALLATION RECORD

Site:	Leadenham Landfill
Project:	Installation of Gas & Groundwater Boreholes
Job No:	4847

LOCATION FROM SPECIFICATION				PROPOSED BOREHOLE FROM SPECIFICATION			ACTUAL BOREHOLE DRILLED ON SITE				Comments
Date	**Borehole reference**	**Groundlevel (m OD)**	**Site base level (m OD)**	**BH depth from GL (m OD)**	**BH depth (m bgl)**	**BH diameter (mm)**	**BH depth from GL (m OD)**	**BH depth (m bgl)**	**BH diameter (mm)**	**Groundlevel (m OD)**	
26/08/2020	BH33	91.111	70.000	67.111	24.00	200.00	67.111	24.00	200	91.111	N352643.500 E496553.256
27/08/2020	BH34	94.320	70.000	67.320	27.00	200.00	67.320	27.00	200	94.320	N352598.480 E496621.449

	INSTALLATION												Comments
Borehole reference	**Base of BH pipework (m OD)**	**Installed pipework depth (m bgl)**	**Depth to top of perforated pipe bgl (m)**	**Depth to bottom of perforated pipe bgl (m)**	**Depth to top of gravel filter bgl (m)**	**Sand bleed layer thickness (m)**	**Depth to bottom of gravel filter bgl (m)**	**Depth to top of seal bgl (m)**	**Depth to bottom of seal bgl (m)**	**Length of stick-up (m)**	**Total pipe length (m)**	**Pipe diameter OD (mm)**	
BH33	67.111	24.00	3.00	24.00	3.00	0.20	24.00	0.00	2.80	0.30	24.30	90	
BH34	67.320	27.00	3.00	27.00	3.00	0.20	27.00	0.00	2.80	0.30	27.30	90	

m = metres OD = Above Ordnance Datum GL = Ground Level bgl = below ground surface level BH = Borehole

APPENDIX D

Gravel Volume Calculation Sheet

TerraConsult

Gravel Volume Calculation Sheet

Site:	Leadenham Landfill
Project:	Installation of Gas & Groundwater Boreholes
Job No:	4847

Borehole Details					Area Calculations					Volume Calculations				
Date	**Borehole Reference**	**Pipework Diameter (mm)**	**Borehole Casing Diameter (mm)**	**Depth of Gravel (m)**	**Radius of Pipework (m)**	**Radius of Borehole Casing (m)**	**Area of Pipework (m2)**	**Area of Borehole Casing (m2)**	**Area of Borehole Casing- Area of Pipework (m2)**	**Bulk Density of Gravel (Mg/m3)**	**Volume of Gravel (m3)**	**Tonnage of Gravel Required (t)**	**Estimated Tonnage of Gravel used (t)**	**Comments**
18/08/2020	BH32	90	200	24.00	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.601	0.962	0.900	
20/08/2020	BH31	90	200	22.00	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.551	0.882	0.900	
21/08/2020	BH30	90	200	22.50	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.564	0.902	0.900	
											Total Tonnage	1.844	2.700	

TerraConsult

Gravel Volume Calculation Sheet

Site:	Leadenham Landfill
Project:	Installation of Gas & Groundwater Boreholes
Job No:	4847

Borehole Details					Area Calculations					Volume Calculations				
Date	**Borehole Reference**	**Pipework Diameter (mm)**	**Borehole Casing Diameter (mm)**	**Depth of Gravel (m)**	**Radius of Pipework (m)**	**Radius of Borehole Casing (m)**	**Area of Pipework (m2)**	**Area of Borehole Casing (m2)**	**Area of Borehole Casing- Area of Pipework (m2)**	**Bulk Density of Gravel (Mg/m3)**	**Volume of Gravel (m3)**	**Tonnage of Gravel Required (t)**	**Estimated Tonnage of Gravel used (t)**	**Comments**
25/08/2020	BH35	90	200	5.50	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.138	0.220	0.300	
26/08/2020	BH33	90	200	18.00	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.451	0.722	0.800	
27/08/2020	BH34	90	200	21.00	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.526	0.842	0.800	
											Total Tonnage	0.942	1.900	

Gravel Volume Calculation Sheet

Site:	FCC Leadenham Landfill
Project:	Installation of Gas & Groundwater Boreholes
Job No:	4847

Borehole Details					Area Calculations					Volume Calculations				
Date	**Borehole Reference**	**Pipework Diameter (mm)**	**Borehole Casing Diameter (mm)**	**Depth of Gravel (m)**	**Radius of Pipework (m)**	**Radius of Borehole Casing (m)**	**Area of Pipework (m2)**	**Area of Borehole Casing (m2)**	**Area of Borehole Casing- Area of Pipework (m2)**	**Bulk Density of Gravel (Mg/m3)**	**Volume of Gravel (m3)**	**Tonnage of Gravel Required (t)**	**Estimated Tonnage of Gravel used (t)**	**Comments**
21/08/2020	BH4A	90	200	18.00	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.451	0.722	0.800	
24/08/2020	BH37	90	200	3.50	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.088	0.140	0.150	
25/08/2020	BH36	90	200	3.50	0.0450	0.100	0.0064	0.0314	0.0251	1.600	0.088	0.140	0.150	
											Total Tonnage	0.862	1.100	

APPENDIX E

Borehole Logs

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	21.00	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496195.85
mN:	352547.99
m OD:	88.80
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
			(1.30)	Dark brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse limestone and chert. Cobbles and possible boulders of subangular limestone present.	0.20 Concrete
		87.50	1.30	LIMESTONE recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite; 90 mm SDR11 HDPE pipe
			(2.20)		3.00
		85.30	3.50	Light brown slightly gravelly slightly clayey SAND.	3.00
			(2.20)		3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
		83.10	5.70	MUDSTONE recovered as clayey subangular fine GRAVEL.	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 21.00	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH04A

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	21.00	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496195.85
mN:	352547.99
m OD:	88.80
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
			(15.30)	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH04A

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	21.00	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496195.85
mN:	352547.99
m OD:	88.80
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		67.80	21.00	Borehole ends at 21.00 m (Termination reason: Target depth)	21.00 21.00	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH04A

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.50	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496318.73
mN:	352521.29
m OD:	94.25
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Dark brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse limestone and chert. Cobbles and or boulders of subangular limestone present.	0.20 Concrete; Hydrated bentonite; 90 mm SDR11 HDPE pipe
			(6.60)		3.00 3.00
		87.65	6.60	Limestone recovered as slightly clayey subangular fine GRAVEL.	3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
			(3.20)		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 25.50	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH30

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.50	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496318.73
mN:	352521.29
m OD:	94.25
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
		84.45	9.80	Limestone recovered as slightly clayey subangular fine GRAVEL. Light brown slightly gravelly slightly clayey SAND.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
			(1.30)				
		83.15	11.10	MUDSTONE recovered as clayey subangular fine GRAVEL.			
			(14.40)				

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH30

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.50	21-08-20	21-08-20	GL	Beretta	n/a	Tricone	Driller	21-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496318.73
mN:	352521.29
m OD:	94.25
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		68.75	25.50	Borehole ends at 25.50 m (Termination reason: Target depth)	25.50 25.50	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH30

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.60	19-08-20	20-08-20	GL	Beretta	n/a	Tricone	Driller	20-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496357.14
mN:	352560.10
m OD:	93.88
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Dark brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse limestone and chert. Cobbles and or boulders of subangular limestone present.	0.20 Concrete
					Hydrated bentonite; 90 mm SDR11 HDPE pipe
			(7.50)		3.60
		86.38	7.50	LIMESTONE recovered as slightly clayey subangular fine GRAVEL.	3.60 3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
			(3.30)		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 25.60	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH31

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.60	19-08-20	20-08-20	GL	Beretta	n/a	Tricone	Driller	20-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496357.14
mN:	352560.10
m OD:	93.88
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				LIMESTONE recovered as slightly clayey subangular fine GRAVEL.			
		83.08	10.80	Light brown slightly gravelly slightly clayey SAND.			
			(1.60)				
		81.48	12.40	MUDSTONE recovered as clayey subangular fine GRAVEL.			
			(13.20)		3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH31

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	25.60	19-08-20	20-08-20	GL	Beretta	n/a	Tricone	Driller	20-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496357.14
mN:	352560.10
m OD:	93.88
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		68.28	25.60	Borehole ends at 25.60 m (Termination reason: Target depth)	25.60 25.60	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH31

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	17-08-20	18-08-20	GL	Beretta	n/a	Tricone	Driller	18-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496490.27
mN:	352620.85
m OD:	93.57
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
			(1.30)	Dark grey slightly sandy gravelly CLAY. Gravel is rounded to subrounded fine to coarse of mudstone. Cobbles and or boulders of subangular mudstone present.	0.20 Concrete
		92.27	1.30	Dark brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse limestone and chert. Cobbles and possible boulders of subangular limestone present.	Hydrated bentonite; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
			(8.80)		3.00 3.00 3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 27.00	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH32

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	17-08-20	18-08-20	GL	Beretta	n/a	Tricone	Driller	18-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496490.27
mN:	352620.85
m OD:	93.57
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				Dark brown slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse limestone and chert. Cobbles and possible boulders of subangular limestone present.			
		83.47	10.10	LIMESTONE recovered as slightly clayey subangular fine GRAVEL.			
			(0.30)				
▼		83.17	10.40	Light brown slightly gravelly slightly clayey SAND.			
			(1.80)				
		81.37	12.20	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
			(13.40)				

Groundwater entries:

Struck:	Rose to:	Casing:	Type:
10.80	0.00		

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH32

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	17-08-20	18-08-20	GL	Beretta	n/a	Tricone	Driller	18-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496490.27
mN:	352620.85
m OD:	93.57
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		67.97	25.60				
				Borehole ends at 27.00 m (Termination reason: Target depth)	27.00	Borehole diameter 200 mm	
					27.00		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH32

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	24.00	26-08-20	26-08-20	GL	Beretta	n/a	Tricone	Driller	26-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496553.26
mN:	352643.50
m OD:	91.11
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Dark brown slightly sandy gravelly CLAY. Gravel is rounded to subrounded fine to coarse of limestone and chert. Cobbles and or boulders of subangular limestone present.	0.20 Concrete
			(3.40)		Hydrated bentonite; 90 mm SDR11 HDPE pipe
		87.71	3.40	LIMESTONE recovered as slightly clayey subangular fine GRAVEL.	3.00 3.00
			(1.40)		
		86.31	4.80	Light brown locally highly fractured limestone recovered as slightly gravelly slightly clayey SAND.	3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
			(7.20)		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 24.00	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH33

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	24.00	26-08-20	26-08-20	GL	Beretta	n/a	Tricone	Driller	26-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496553.26
mN:	352643.50
m OD:	91.11
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				Light brown locally highly fractured limestone recovered as slightly gravelly slightly clayey SAND.			
		79.11	12.00	Light brown slightly gravelly slightly clayey SAND.			
			(1.80)				
		77.31	13.80	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
			(10.20)				

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH33

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	24.00	26-08-20	26-08-20	GL	Beretta	n/a	Tricone	Driller	26-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496553.26
mN:	352643.50
m OD:	91.11
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		67.11	24.00	Borehole ends at 24.00 m (Termination reason: Target depth)	24.00 24.00	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH33

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	26-08-20	27-08-20	GL	Beretta	n/a	Tricone	Driller	27-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496621.45
mN:	352598.48
m OD:	94.32
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description		Installation details: Backfill / Legend / Pipe
			(3.30)	Dark brown slightly sandy gravelly CLAY. Gravel is rounded to subrounded fine to coarse of limestone and chert. Cobbles and or boulders of subangular limestone present.	0.20	Concrete; Hydrated bentonite; 90 mm SDR11 HDPE pipe
		91.02	3.30	Limestone recovered as slightly clayey subangular fine GRAVEL.	3.00 3.00	3 - 6 mm gravel; 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
			(8.50)			

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 27.00	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH34

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	26-08-20	27-08-20	GL	Beretta	n/a	Tricone	Driller	27-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496621.45
mN:	352598.48
m OD:	94.32
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				Limestone recovered as slightly clayey subangular fine GRAVEL.			
		82.52	11.80	Light brown slightly gravelly slightly clayey SAND.			
			(1.60)				
		80.92	13.40	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

AGS

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH34

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	27.00	26-08-20	27-08-20	GL	Beretta	n/a	Tricone	Driller	27-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496621.45
mN:	352598.48
m OD:	94.32
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
			(13.60)	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		67.32	27.00	Borehole ends at 27.00 m (Termination reason: Target depth)	27.00	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

AGS

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH34

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.00	25-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496694.47
mN:	352534.23
m OD:	98.40
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Fractured weathered limestone recovered as slightly clayey subangular fine GRAVEL.	0.20 Concrete
			(1.80)		
		96.60	1.80	Limestone recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite; 90 mm SDR11 HDPE pipe
			(14.50)		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 19.00	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH35

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.00	25-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496694.47
mN:	352534.23
m OD:	98.40
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Limestone recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite / 90 mm SDR11 HDPE pipe
					16.00
		82.10	16.30	Light brown slightly gravelly slightly clayey SAND.	16.00
			(2.70)		3 - 6 mm gravel / 90 mm SDR11 HDPE pipe, 2 mm slots, 300 µm geotextile wrap
		79.40	19.00	MUDSTONE recovered as clayey subangular fine GRAVEL.	19.00
			(0.50)	Borehole ends at 19.00 m (Termination reason: Target depth)	Borehole diameter 200 mm

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH35

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.00	25-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496694.47
mN:	352534.23
m OD:	98.40
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
		78.90	19.50	MUDSTONE recovered as clayey subangular fine GRAVEL.	19.50		90 mm SDR11…

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

AGS

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH35

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.50	24-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496636.61
mN:	352457.79
m OD:	100.41
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill / Legend / Pipe
				Fractured weathered limestone recovered as slightly clayey subangular fine GRAVEL.	0.20 Concrete
			(2.30)		
		98.11	2.30	Limestone recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite; 90 mm SDR11 HDPE pipe
			(13.80)		

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 19.50	air		

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH36

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.50	24-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496636.61
mN:	352457.79
m OD:	100.41
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
				Limestone recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite		90 mm SDR11 HDPE pipe
		84.31	16.10	Light brown slightly gravelly slightly clayey SAND.			
					3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
			(3.10)				
		81.21	19.20				

16.50
16.50

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH36

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.50	24-08-20	25-08-20	GL	Beretta	n/a	Tricone	Driller	25-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496636.61
mN:	352457.79
m OD:	100.41
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
			(0.30)	MUDSTONE recovered as clayey subangular fine GRAVEL.	3 - 6 mm gravel		90 mm SDR11…
		80.91	19.50	Borehole ends at 19.50 m (Termination reason: Target depth)	19.50 19.50	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH36

Borehole Log

TerraConsult

Borehole formation details:

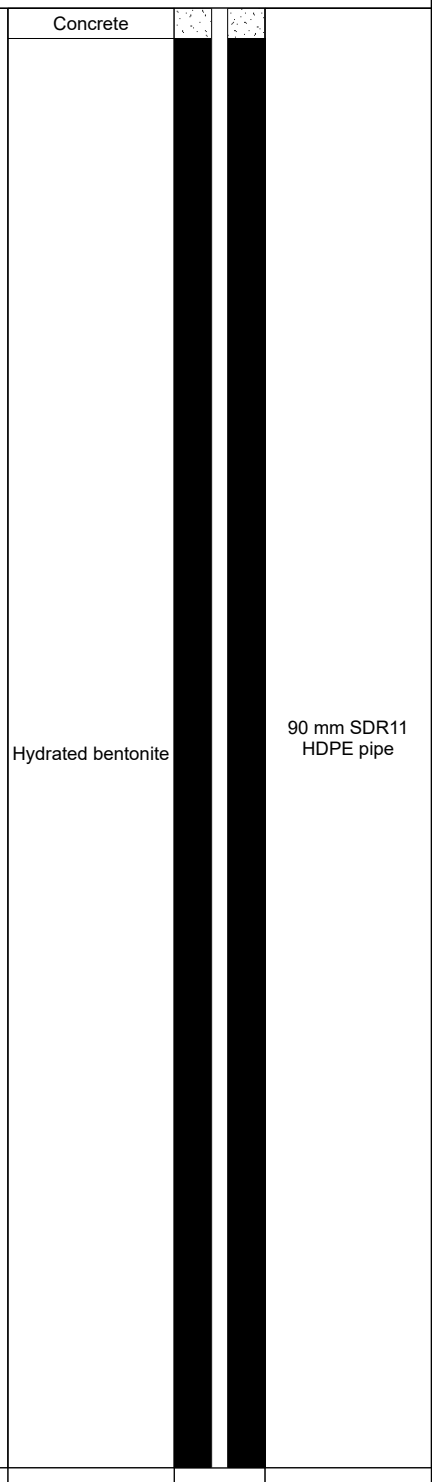
Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.00	24-08-20	24-08-20	GL	Beretta	n/a	Tricone	Driller	24-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496544.44
mN:	352342.13
m OD:	100.04
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description
			(0.80)	Dark brown slightly sandy gravelly CLAY. Gravel is rounded to subrounded fine to coarse of limestone and chert. Cobbles and or boulders of subangular limestone present.
		99.24	0.80	Fractured weathered limestone recovered as slightly clayey subangular fine GRAVEL.
			(3.80)	
		95.44	4.60	Limestone recovered as slightly clayey subangular fine GRAVEL.

Installation details



Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:
0.00 - 19.00	air		

AGS

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH37

Borehole Log

TerraConsult

Borehole formation details:

Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill bit:	Logger:	Logged:	Remarks:
RO	0.00	19.00	24-08-20	24-08-20	GL	Beretta	n/a	Tricone	Driller	24-08-20	Stratum descriptions are based on Lead Driller's descriptions

Location details:

mE:	496544.44
mN:	352342.13
m OD:	100.04
Grid:	OSGB

Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Installation details: Backfill	Legend	Pipe
			(11.00)	Limestone recovered as slightly clayey subangular fine GRAVEL.	Hydrated bentonite		90 mm SDR11 HDPE pipe
		84.44	15.60	Light brown slightly gravelly slightly clayey SAND.	16.00		
			(3.20)		16.00 3 - 6 mm gravel		90 mm SDR11 HDPE pipe 2 mm slots 300 µm geotextile wrap
		81.24	18.80	MUDSTONE recovered as clayey subangular fine GRAVEL.			
		81.04	19.00	Borehole ends at 19.00 m (Termination reason: Target depth)	19.00		
					19.00	Borehole diameter 200 mm	

Groundwater entries:

Struck:	Rose to:	Casing:	Type:

Headworks:

Steel raised cover

Depth related remarks:

From	to:	Remarks:

Flush details:

Depth:	Type:	Return:	Colour:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in meters.

Log issue: FINAL

Scale: 1:50

Project: Leadenham Landfill - Monitoring Well Installation

Project No: 4847

Client: FCC Environment

Exploratory position reference:

BH37

APPENDIX F

Drilling Release Form

TerraConsult

CQA Form

Leadenham Landfill

Drilling Release Form

The CQA Inspector hereby informs that the following borehole/s have been set out by FCC Environment, have been checked against the layout drawing and is / are available for drilling.

The duties of the CQA Inspector will be as follows:

- To ensure all borehole positions shown on the borehole location drawings are set out by the surveyor and are clearly and confidently identified on site.
- To ensure, by reasonable visual assessment that all the "as set out" boreholes positions are located as shown on the borehole location plan.
- At any area where the CQA Inspector suspects a borehole position to have been incorrectly set out or where the position can not be clearly identified, a further survey is to be carried out.
- The CQA Inspector shall be present during the set up of the drilling rig at the borehole positions and shall ensure that the drilling rig is located at the position set out by the surveyor and in accordance with the borehole location plan.
- In the event that a borehole position requires relocation, the CQA Inspector will ensure that the new position is surveyed and approved by the Design Engineer prior to commencing drilling at the relocated position.

BOREHOLE/S: BH04A, BH30, BH31, BH32, BH33, BH34, BH35, BH36, BH37

Date: 17th August 2020

Time: 10:00

Signed

CQA Inspector
P. Feeney (TCL)

Drilling Contractor
ANTS Group Ltd,

APPENDIX G

Non Compliance Record

TerraConsult

NON-COMPLIANCE RECORD

CQA Form 3
SITE : Leadenham Landfill Site

DATE : August 2020

JOB No : 4847

CQA ENGINEER : M. Gill

Non-Compliance With :	Reason for Non-Compliance :	Action taken :	Remarks :
QA Plan Section 4.4.1 and 4.4.4 (i) - Pipework	The QA Plan Pipework requirements state that the pipework used shall be `90mm ID SDR11 HDPE casing for the gas and groundwater monitoring boreholes. The pipework delivered to site and installed by the driller was a 90mm OD SDR11 HDPE casing. The pipework delivery note does not identify if the 90mm sizing was OD or ID. .	The 90mm OD SDR11 pipe used is suitable and is fit for purpose as a gas and groundwater monitoring borehole. TerraConsult are to provide refresher training to site engineers on the interpretation of the supplier's delivery note codings.	No further action taken.

APPENDIX H

Photographic Record

Leadenham Landfill CQA – FCC Environment Ltd

Gas and Groundwater Monitoring Well Installation Works – Aug 2020

Figure 1
Drilling rig set up at first proposed location.

Figure 2
Site access and sidewall.

Figure 3
Site sidewall and rig set up at borehole location.

Figure 4
Internal bund.

Figure 5
Site sidewall and rig set up at borehole location.

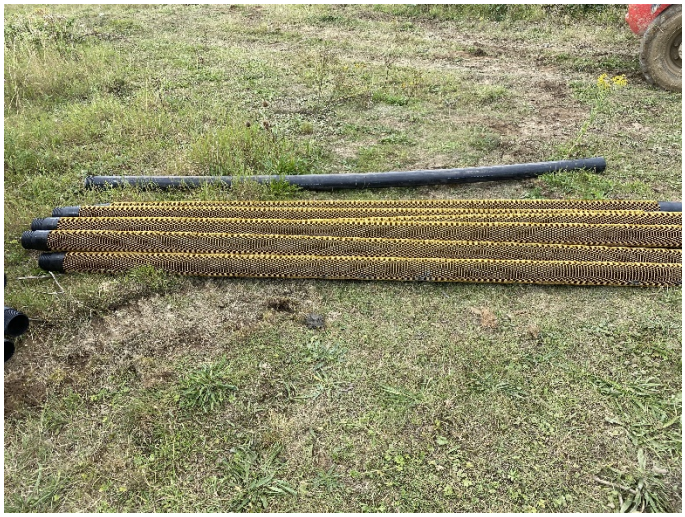


Figure 6
Slotted 3m pipework with pre-fitted geosock.

Figure 7
BH30 completed installation.

Figure 8
BH31 completed installation.

Figure 9
BH32 completed installation.

Figure 10
BH04A completed installation.

Figure 11
BH35 completed installation.

Figure 12
BH33 completed installation.

Figure 13
BH34 completed installation.

Figure 14
BH36 completed installation.

Figure 15
BH37 completed installation.

From:	DALE, Helen
To:	Colin Fenwick
Cc:	Branson, Jim
Subject:	RE: Leadenham Borehole Monitoring Proposals
Date:	14 July 2020 13:52:39
Attachments:	image002.gif image003.gif image004.gif image005.gif image006.gif image007.png image009.jpg

---

Colin
Confirm receipt of the V8 borehole plan.

With regards to the permit pre operational measure 1b, relating to groundwater monitoring prior to waste entering the new cell (northern development), I have discussed this with Jim Branson. Ideally 12 months of monitoring data is the norm as it covers all the seasonal variations. The other considerations are local agricultural practices such as the application of fertilisers and pesticides. The pre operational measure does state 'unless otherwise agreed in writing'.

In this instance the Environment Agency will agree to monitoring twice monthly for 6 months to obtain real time data that will enable us to set control and trigger levels limits within the permit. If the limits that are eventually agreed turn out to be unrealistic, then further evidence can be supplied by Lincwaste Ltd and the permit can be varied again in the future.

Regards

Helen Dale BSc (Hons) MIEMA CEnv

Regulatory Officer - EPR Installations North
Environment Agency, **Ceres House, Searby Road, Lincoln, LN2 4DW**
helen.dale@environment-agency.gov.uk
External: 020 302 54962
Internal ex: 34962

Working days: Monday to Friday

From: Colin Fenwick [mailto:Colin.Fenwick@fccenvironment.co.uk]

Sent: 09 July 2020 10:41
To: DALE, Helen <helen.dale@environment-agency.gov.uk>
Cc: Jon Seagrave <Jon.Seagrave@fccenvironment.co.uk>; Branson, Jim <jim.branson@environment-agency.gov.uk>; Adam Mears <Adam.Mears@fccenvironment.co.uk>; Anthony Porter <Anthony.Porter@fccenvironment.co.uk>; James Cook <james.cook@fccenvironment.co.uk>; Mark Pailing <Mark.Pailing@fccenvironment.co.uk>
Subject: Leadenham Borehole Monitoring Proposals

Morning Helen,

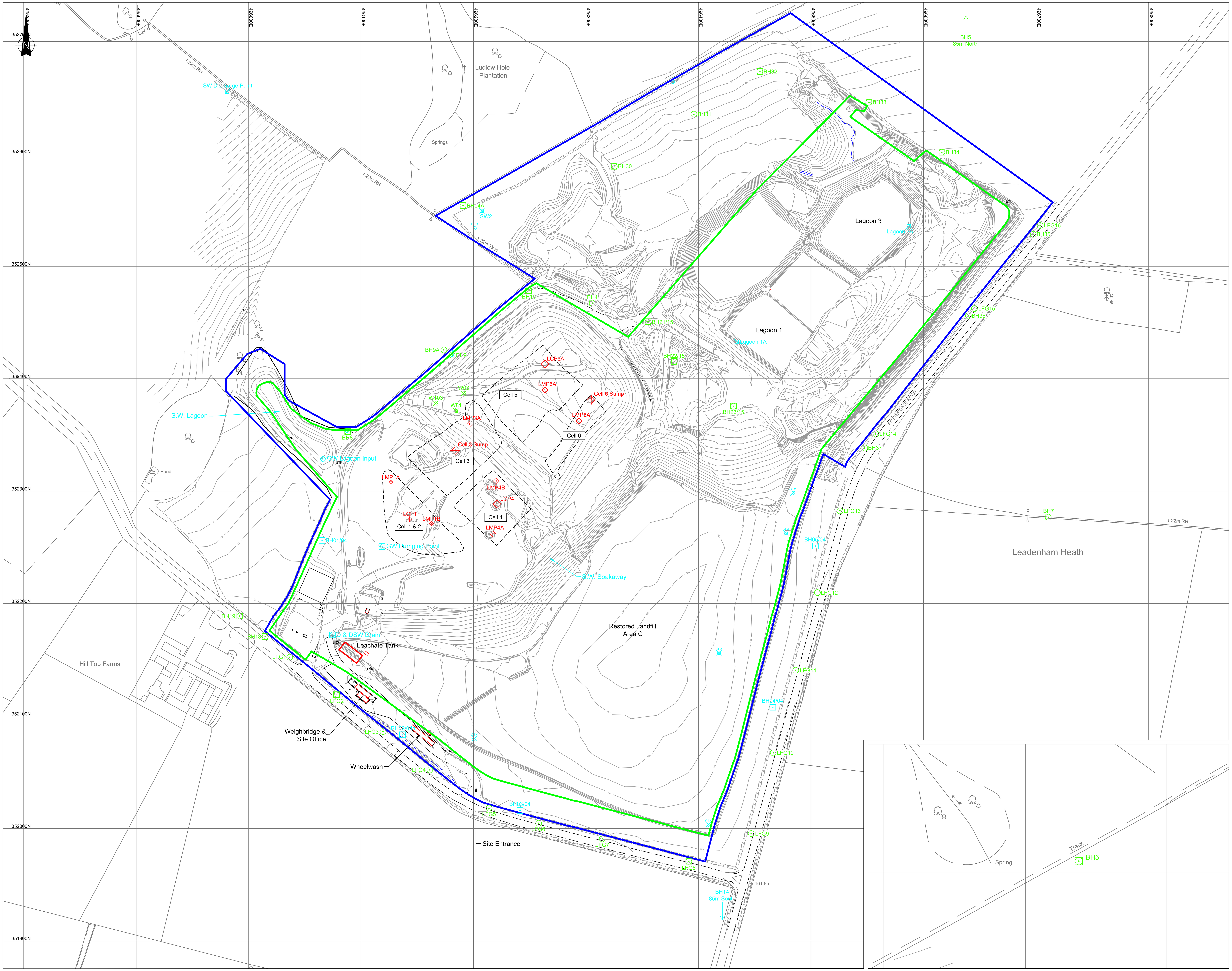
As discussed on the phone, just to put into writing:

We are proposing to install the new LFG and GW monitoring boreholes around the northern development area in the coming months and begin gathering data to enable us to fulfil the pre-op conditions before waste goes into this area. As I mentioned, the final locations of the BH's are being discussed due to the feasibility of getting drilling rigs to the 2 northernmost proposed locations – I'll send v8 of the plan as soon as I have finished it.

FCC are proposing that rather than 12 months of monthly data to gather the necessary 12 points of data, we instead monitor fortnightly over a 6 month period. Due to Kirkby and Staple Quarry closing for periods during the Covid-19 outbreak, Leadenham had an unexpected influx of waste and to further compound the sites current life expectancy, Staple Quarry's end date seems to be creeping forward also. Given how close Kirkby is to completion too, it is essential for the areas waste management that Leadenham be prepared to open the new cells to deal with the excess amounts of waste that will be diverted there. Agreeing a reduced timeframe for gathering this monitoring data will ensure we are in the best position with data to be able to propose limits prior to site opening as we can implement the increased monitoring as soon as the boreholes are drilled. Given that 6 months from expected completion would take us through to the ends of winter, I am confident that 6 months monitoring will still allow us to propose limits that can account for seasonal trends and be reasonable limits that we will not breach.

Kind regards

Colin Fenwick – Compliance Advisor
Mobile: 07917068223 | Email: Colin.Fenwick@fccenvironment.co.uk
FCC Environment | North Hykeham | Whisby Road | North Hykeham | Lincoln | Lincolnshire | LN6 3QZ | http://www.fccenvironment.co.uk/



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:

- Ownership Boundary
- Planning Permission Boundary
- 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
- Groundwater Proposed
- Proposed Combined Gas/ Groundwater Monitoring Point
- As-built Cell Footprint
- Latest Available Ground Contours

Revision:	Date:	Description:	By:	Chk:
A	19.01.16	BH02/04 removed, BH02/04a added	BS	GB
B	06.04.16	Site survey updated, WMP Lagoon 1A & 3 added	BS	GB
C	10.07.18	SW monitoring updated. Cell 1 & 2 detail added.	BS	GB
D	14.11.18	Site survey updated. Cell 1 & 2 detail amended.	BS	GB
E	22.02.19	Site survey updated.	BS	GB
F	21.06.19	BH9A added	BS	GB
G	09.09.19	SW discharge point added & site survey updated	BS	GB
H	21.11.19	Layout amended	BS	GB
I	10.11.20	Proposed wells added. Proposed cells added. Site survey updated.	BS	CF
J	21.04.21	SW2 added	MK	CF

Reference files:
Information taken from plans;
Site Survey: 714W3208_COMPOSITE
As-built cells & Future Cells: 714B3060

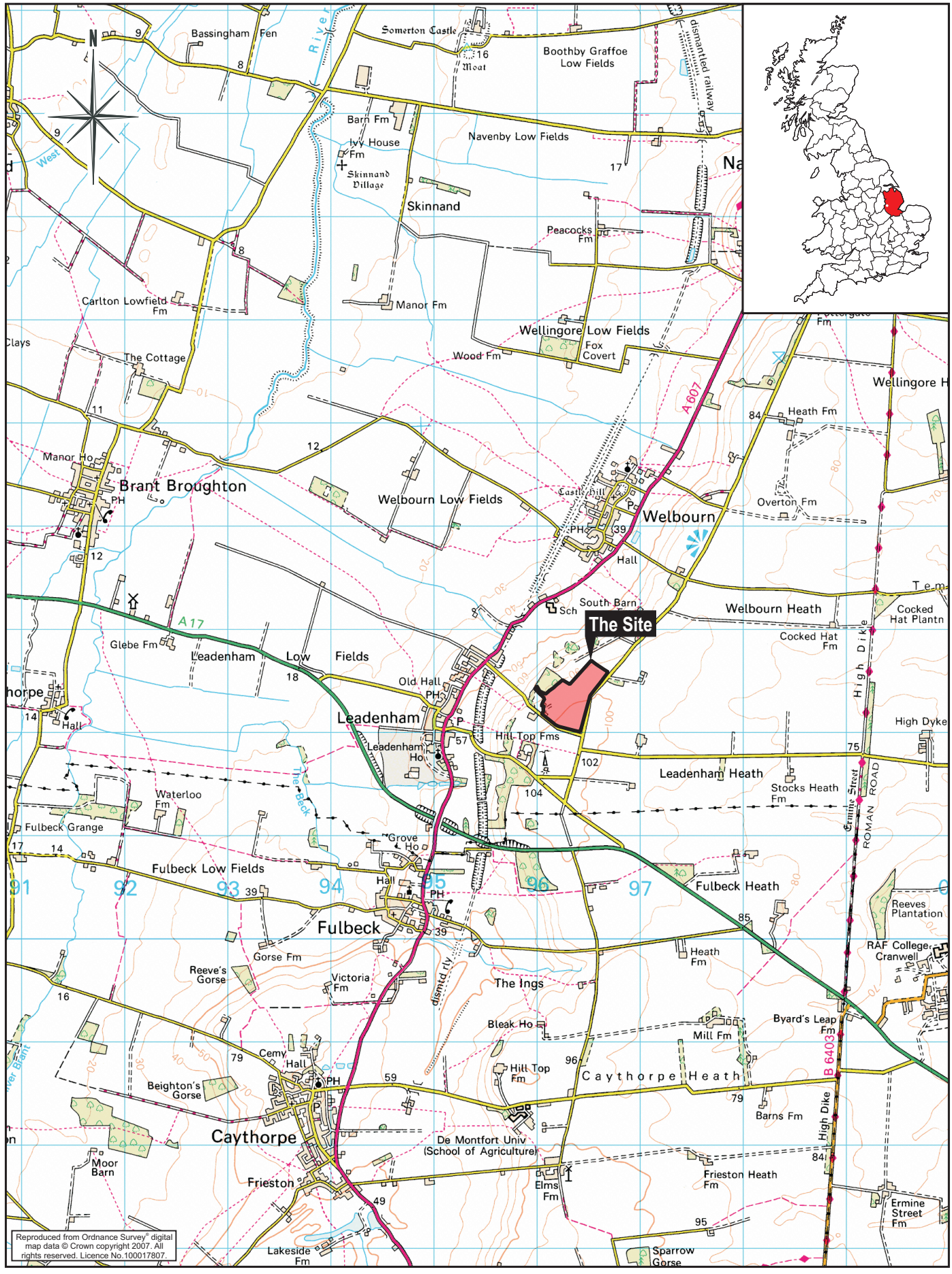
FCC Environment (UK) Limited
6 Sidings Court, White Rose Way, Doncaster. DN4 5NU

Site: **LEADENHAM**
LANDFILL SITE

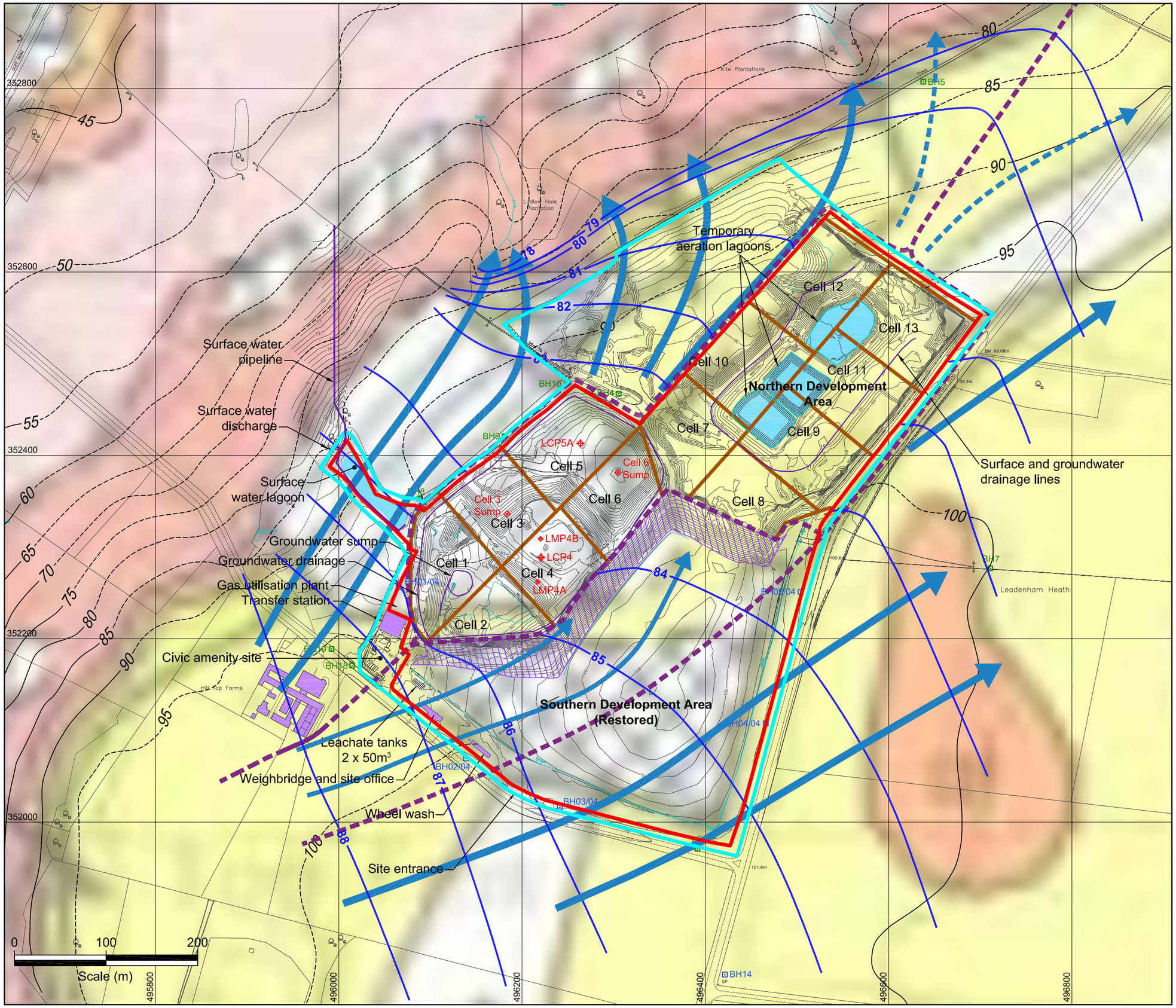
Drawing Title: Environmental Monitoring Plan

Drawn By:	Checked By:	Date:	Scale:	Paper Size:
MK	CF	21.04.21	1:1500	A1

Status:	Revision:	Plan Number:	Drawing No:
FINAL	J	**PLAN 4**	**714M259**



Golder Associates	Client: Waste Recycling Group	Created by: AP	Project Manager: JL	Reviewer: RL	Date: 04/12/09
	Project: Leadenham Landfill Site PPC Section A: Environmental Setting and Installation Design	File No.: 5230487r1		Project No.: 08514290097	
		Size: A4	Scale: 1:50,000	Status: Issue	
	Title: Site Location Plan	Drawing No.: ESID1			Rev: -



N

NOTE

All levels relative to Newlyn Ordnance Datum.

REFERENCE

1. Reproduced from Ordnance Survey digital map data Crown copyright 2002. All rights reserved
2. Site survey provided by Waste Recycling Group, Drawing Ref: 714W135, dated 14/10/08.

LEGEND

- Land under applicant's control
- Installation boundary
- Cell boundary
- Ground contour: m AOD July 2008
- 80 Groundwater Contour
- interpreted groundwater flow direction
- Line of groundwater divide
- Groundwater drainage
- Combined Gas/ Groundwater Monitoring Point
- Groundwater Monitoring Borehole
- Leachate Collection Point
- Leachate Monitoring Point
- Leachate Collection Sump
- Area to be filled against previously deposited waste utilising interface lining system to provide separation between the two fill areas

Client	Waste Recycling Group
Project	Leadenham Landfill Site PPC Section A: Environmental Setting and Installation Design
Title	Local Hydrology and Hydrogeology

Created by	Project Manager	Reviewer	Date
AP	JL	RL	17/12/09

File No.	Project No.
5230499r5	08514290097

Size	Scale	Status
A3	1:4000	Issue

Drawing No.	Rev
ESID11	-

Golder Associates
Attenborough House
Browns Lane Business Park
Stanton-on-the-Wolds
Nottinghamshire
NG12 5BL
+44 (0)115 937 1111

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 SIRIUS ENVIRONMENTAL PRIOR TO CONSTRUCTION WORKS COMMENCING.

LEGEND

- 18.5 — SITE SURVEY
- 18.5 — EXISTING AS BUILT CELL CONTOURS
- 18.5 — CELLS 7 - 10 PROPOSED CONTOURS
- ENVIRONMENTAL PERMIT BOUNDARY
- CELL FOOTPRINT
- RESTORED LANDFILL
- OPERATIONAL AREA
- CAPPED AREA
- FUTURE DEVELOPMENT

CELL 7
CELL 8
CELL 9
CELL 10
NORTHERN DEVELOPMENT AREA
Cell 5
Cell 6
Cell 3
Cell 4
WESTERN DEVELOPMENT AREA
Estimated Base at 93 AOD based on Gas Infrastructure
SOUTHERN DEVELOPMENT AREA
GAS UTILISATION PLANT
CIVIC AMENITY SITE
LEACHATE TANK 1 X 50m³
WEIGHBRIDGE AND SITE OFFICE
WHEEL WASH
SITE ENTRANCE

REV	DESCRIPTION	DATE	BY

CLIENT

FCC Environment

FCC Environment (UK) Limited
Ground Floor West, 900 Pavilion Drive, Northampton Business Park, Northampton, NN4 7RG

sirius Environmental
Office Suite 2, The Beacon Centre for Enterprise, Dafen, Llanelli. SA14 8LQ. 01554 780 544

JOB TITLE

Leadenham Landfill Site Environmental Permit Variation Application

DRAWING TITLE

Site Layout and Waste Deposition

DRAWN	DATE	APPROVED	DATE
M.C	17/03/2021	M.K	17/03/2021

SCALE	SHEET	DRAWING NUMBER	REVISION
1:2,000	A1L	WR7770/09/03	1

Environment Agency	**EPR Compliance Assessment Report**	Report ID: PP3133TS/0403363

This form will report compliance with your permit as determined by an Environment Agency officer

Site	Leadenham Landfill & Household Waste Site - EPR/XP3798NK				Permit Ref	PP3133TS	
Operator/ Permit holder	Lincwaste Limited						
Date	09/07/2021				Time in		Out
What parts of the permit were assessed	Improvement condition IC1 and IC2 - BH9A						
Assessment	Report/data review	EPR Activity:	Installation	X	Waste Op		Water Discharge
Recipient's name/position	Business Manager; Compliance Advisor						
Officer's name	Helen M Dale				Date issued	21/09/2021	

Section 1 - Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations (EPR). A detailed explanation and any action you may need to take are given in the "Detailed Assessment of Compliance" (section 3). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS scores can be consolidated or suspended, where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit Conditions and Compliance Summary				**Condition(s) breached**
a) Permitted activities	**1.** Specified by permit	A		
b) Infrastructure	**1.** Engineering for prevention & control of pollution	N		
	2. Closure & decommissioning	N		
	3. Site drainage engineering (clean & foul)	N		
	4. Containment of stored materials	N		
	5. Plant and equipment	N		
c) General management	**1.** Staff competency/ training	N		
	2. Management system & operating procedures	N		
	3. Materials acceptance	N		
	4. Storage handling, labelling, segregation	N		
d) Incident management	**1.** Site security	N		
	2. Accident, emergency & incident planning	N		
e) Emissions	**1.** Air	A		
	2. Land & Groundwater	A		
	3. Surface water	N		
	4. Sewer	N		
	5. Waste	N		
f) Amenity	**1.** Odour	N		
	2. Noise	N		
	3. Dust/fibres/particulates & litter	N		
	4. Pests, birds & scavengers	N		
	5. Deposits on road	N		
g) Monitoring and records, maintenance and reporting	**1.** Monitoring of emissions & environment	A		
	2. Records of activity, site diary, journal & events	N		
	3. Maintenance records	N		
	4. Reporting & notification	N		
h) Resource efficiency	**1.** Efficient use of raw materials	N		
	2. Energy	N		

KEY: **C1, C2, C3, C4** = CCS breach category **(* suspended scores are marked with an asterisk),**
A = Assessed (no evidence of non-compliance), **N** = Not assessed, **NA** = Not Applicable, **O** = Ongoing non-compliance – not scored
MSA, **MSB**, **TCM** = Management System condition A, Management System Condition B and Technically Competent Manager condition which are environmental permit conditions from Part 3 of schedule9 EPR (see notes in Section 5/6).

Number of breaches recorded	0	**Total compliance score** (see section 5 for scoring scheme)	0

If the Total No Breaches is greater than zero, then please see Section 3 for details of our proposed enforcement response

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- the part(s) of the permit that were assessed (e.g. maintenance, training, combustion plant, etc)
- where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- any non-compliances identified
- any non-compliances with directly applicable legislation
- details of any multiple non-compliances
- information on the compliance score accrued inc. details of suspended or consolidated scores.
- details of advice given
- any other areas of concern
- all actions requested
- any examples of good practice.
- a reference to photos taken

This report should be clear, comprehensive, unambiguous and normally completed within 14 days of an assessment.

Permit variation EPR-XP3798NK V013 issued 18/06/2020

Permit condition 2.4
Improvement programme
IC1:
The operator shall:

- Monitor, on a monthly interval, the new groundwater monitoring point BH9A and collect a statistically significant data set covering a minimum period of 12 months.
- Undertake the monitoring in accordance with the Environment Agency Guidance TGN02 'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003).
- Establish the background concentrations and propose compliance limits for the parameters specified in schedule 3, table S3.4 and the corresponding control levels.
- Submit a written report on the proposed compliance limits and action levels to the Environment Agency for approval.

The operator shall undertake the monitoring in accordance with the Environment Agency's written approval.

IC2:
The operator shall:

- Monitor, on a monthly interval, the new gas monitoring point BH9A and collect a statistically significant data set covering a minimum period of 12 months.
- Undertake the monitoring in accordance with the Environment Agency Guidance LFTGN03 'Management of Landfill Gas' (September 2004).
- Establish the background concentration of methane and carbon dioxide and propose compliance limit for methane and action levels for methane and carbon dioxide in accordance with Industry Code of Practice 'Perimeter soil gas emissions criteria and associated management' (January 2011, v1.01).
- Submit a written report on the gas compliance limit and action levels to the Environment Agency for approval.

The operator shall undertake the monitoring in accordance with the Environment Agency's written approval.

The Environment Agency acknowledges receipt on the 09 July 2021 of the following documents, submitted to full fill the requirements of the improvement conditions IC1 and IC2:

- Discharge of pre-operational and improvement conditions, WR7809/03 – June 2021
- Environmental monitoring plan – No 714M259
- Site location plan – No ESID1
- Installation of gas and groundwater monitoring boreholes – validation report – November 2020
- Email dated 14 July 2020 – EA agreeing to twice monthly monitoring for 6 months
- Groundwater quality data BH9A
- Groundwater level data BH9A
- Ground gas quality data BH9A

Groundwater and gas monitoring borehole BH09A was installed as a replacement to BH9 in the Western Development Area. A programme of monitoring over an agreed period of six months commenced between November 2020 and May 2021. This provided the evidence required to set control and trigger levels for the groundwater and gas.

All submitted documents have been reviewed and the Environment Agency are satisfied that the techniques and guidance used to derive proposed control and trigger levels for groundwater and gas are appropriate. The requirements have been met for the IC1 and IC2 and these improvement conditions can now be deemed approved.

Section 3- Enforcement Response	**Only one of the boxes below should be ticked**
You must take immediate action to rectify any non-compliance and prevent repetition. Non-compliance with your permit conditions constitutes an offence* and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below. **Non-compliance with **MSA**, **MSB** & **TCM** do not constitute an offence but can result in the service of a compliance, suspension and/or revocation notice*.	
Other than the provision of advice and guidance, at present we do not intend to take further enforcement action in respect of the non-compliance identified above. This does not preclude us from taking enforcement action if further relevant information comes to light or advice isn't followed.	
In respect of the above non-compliance you have been issued with a warning. At present we do not intend to take further enforcement action. This does not preclude us from taking additional enforcement action if further relevant information comes to light or offences continue.	
We will now consider what enforcement action is appropriate and notify you, referencing this form.	

Section 4- Action(s)

Where non-compliance has been detected and an enforcement response has been selected above, this section summarises the steps you need to take to return to compliance and also provides timescales for this to be done.

Criteria Ref.	**CCS Category**	**Action Required / Advised**	**Due Date**
See Section 1 above			

Section 5 - Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- advise on corrective actions verbally or in writing
- require you to take specific actions in writing
- issue a notice
- require you to review your procedures or management system
- change some of the conditions of your permit
- decide to undertake a full review of your permit

Any breach of a permit condition is an offence* and we may take legal action against you.

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and or suspension or revocation of the permit.
- A civil sanction Enforcement Undertaking (EU) offer may also be available to you as an alternative enforcement response for this/these offence(s).

See our Enforcement and Civil Sanctions guidance for further information

A breach of permit condition **MSA, MSB & **TCM** is not an offence but may result in the service of a notice requiring compliance and/or suspension or revocation of the permit*.

This report does not relieve the site operator of the responsibility to

- ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- ensure you comply with other legislative provisions which may apply.

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance which could have a **major** environmental effect	60
C2	A non-compliance which could have a **significant** environmental effect	31
C3	A non-compliance which could have a **minor** environmental effect	4
C4	A non-compliance which has **no** potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

MSA, MSB & TCM are conditions inserted into certain permits by Schedule 9 Part 3 EPR

MSA requires operators to manage and operate in accordance with a written management system that identifies and minimises risks of pollution.

MSB requires that the management system must be reviewed, kept up-to-date and a written record kept of this.

TCM requires the submission of technical competence information.

Section 6 – General Information

Data protection notice

The information on this form will be processed by the Environment Agency to fulfill its regulatory and monitoring functions and to maintain the relevant public register(s). The Environment Agency may also use and/or disclose it in connection with:

- offering/providing you with its literature/services relating to environmental matters
- consulting with the public, public bodies and other organisations (e.g. Health and Safety Executive, local authorities) on environmental issues
- carrying out statistical analysis, research and development on environmental issues
- providing public register information to enquirers
- investigating possible breaches of environmental law and taking any resulting action
- preventing breaches of environmental law
- assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Information Regulations request.

The Environment Agency may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The Environment Agency will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within 28 days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

You must notify your local officer within 28 days of receipt if, you wish to challenge any part of this compliance assessment report. If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with the officer's line managers. If you wish to raise your dispute further through our official complaints and Commendations procedure, phone our general enquiry number 03708 506 506 (Mon to Fri 08.00–18.00) and ask for the customer contact team or send an email to enquiries@environment-agency.gov.uk. If you are still dissatisfied, you can make a complaint to the Ombudsman. For advice on how to complain to the Parliamentary and Health Service Ombudsman phone their helpline on 0345 015 4033.

Environment Agency	**EPR Compliance Assessment Report**	Report ID: PP3133TS/0402657

This form will report compliance with your permit as determined by an Environment Agency officer

Site	Leadenham Landfill & Household Waste Site - EPR/XP3798NK				Permit Ref	PP3133TS		
Operator/ Permit holder	Lincwaste Limited							
Date	09/07/2021				Time in		Out	
What parts of the permit were assessed	Pre Operational condition PO 01							
Assessment	Report/data review	EPR Activity:	Installation	X	Waste Op		Water Discharge	
Recipient's name/position	Business Manager; Compliance Advisor							
Officer's name	Helen M Dale				Date issued	21/09/2021		

Section 1 - Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations (EPR). A detailed explanation and any action you may need to take are given in the "Detailed Assessment of Compliance" (section 3). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS scores can be consolidated or suspended, where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit Conditions and Compliance Summary				**Condition(s) breached**
a) Permitted activities	**1**. Specified by permit	A		
b) Infrastructure	**1.** Engineering for prevention & control of pollution	A		
	2. Closure & decommissioning	N		
	3. Site drainage engineering (clean & foul)	N		
	4. Containment of stored materials	N		
	5. Plant and equipment	N		
c) General management	**1**. Staff competency/ training	N		
	2. Management system & operating procedures	N		
	3. Materials acceptance	N		
	4. Storage handling, labelling, segregation	N		
d) Incident management	**1**. Site security	N		
	2. Accident, emergency & incident planning	N		
e) Emissions	**1.** Air	A		
	2. Land & Groundwater	A		
	3. Surface water	N		
	4. Sewer	N		
	5. Waste	N		
f) Amenity	**1**. Odour	N		
	2. Noise	N		
	3. Dust/fibres/particulates & litter	N		
	4. Pests, birds & scavengers	N		
	5. Deposits on road	N		
g) Monitoring and records, maintenance and reporting	**1**. Monitoring of emissions & environment	A		
	2. Records of activity, site diary, journal & events	N		
	3. Maintenance records	N		
	4. Reporting & notification	N		
h) Resource efficiency	**1**. Efficient use of raw materials	N		
	2. Energy	N		

KEY: **C1, C2, C3, C4** = CCS breach category **(* suspended scores are marked with an asterisk),**
A = Assessed (no evidence of non-compliance), **N** = Not assessed, **NA** = Not Applicable, **O** = Ongoing non-compliance – not scored
MSA, **MSB**, **TCM** = Management System condition A, Management System Condition B and Technically Competent Manager condition which are environmental permit conditions from Part 3 of schedule9 EPR (see notes in Section 5/6).

Number of breaches recorded	0	**Total compliance score** (see section 5 for scoring scheme)	0

If the Total No Breaches is greater than zero, then please see Section 3 for details of our proposed enforcement response

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- the part(s) of the permit that were assessed (e.g. maintenance, training, combustion plant, etc)
- where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- any non-compliances identified
- any non-compliances with directly applicable legislation
- details of any multiple non-compliances
- information on the compliance score accrued inc. details of suspended or consolidated scores.
- details of advice given
- any other areas of concern
- all actions requested
- any examples of good practice.
- a reference to photos taken

This report should be clear, comprehensive, unambiguous and normally completed within 14 days of an assessment.

Permit variation EPR-XP3798NK V013 issued 18/06/2020

Pre operational condition PO1
Permit Condition 2.4.1

The PO1 states:
The operator shall:

- Install groundwater boreholes around areas of future landfill development in the Northern Development area
- Submit in writing for Environment Agency approval, a revised drawing (with referencing of new boreholes) and monitoring schedule to obtain back ground data over a period of at least 12 months (unless otherwise agreed in writing).
- Undertake background monitoring in accordance with the Agencies written approval
- Submit in writing for Environment Agency approval, control and trigger levels for groundwater, based on the outcome of background monitoring around future landfill phases.

The Environment Agency acknowledges receipt on the 09 July 2021 of the following documents, submitted to full fill the requirements of the pre-operational condition PO01:

- Discharge of pre-operational and improvement conditions, WR7809/03 – June 2021
- Environmental monitoring plan – No 714M259
- Site location plan – No ESID1
- Installation of gas and groundwater monitoring boreholes – validation report – November 2020
- Email dated 14 July 2020 – EA agreeing to twice monthly monitoring for 6 months
- Groundwater quality data
- Groundwater level data

Nine groundwater monitoring boreholes were installed around the Northern Development Area during August 2020 and a programme of monitoring over an agreed period of six months commenced between November 2020 and May 2021. This provided the evidence required to set control and trigger levels for the groundwater boreholes BH04A; BH30; BH31; BH32; BH33, BH34, BH35, BH36 and BH37.

All submitted documents have been reviewed and the Environment Agency are satisfied that the techniques used to derive proposed control and trigger levels for groundwater are appropriate and that the requirements have been met for the PO01 and this pre operational measures can now be deemed approved.

Pre operational condition PO02 has previously been approved on 26 June 2020, CAR ref: PP3133TS/0369512

Section 3- Enforcement Response	**Only one of the boxes below should be ticked**
You must take immediate action to rectify any non-compliance and prevent repetition. Non-compliance with your permit conditions constitutes an offence* and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below. **Non-compliance with **MSA**, **MSB** & **TCM** do not constitute an offence but can result in the service of a compliance, suspension and/or revocation notice*.	
Other than the provision of advice and guidance, at present we do not intend to take further enforcement action in respect of the non-compliance identified above. This does not preclude us from taking enforcement action if further relevant information comes to light or advice isn't followed.	
In respect of the above non-compliance you have been issued with a warning. At present we do not intend to take further enforcement action. This does not preclude us from taking additional enforcement action if further relevant information comes to light or offences continue.	
We will now consider what enforcement action is appropriate and notify you, referencing this form.	

Section 4- Action(s)			
Where non-compliance has been detected and an enforcement response has been selected above, this section summarises the steps you need to take to return to compliance and also provides timescales for this to be done.			
Criteria Ref.	**CCS Category**	**Action Required / Advised**	**Due Date**
See Section 1 above			

Section 5 - Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- advise on corrective actions verbally or in writing
- require you to take specific actions in writing
- issue a notice
- require you to review your procedures or management system
- change some of the conditions of your permit
- decide to undertake a full review of your permit

Any breach of a permit condition is an offence* and we may take legal action against you.

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and or suspension or revocation of the permit.
- A civil sanction Enforcement Undertaking (EU) offer may also be available to you as an alternative enforcement response for this/these offence(s).

See our Enforcement and Civil Sanctions guidance for further information

A breach of permit condition **MSA, MSB & **TCM** is not an offence but may result in the service of a notice requiring compliance and/or suspension or revocation of the permit*.

This report does not relieve the site operator of the responsibility to

- ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- ensure you comply with other legislative provisions which may apply.

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance which could have a **major** environmental effect	60
C2	A non-compliance which could have a **significant** environmental effect	31
C3	A non-compliance which could have a **minor** environmental effect	4
C4	A non-compliance which has **no** potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

MSA, MSB & TCM are conditions inserted into certain permits by Schedule 9 Part 3 EPR

MSA requires operators to manage and operate in accordance with a written management system that identifies and minimises risks of pollution.

MSB requires that the management system must be reviewed, kept up-to-date and a written record kept of this.

TCM requires the submission of technical competence information.

Section 6 – General Information

Data protection notice

The information on this form will be processed by the Environment Agency to fulfill its regulatory and monitoring functions and to maintain the relevant public register(s). The Environment Agency may also use and/or disclose it in connection with:

- offering/providing you with its literature/services relating to environmental matters
- consulting with the public, public bodies and other organisations (e.g. Health and Safety Executive, local authorities) on environmental issues
- carrying out statistical analysis, research and development on environmental issues
- providing public register information to enquirers
- investigating possible breaches of environmental law and taking any resulting action
- preventing breaches of environmental law
- assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Information Regulations request.

The Environment Agency may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The Environment Agency will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within 28 days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

You must notify your local officer within 28 days of receipt if, you wish to challenge any part of this compliance assessment report. If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with the officer's line managers. If you wish to raise your dispute further through our official complaints and Commendations procedure, phone our general enquiry number 03708 506 506 (Mon to Fri 08.00–18.00) and ask for the customer contact team or send an email to enquiries@environment-agency.gov.uk. If you are still dissatisfied, you can make a complaint to the Ombudsman. For advice on how to complain to the Parliamentary and Health Service Ombudsman phone their helpline on 0345 015 4033.