

REPORT Biffa Waste Services Ltd Eye Landfill, Eastern Extension

Leachate Management and Monitoring Plan

Submitted to:

Biffa Waste Services Ltd

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Submitted by:

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Distribution List

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1.0 REPORT CONTEXT

This report has been prepared by Golder, member of WSP in UK (Golder), on behalf of Biffa Waste Services Ltd (Biffa) and presents a Leachate Management and Monitoring Plan for the proposed Eastern Extension (Eastern Extension) at Eye Landfill, Eyebury Road, Eye, Peterborough PE6 7TH (the Site).

The Site currently consists of four main areas compromising the Central Area, Northern Extension, North-eastern Extension and Southern Extension. The North-eastern and Southern Extensions are currently authorised by Environmental Permit (EP) EPR/BP/3537PP. Biffa intends to secure additional void space for non-hazardous waste landfill development at the neighbouring Willow Hall Farm Quarry and Inert Landfill, Willow Hall Lane, Thorney, Peterborough, PE6 0QN, which lies to the east of the Eye Landfill (the 'Eastern Extension'), currently operated by PJ Thory Ltd ('Thory'). Thory currently operate their Quarry and Inert Landfill under EP for inert landfill (EPR/DB3007TZ), which was issued to TAG Industries Ltd in 2016 and transferred to Thory in 2017 (EPR/FB3204MX).

This report details the Leachate Management and Monitoring Plan to be implemented specifically at the proposed Eastern Extension and is therefore not applicable to other areas of the Site. This Plan is a 'live' document, which shall be updated accordingly as the project is progressed. Consequently, the Plan should be reviewed after 12 months operation at the site and revised as required. The requirements of this Plan may be transferred to a site-specific Leachate Management and Monitoring Plan developed in accordance with Biffa's Environmental Management System. This Plan should be read in conjunction with the Permit variation application for the Eastern Extension, in particular Environmental Setting and Installation Design (ESID; ref. 21453458.632), and Hydrogeological Risk Assessment (HRA; ref. 21453458.633).

2.0 LEACHATE GENERATION

Water coming into contact with wastes other than those which are inert will become contaminated. In the event that the quantity of water entering the landfill exceeds the absorptive capacity of the waste, the contaminated water will drain as leachate.

The Eastern Extension will comprise 10 non-hazardous waste cells (Cells 9 to 18).

Leachate production rates for each cell have been identified assuming infiltration rates of 167 mm/yr (effective rainfall) in operational areas, 150 mm/yr in temporary capped areas and 50 mm/yr in permanently capped areas. The Water Balance is presented in the ESID report, and summarised in Table LMP1.

Cell	Plan Area	Total Void Space^	Time to Fill Cell	Total Water Input During Filling	Total Water Output (Absorptive Capacity) During Filling	Free Leachate Volume
	(m²)	(m³)	(years)	(m³)	(m³)	(m³)
Cell 9	24002	332307	1.6	6313	16615	-10303
Cell 10	31083	430343	2.0	10587	21517	-10930
Cell 11	22333	309200	1.5	5465	15460	-9995
Cell 12	16357	226462	1.1	2932	11323	-8391
Cell 13	26452	366227	1.7	7667	18311	-10644
Cell 14	21039	291284	1.4	4850	14564	-9714

Table LMP1: Summary of Water Balance



Cell	Plan Area	Total Void Space^	Time to Fill Cell	Total Water Input During Filling	Total Water Output (Absorptive Capacity) During Filling	Free Leachate Volume
	(m²)	(m³)	(years)	(m³)	(m³)	(m³)
Cell 15	19064	263940	1.3	3982	13197	-9215
Cell 16	20678	286286	1.4	4685	14314	-9629
Cell 17	27825	385236	1.8	8484	19262	-10778
Cell 18	24774	342995	1.6	6725	17150	-10424

3.0 LEACHATE MANAGEMENT

All cells will be engineered to contain leachate generated within the Eastern Extension and all cells will be provided with an engineered leachate monitoring and collection system. The HRA assesses potential pathways for leachate migration and corresponding risk to groundwater and surface water receptors.

In order to minimise rainwater ingress into the site, all non-hazardous waste cells at the site will be capped at the earliest practicable opportunity, following completion of infilling to final pre-settlement restoration contours. The restoration profile has been designed in order to ensure the efficient drainage of rainfall run-off from the Eastern Extension, thereby minimising infiltration. At the earliest opportunity, restoration sub-soil and topsoil will be spread over the cap, and vegetation established.

3.1 Leachate Drainage System

The base of each cell will be profiled to provide a fall of approximately 1:100 towards a leachate collection point as shown in the **Drawing ESID7A - Leachate Management Layout**. A pipe system will be placed on the surface of the basal clay that comprises a central HDPE slotted pipe with secondary drains comprising HDPE slotted pipe connected at regular intervals in a herringbone pattern. The central pipe will be connected to the leachate collection point, which will be constructed from the base of the cell to the surface of the Site to enable the extraction of the collected leachate.

The side slope lining system for the Eastern Extension will be the same as the basal lining system described above.

The final design and properties of the leachate drainage system will be submitted to the Environment Agency (EA) within a Construction Quality Assurance (CQA) plan prior to placement of any drainage material. Following agreement by the EA, the works will be completed in accordance with the CQA plan, and a CQA report detailing the results of compliance testing will be produced.

3.2 Leachate Extraction

Leachate extraction within the non-hazardous landfill at the Eastern Extension will follow the procedures applied at the Southern Extension. In accordance with EA guidance LFTGN 02 (2003), one leachate collection sump per hydraulically isolated cell is required. The collection point will be located at the lowest point along the boundary of each of the cells, as shown in the **Drawing ESID7A - Leachate Management Layout**, or as otherwise agreed with the EA as part of the site-specific design, specification, and construction quality assurance plan.

Leachate will be removed from the leachate collection points by means of vertical leachate extraction wells or upslope risers extending to the surface of the landfill. The wells will be able to accommodate automatic pumping equipment (eductors or submersible pumps) to extract leachate (Drawing ESID7B - Leachate Management Details). In the event of failure of the leachate extraction point, actions will be taken to install a suitable replacement as close to the existing leachate extraction point as practicable. In order to manage leachate heads across the cell, leachate may also be abstracted from monitoring points if necessary.

Leachate will be extracted from the cells to maintain the level of leachate within each cell below control levels.

Leachate Recirculation 3.3

During the early stages of waste infilling, and when required, leachate will be re-circulated after collection in the extraction wells. The leachate will be returned to the waste mass to increase evaporative loss and fully utilise the absorptive capacity of the waste.

Prior to completion of infilling of wastes to final levels in individual areas, leachate may be re-circulated back into the waste mass by either pumping below the working face using temporary pipework or vacuum tanker, prior to covering with new wastes. Alternatively, pipework will be introduced into shallow trenches excavated into recently placed wastes, filled with selected hardcore. A similar layout to the herringbone placed in the base will be used to obtain coverage of the site surface and therefore to develop a sufficient wetting area as it percolates downwards through the waste, such that a uniform distribution of moisture content may be achieved.

To minimise odour from these operations, leachate will not be spray irrigated onto areas of the site, and shallow trenches (once backfilled with hardcore) will be covered over with suitable material to suppress odour from the recirculation trench. Pipework will be introduced into these trenches before leachate is pumped in, and the discharge will be monitored to ensure that it does not give rise to unacceptable odour. Should unacceptable odour arise, or the trench become saturated, the discharge will be discontinued and moved to an alternative discharge point. Where trenches become a source of odour, these will be abandoned, and the entry covered over to prevent further odour. Use of trenches will be rotated to obtain a uniform distribution of wetting and prevent saturation at individual locations.

After completion of each cell, a leachate re-circulation system will be installed, as required, beneath the cap. This will allow the re-introduction of leachate abstracted from the extraction wells back into the waste mass to accelerate the stabilisation of the waste mass.

The leachate re-circulation system will comprise an entry point through the cap in each cell. The system will spread the leachate back over the waste through a system of perforated HDPE pipes below the low permeability sealing liner.

The system will comprise pipework forming a herringbone drainage system, placed in 0.5 m wide by 0.5 m deep trenches excavated into the waste at the surface of the landfill (or an alternative design agreed with the EA if required). Trenches will be backfilled with selected hardcore and aggregate which is free draining.

Leachate recirculation will promote accelerated stabilisation by maintaining moisture levels within the waste body as a whole and assist in the flushing out of chemical contaminants such as ammoniacal nitrogen. This process will also aid landfill gas production, and the use of active landfill gas extraction and flaring will also aid biodegradation. Enhanced gas production rates as a consequence of leachate recirculation and gas extraction will further promote accelerated stabilisation and will also increase the potential for landfill gas utilisation, rather than simple flaring.

To assist in the recirculation process, potential barriers to the uniform distribution of leachate within the waste mass will be minimised. Low permeability cover materials will not be used as daily cover. Where such materials are used as daily or intermediate cover, these will be removed prior to deposit of subsequent lifts of waste.



It is not anticipated that pre-treatment of leachate pH, temperature, or particle size will be necessary prior to recirculation.

3.4 Leachate Disposal

Excess leachate that cannot be re-circulated will be removed from the low point in the basal drainage system, by means of a leachate extraction well which will extend up to the surface. Leachate will be extracted from the cells to maintain leachate heads within each cell below the leachate head compliance level. Leachate will be transferred by surface pipework from the abstraction wells to the leachate holding tank at the Site Reception for removal by road tanker to an appropriately authorised water treatment works.

3.5 Leachate Management Aftercare

All the components of the leachate extraction systems below the landfill cap will be left in the waste. All headworks, pipework, manifold chambers etc. above the capping system will be removed as part of the decommissioning. Leachate management infrastructure (including the storage tank and main leachate line) will be decommissioned and dismantled at the end of the Aftercare Period when risk assessment has identified that leachate management does not need to continue.

4.0 LEACHATE MONITORING

4.1 Leachate Monitoring Infrastructure

One leachate extraction well and two remote leachate monitoring wells will be located in each cell within the Eastern Extension, at the locations shown on Drawing ESID7A - Leachate Management Layout. The two monitoring wells in each cell will be away from the extraction well to determine the head of leachate over the cell base.

The extraction locations which will be used for leachate monitoring and sampling will comprise the wells summarised in Table LMP2, as shown on Drawing ESID7A - Leachate Management Layout.

Cell	Leachate Extraction Well	Leachate Monitoring Well
Cell 9	LEWEE9A	LMWEE9B and LMWEE9C
Cell 10	LEWEE10A	LMWEE10B and LMWEE10C
Cell 11	LEWEE11A	LMWEE11B and LMWEE11C
Cell 12	LEWEE12A	LMWEE12B and LMWEE12C
Cell 13	LEWEE13A	LMWEE13B and LMWEE13C
Cell 14	LEWEE14A	LMWEE14B and LMWEE14C
Cell 15	LEWEE15A	LMWEE15B and LMWEE15C
Cell 16	LEWEE16A	LMWEE16B and LMWEE16C
Cell 17	LEWEE17A	LMWEE17B and LMWEE17C
Cell 18	LEWEE18A	LMWEE18B and LMWEE18C

Table LMP2: Leachate Extraction and Monitoring Points



4.2 Leachate Monitoring Programme

The Eastern Extension will be operated on the principle of hydraulic containment. In accordance with the findings of the HRA, the leachate level within each cell will be maintained at or below 1.4 m above the base of the cell (the compliance limit, which should be 1 m below the minimum groundwater level in the Kellaways Sand and River Terrace Deposits (once rebound occurs)). Leachate is monitored from one leachate collection point and two remote monitoring points located within each cell.

Leachate level (measured to the top level of the pipework) and leachate head above base will be determined to an accuracy of 0.01 m. The leachate level will be measured using an electronic dip tape, which is lowered down the borehole until the electronic beeper sounds. The graduation on the tape is read to give the depth at which the beeper starts to sound. A report, reviewing the results of the monitoring completed over the previous twelve-month period, will be produced and submitted to the EA by 31 March (or other date agreed in writing by the EA) each year.

The suggested analysis suites for leachate quality are based on a combination of EA guidance (2003) and the risks posed to groundwater as described in the HRA of the Permit variation Application.

LEACHATE COMPLIANCE LEVELS 5.0

5.1 Leachate Level

Following installation, the leachate points specified above will be monitored at monthly intervals and leachate levels measured, accurate to 0.01 m, determined relative to Ordnance Datum, and as leachate head above base. Once each phase is capped, then the level of leachate in the boreholes will be monitored on a monthly basis. Results of leachate level measurement will be forwarded to the EA in accordance with the Permit.

As the Eastern Extension will be operated under the principle of hydraulic containment, the level of leachate in each cell will be controlled to ensure that hydraulic containment is maintained to ensure its resultant inward advective flow. Leachate levels will be monitored in the two remote leachate monitoring points in each cell. To ensure that hydraulic containment is maintained, compliance limits for leachate level are set in accordance with HRA as 1.4 m above the cell base.

5.1.1 Variation in Groundwater Elevation

A HRA review will be completed every six years, in accordance with EA guidance. This will assess if the Eastern Extension remains in hydraulic containment using the recent groundwater and leachate elevation data. Should groundwater elevations in the River Terrace Deposits (following rebound after cessation of groundwater management) or Kellaways Sand reduce to below -1.9 m above Ordnance Datum (m AOD) (equivalent to 1 m above the leachate compliance limit) for more than four months, then the data will be reviewed by use of statistics and graphical presentation to establish the presence of any trends or patterns and an action plan will be submitted to the EA for approval.

5.1.2 Proposed Action Plan in the Event of Breach of Control or Compliance Level

Where leachate levels exceed the control or trigger level in any of the cells at the Eastern Extension, then the action plan detailed in Table LMP3 below will be implemented in relation that cell.



Table LMP3: Action Plan in the Event of a Breached Compliance Limit

Contingency Action	Compliance Limit
Advise site management, and environmental manager of landfill operating company and EA.	•
The leachate well should be dipped within two weeks of the breach to confirm the measurement. If repeat measurements confirm a breach and an increasing trend over a period of 3 months, a specific action plan will be submitted to the Environment Agency and implemented, including where appropriate increased monitoring frequency and/or installation of additional pumps to reduce leachate levels below the compliance level.	~
In the event that the compliance level is exceeded for more than six months, a further specific action plan will be submitted to the Environment Agency and implemented, including additional groundwater and surface water quality monitoring if deemed appropriate.	~

5.2 **Leachate Quality**

The quality of leachate will be monitored by regular sampling and analysis to a similar monitoring regime as previously agreed between Biffa and the EA for Northeastern and Southern Extension at the Eye Landfill. The current EP for the Southern Extension states the frequency with which Biffa reports the results of the environmental monitoring programme to the EA. The frequency of monitoring is considered applicable to the Eastern Extension and is summarised in Table LMP4 below. The MEPP is presented as Drawing HRA3 -Monitoring and Extraction Point Plan.

Monitoring Point Ref./Description	Determinant	Monitoring	Monitoring Standard or Method	
Operational Cells			As specified in	
MEPP	Levels	Monthly	Environment Agency Guidance TGN02	
	pH, EC, total alkalinity, ammoniacal nitrogen, chloride, COD, BOD, cadmium, chromium, copper, lead, nickel, iron, arsenic, magnesium, potassium, total sulphates, calcium, sodium, zinc, manganese,	Quarterly	'Monitoring of Landfill Leachate, Groundwater and Surface Water' (February 2003), Horizontal Guidance Note H1 - Environmental Risk	
	Hazardous substances (also including phenol, naphthalene, mecoprop)	Annually	Assessment for permits, Annex J3, version 2.1, Dec 2011, or such other subsequent guidance as may be agreed in writing	
	Depth to base (m AOD)	Annually		
Non Operational Cells			with the Environment	
MEPP	Levels	Monthly	Agency.	
	pH, EC, total alkalinity, ammoniacal nitrogen, chloride, COD, BOD, cadmium, chromium, copper, lead, nickel, iron, arsenic, magnesium, potassium, total sulphates, calcium, sodium, zinc, manganese,	Annually		
	Hazardous substances (also including phenol, naphthalene, mecoprop)	Once every four years		
	Depth to base (m AOD)	Annually		

Table LMP4: Leachate Monitoring Requirements.



Analysis, detection limits, and reporting of results will be undertaken in accordance with guidance issued by the EA.

Due to the low risk posed by the site to the identified receptors under normal operating conditions, it is proposed that control levels and compliance limits for leachate quality are not set. However, since no leachate data is available for the proposed site and assumptions were made in the HRA for the source term based on data from similar sites, it is proposed to review the leachate quality every six years after issue of the Permit as part of the HRA Review. If significant deterioration of the leachate quality compared to the source term used in the HRA is identified, then the HRA should be revisited with a revised leachate source term.

5.2.1 **Priority Contaminants**

Both hazardous substances and non-hazardous pollutants are anticipated to be present within the leachate to be produced in the Eastern Extension.

In accordance with the analysis provided in HRA, the priority contaminants to be assessed for the Eastern Extension are:

- Ammoniacal nitrogen
- Arsenic
- Chloride
- Mecoprop
- Naphthalene
- Nickel
- Phenol

6.0 QUALITY ASSURANCE OF LEACHATE MONITORING AND SAMPLING

Samples will be collected using a dedicated leachate sampling bailer or pump, to avoid cross contamination with groundwater samples, and which will be cleaned or rinsed with the first sampling between successive wells. Alternatively, samples will be pumped using the leachate control pump within the relevant cell.

Appropriate protective equipment will be worn when handling leachate. Samples will be stored and despatched to the laboratory as soon as practicable. All samples will be analysed at an accredited laboratory that operates externally verified quality control procedures and checks on analytical work. These include spiked samples, blanks etc. On account of the large batches of samples that are processed by such a laboratory, the QA/QC checks implemented are efficient in identifying any quality control failures. Accordingly, it is not proposed to submit additional QC samples (sampling duplicates, field standards or field blanks) from the site, as this will only duplicate the controls already being implemented by the laboratory.

Sampling will be undertaken by staff appropriately trained in environmental monitoring procedures, and who are familiar with the equipment and its limitations. Biffa will confirm that the personnel engaged in monitoring activities are trained to undertake the task.

These will comprise the companies own technical personnel, the Site manager or nominated deputy, following appropriate training by technical personnel. All monitoring staff will undergo a period of job training and in addition external courses are used to supplement internal training. Results will be validated by the sampling personnel detailed above.



The range of determinands detailed above includes an ionic balance for all samples taken for the full range of determinands at annual intervals. Leachate samples which attain an ionic balance within +15% will be deemed satisfactory. Where the ionic balance falls outside this range, the results will be investigated.

7.0 MAKING AND SUBMISSION OF RECORDS

Records will be kept by Biffa of determinands analysed, date of sampling, sampler, results, units and any repeat analysis or laboratory comment, or internal assessment, on the validity of the results.

A copy of the results of sampling and analysis will be forwarded to the EA in accordance with the Permit.

8.0 REFERENCES

- EA, 2003. Guidance on monitoring of landfill leachate, groundwater and surface water. LFTGN02. 1) February 2003.
- EA, 2021. Landfill operators: environmental permits. Monitor and report your performance Landfill 2) operators: environmental permits - Guidance - GOV.UK (www.gov.uk).



Signature Page

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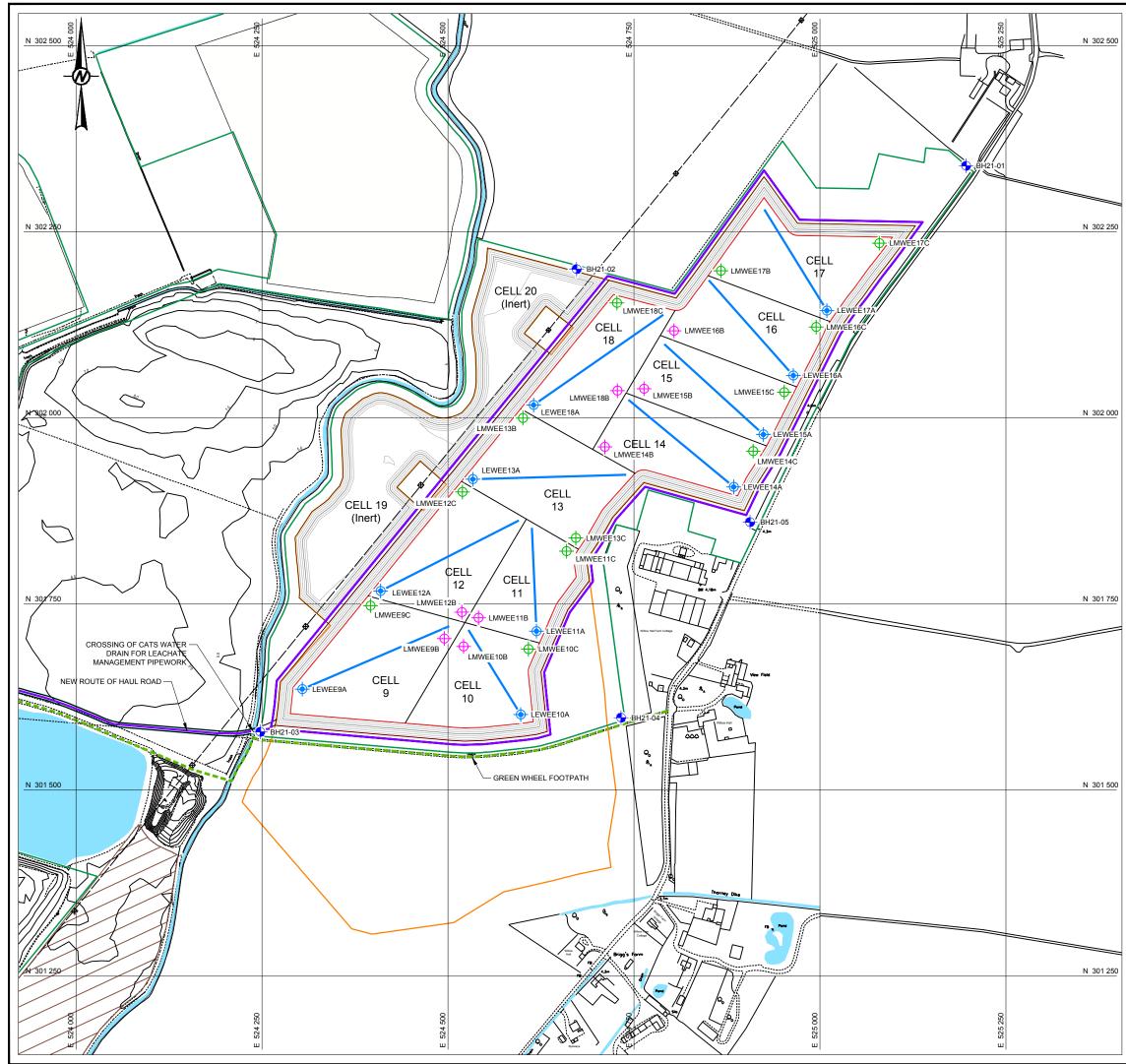
Nicola White Associate Hydrogeologist

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Drawings





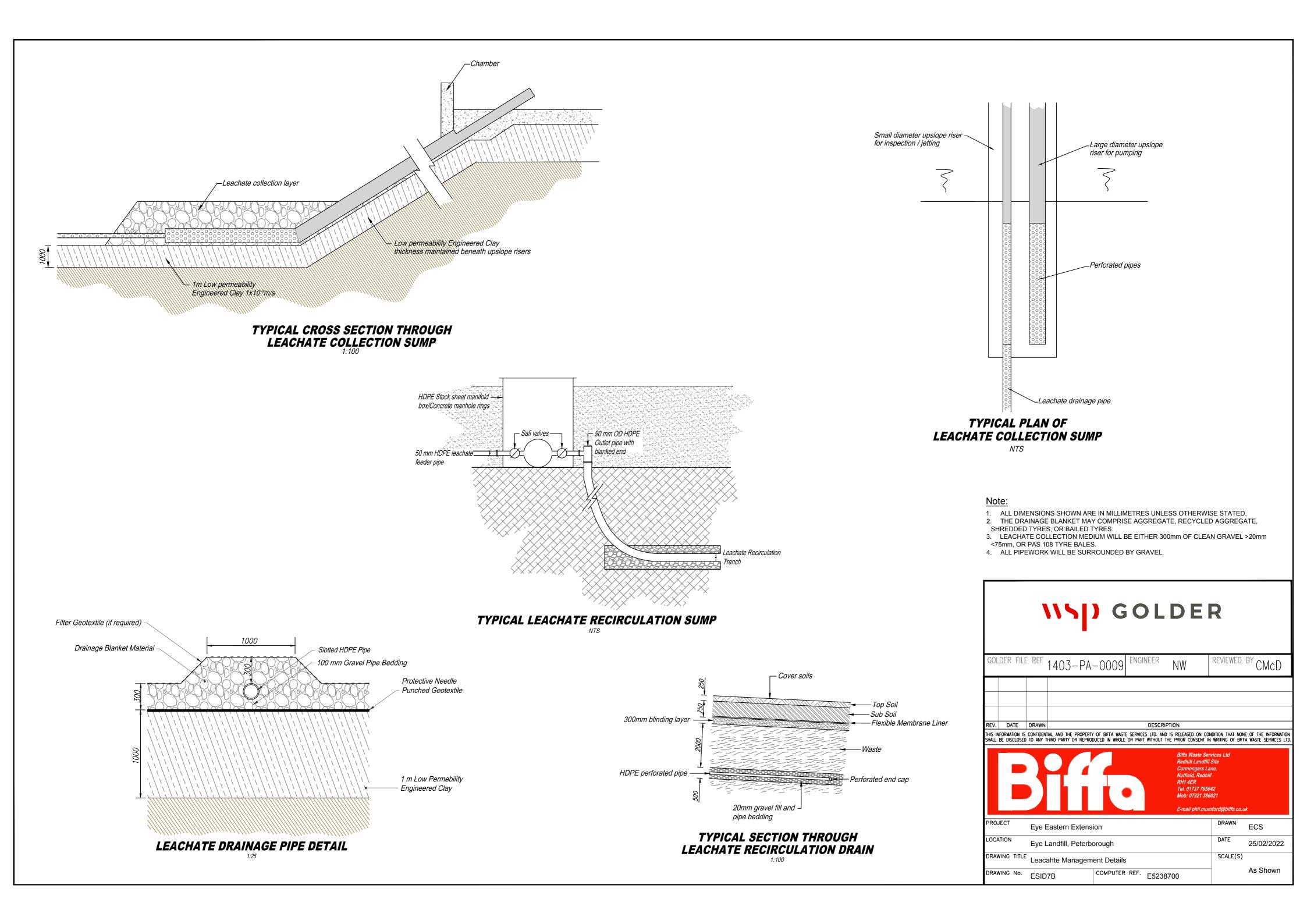
LEGEND	
	PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
	MINERAL EXTRACTION BOUNDARY
	GAS EXTRACTION RING MAIN
	LEACHATE EXTRACTION WELL, EASTERN EXTENSION
	UPSLOPE RISER) LEACHATE MONITORING WELL, EASTERN EXTENSION
	UPSLOPE RISER) LEACHATE MONITORING WELL, EASTERN EXTENSION
•	(VERTICAL)
•	SITE INVESTIGATION BOREHOLE (2021)
Name	BEDS Description and Code
BH21-01	BH46 – 91002460
BH21-02	BH49 – 91002490
BH21-03	BH51 – 91002510
BH21-04	BH52 – 91002520
BH21-05	BH53 – 91002530
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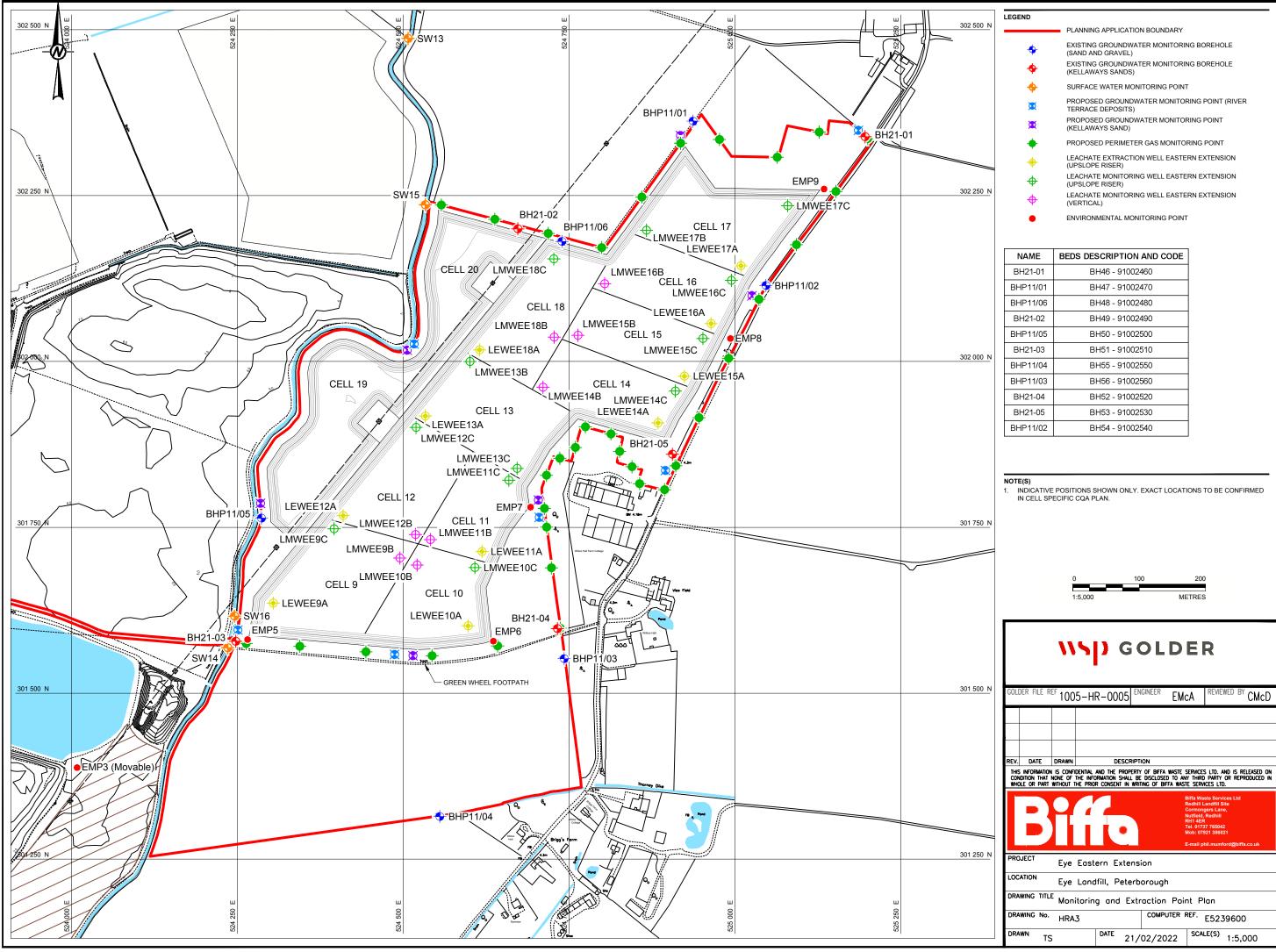
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	PLANNING APPLICATION BOUNDARY
	PLANNING AFFEICATION BOONDART
+	EXISTING GROUNDWATER MONITORING BOREHOLE (SAND AND GRAVEL)
.	EXISTING GROUNDWATER MONITORING BOREHOLE (KELLAWAYS SANDS)
•	SURFACE WATER MONITORING POINT
×	PROPOSED GROUNDWATER MONITORING POINT (RIVER TERRACE DEPOSITS)
X	PROPOSED GROUNDWATER MONITORING POINT (KELLAWAYS SAND)
+	PROPOSED PERIMETER GAS MONITORING POINT
÷	LEACHATE EXTRACTION WELL EASTERN EXTENSION (UPSLOPE RISER)
	LEACHATE MONITORING WELL EASTERN EXTENSION (UPSLOPE RISER)
¢	LEACHATE MONITORING WELL EASTERN EXTENSION (VERTICAL)
•	ENVIRONMENTAL MONITORING POINT

NAME	BEDS DESCRIPTION AND CODE
BH21-01	BH46 - 91002460
BHP11/01	BH47 - 91002470
BHP11/06	BH48 - 91002480
BH21-02	BH49 - 91002490
BHP11/05	BH50 - 91002500
BH21-03	BH51 - 91002510
BHP11/04	BH55 - 91002550
BHP11/03	BH56 - 91002560
BH21-04	BH52 - 91002520
BH21-05	BH53 - 91002530
BHP11/02	BH54 - 91002540





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