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QUERCIA LIMITED

CLAYTON HALL LANDFILL

ADDENDUM TO ENVIRONMENTAL SETTING AND INSTALLATION DESIGN (ESID)

DECEMBER 2024

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DECEMBER 2024

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1 INTRODUCTION

1.1.1 Quercia Limited have commissioned Wardell Armstrong to prepare an environmental permit variation application for their Clayton Hall Landfill Site in Chorley, Lancashire.

1.1.2 The environmental permit allows the disposal of non-hazardous waste to landfill (permit reference is EPR/BV1364ID).

1.1.3 The Site is located approximately 9km south of Preston, at Clayton Hall Sand Quarry, Dawson Lane, Whittle-le-Woods, Chorley, PR6 7DT. The National Grid Reference (NGR) for the Site is SD 56787 22022.

1.1.4 The purpose of the variation is to include a new area of land within the landfill boundary, extending Cell 4B, to add phase 4. The environmental monitoring schedule has also been adjusted accordingly to incorporate the new area.

1.1.5 It has been calculated that approximately 124,618m^3 of waste will be required to fill phase 4 and complete the landfill.

1.1.6 This Environmental Setting and Installation Design (ESID) Addendum has been prepared in accordance with Environment Agency guidance for Landfill Operators and Environmental Permits.

1.1.7 This Environmental Setting and Installation Design (ESID) Addendum provides a Conceptual Site Model detailing the potential sources for pollution, pollution pathways and receptors.

2 REPORT CONTEXT

2.1.1 The Cell 4B extension has been designed and this variation seeks to allow the construction of this new phase of the landfill to the south of the site.

2.1.2 It has been calculated that approximately 124,618m³ of waste will be required to be deposited into this cell to bring the area up to the final level contours.

2.1.3 There are no proposed changes to the non-hazardous wastes already permitted.

2.1.4 This report provides the updated Conceptual Site Model (CSM) for Clayton Hall Landfill and the design of the landfill for the extension area.

3 SITE DETAILS

3.1 Site Location

3.1.1 Clayton Hall Landfill Site (the Site) is located approximately 9km south of Preston at Clayton Hall Sand Quarry, Clayton Hall Quarry, Dawson Lane, Whittle-le-Woods, Chorley PR6 7DT. The permit boundary is shown on Drawing No ST18115-501.

3.1.2 The National Grid Reference (NGR) for the centre of the Site is SD 56787 22022.

3.1.3 The Site is located to the south of Clayton-le-Woods, a village within the Borough of Chorley, Lancashire. To the south, north and east of the site the site is bordered by greenfield areas.

3.1.4 Access to the site is via Clayton Hall Sand Quarry, which connects to Dawson Lane approximately 350m to the southeast of the site.

3.2 Site Topography

3.2.1 A topographical survey has been provided by Survey Solutions.

3.2.2 The Site consists of several low-lying areas such as ponds and lagoons. The lowest point is approximately 50.64m AOD to the southeast of the landfill. The highest point is in the middle of the site at approximately 95.53m AOD and the site generally slopes from the highest points to the surrounding boundaries of the site.

3.3 Receptors

3.3.1 The town of Clayton le-Woods bounds the site to the west with the closest residential receptors located off Spring Meadow, approximately 30m from the site.

3.3.2 Cuerden Valley Park is located to the east of the site.

3.3.3 The Bryning Brook is the closest surface water course in the vicinity of Clayton Hall, the brook flows in a westerly direction ~40m to the south of the site. The River Lostock is approximately 60m east of the site at its closest point, Clayton Brook is a tributary of the River Lostock and converges with the river some 1.8km north of the site.

3.4 Protected Habitats and Species

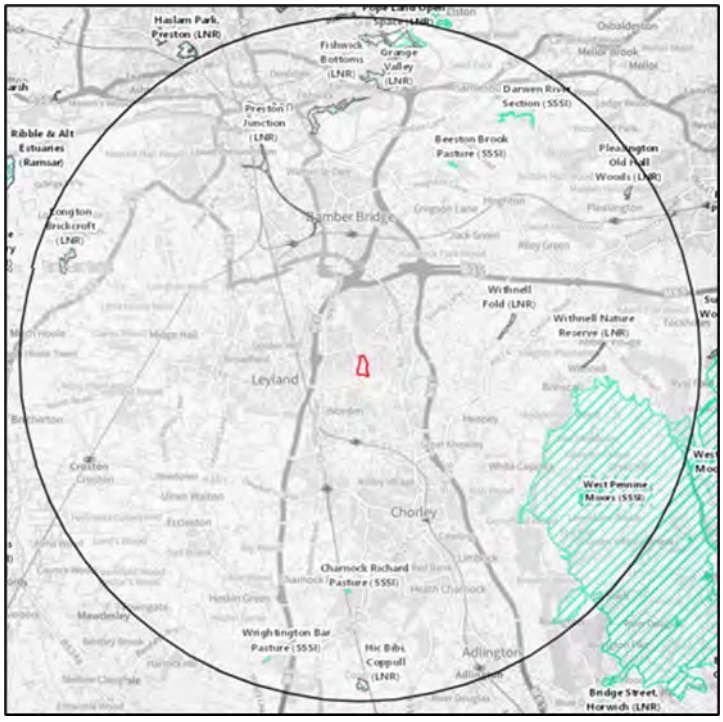
3.4.1 There are no European sites or designated habitats within 2km of the installation boundary.

3.4.2 There are a number of Sites of Special Scientific Interest (SSSIs) and Local Nature Reserves (LNRs) within 10km of the boundary, as summarised in Table 4.1 below and shown in Figure 1.

Table 4.1 – Designated Sites and Protected habitats

Habitat	Distance and Direction from Site
Preston Junction LNR	3.7km, north
Withnell Fold LNR	4km, east
West Pennine Moors SSSI	6.3km, east
Charnock Richard Pasture SSSI	6.3km, south
Withnell Nature Reserve LNR	6.3km, east
Beeston Brook Pasture SSSI	6km, north
Fishwick Bottoms LNR	6.6km, north
Darwen River Section SSSI	7.8km, northeast
Red Car and Tun Brook Woods SSSI	8.8km, north
Longton Brickcroft LNR	8.9km, northwest
Wrightington Bar Pasture SSSI	9km, south
Hic Bibi Coppull LNR	9km, south

Figure 1 – Designated Site Map



4 SOURCE CHARACTERISATION

4.1 Historical Development and Permitting History

4.1.1 Clayton Hall operated as a sand quarry from the 1940's and was subsequently developed as a landfill. The first Waste Management License (No. 74) was granted in December 1977. The current Environmental Permit (EPR/BV1364) was granted in April 2004 and has subsequently been varied, with the last variation granted in November 2019 (EPR/BV1364/V007). The currently permitted Site includes Cells 3A, 3B, 3C, 4A and 4B. The permit variation application seeks to extend the area of Cell 4B.

4.1.2 Planning permission first granted in 1967 to allow extensions to sand and gravel workings. In 1977 the permission was modified scheme of restoration to approved levels fit for agricultural use.

4.1.3 The current permit allows for the landfilling of non-hazardous wastes and the use of waste for landfill restoration.

5 POLLUTION CONTROL MEASURES

5.1 Site Engineering and Site Design

5.1.1 Landfilling has taken place in Cell 1, Cell 2, Cell 3A, 3B, 3C and Cell 4 since 1991. Table 2 below provides a summary of the landfill cells. This summary is derived from the Hydrogeological Risk Assessment Update prepared by Ramboll in September 2019 and updated with information available to Wardell Armstrong from involvement with the design and CQA works.

5.1.2 There are two closed cells (Cell 1 and 2) which do not form part of the extant Environmental Permit. Cell 1 was lined with a 1m thick clay liner (with permeability less than $1x10^{-9}$ m/s). Filling of Cell 1 commenced in 1991, although subsequently wastes were removed from Cell 1 and deposited into Cell 3 allowing construction of Cell 4. Cell 1 is now incorporated into Cell 4. Cell 2 is an unlined cell which accepted inert quarry waste (silts and silty sands) between around 1993 and 2003.

Table 2: Landfill Cell Summary

Cell	Construction information	Date of Inception	Accepted waste
3A	Formation level 42m AOD 2m clay basal liner layer comprising locally won compacted clay with permeability less than 1 x 10^{-9} m/s. Geomembrane liner (HDPE) and geosynthetic clay liner (GCL) side slopes	1994	Non-hazardous waste, approximately 170,000m³ deposited between 1994 and 2003
3B	Formation level 42m AOD 2m thick HDPE geomembrane primary liner, over a 300m bentonite enriched soil (BES) secondary liner with permeability less than 1 x 10^{-10} m/s. Liner extends upslope to 47m AOD. HDPE and GCL side wall liners of 2m thick HDPE geomembrane primary liner, over a geosynthetic (GCL) secondary liner, in a series of 4m high lifts from 47m AOD to 63m AOD, with an 8m lift to 71m AOD in 2003.	1995	
3C	Formation level 42m AOD 2m thick HDPE geomembrane primary liner, over a 300m bentonite enriched soil (BES) secondary liner with permeability less than 1 x 10^{-10} m/s. The liner extents upslope to 47m AOD. HDPE and GCL side wall liners of 2mm thick HDPE geomembrane primary liner, over a geosynthetic (GCL) secondary liner, in a series of 4m high lifts from 47m AOD to 63m AOD, with an 8m lift to 71m AOD in 2003.	1996	
4A	2mm thick HDPE primary liner over a 300m thick and BES secondary liner. HDPE and GCL side slopes	2002	Non-hazardous waste approximately 10,000m³ between 2002 and 2003

Table 2: Landfill Cell Summary			
Cell	**Construction information**	**Date of Inception**	**Accepted waste**
4B Phases 1 – 3	2mm thick HDPE primary liner over a 300m thick and BES secondary liner. HDPE and GCL side slopes	2003	Non-hazardous waste between 2003 and 2024
4B Phase 4	2mm thick HDPE primary liner over a 300m thick and BES secondary liner. HDPE and GCL side slopes	2024 - onwards	Approximately 124,618m^3 to be deposited
2 Closed	No engineered lining system	Approximately 1993	Inert waste soils from quarrying operations
1 Closed	Lined with 1m thick recompacted locally won clay with a permeability of less than 1 x 10^{-9} m/s. Formation level 54m AID, liner extended to approximately 59m AOD.	1991	Wastes were removed from cell 1 and deposited into cell 3to allow the construction of cell 4. Cell 1 now lies within cell 4.

5.1.3 There is no proposed change to the permitted non-hazardous wastes currently authorised for disposal at the site.

5.2 Cell Construction

5.2.1 The basal sub-grade will be formed from the stiff silty clay (Till) which has an upper contact at approximately 56.53mAOD. BH106A proves that the stiff silty clay extends to a level of 42.53mAOD and has a thickness of 14m.

5.2.2 The construction of the Cell 4B Extension will comprise of the following components:

- excavation and formation works;
- groundwater underdrainage system within the western and southern sidewalls and in the base of Cell 4B Phase 4 including installation of a sidewall riser pipe;
- placement of 500mm thick mineral liner;
- installation of 2mm thick double textured HDPE geomembrane liner over the side slope areas;
- installation of 2mm thick smooth HDPE geomembrane liner over the basal area;
- installation of sidewall protection geotextile on the side slopes;
- installation of basal protection geotextile on the basal area and 2m up the side slopes;

- placement of 300mm of 20 – 40mm leachate drainage stone layer over the basal area and 2m up the side slopes;
- installation of leachate collection pipework and two leachate monitoring points;
- removal of the existing Cell 4B Phase 3 perimeter bund and connection of the leachate drainage system; and
- geophysical leak detection survey over the basal geomembrane lining system within Cell 4B Phase 4 and 2,000mm up the sidewalls.

5.2.3 Clay materials for the construction of Cell 4B Phase 4 will be imported. Should the clay material source differ from the source used during the Cell 4B Phase 3 construction works (imported clay from Whitemoss) material suitability testing will be undertaken in accordance with Environment Agency Guidance.

5.3 Lining System Design

5.3.1 The composite lining system for Cell 4B Phase 4 will comprise of the following works:

- excavation/backfilling of materials to form the basal and side slope profile of the cell;
- exposure to tie-in to the previously constructed Cell 4B Phase 3;
- installation of a groundwater underdrainage system, connecting the existing Cell 4 surface water system to the Cell 4 Phase 4;
- placement of a minimum of 500mm thick engineered material liner with a maximum permeability of 5×10^{-10} m/s;
- installation of 2mm thick double textured HDPE geomembrane liner over the side slope areas;
- installation of 2mm thick smooth HDPE geomembrane liner over the basal area;
- installation of sidewall protection geotextile on the side slopes beneath the sand/fines protection layer;
- installation of basal protection geotextile on the basal area and 2m up the side slopes;

- installation of leachate collection pipework and two leachate monitoring points;
- placement of a minimum 300mm thick 20 – 40mm stone leachate drainage layer over the basal area and 2m up the side slopes;
- installation of associated drainage pipework and leachate monitoring chambers with extended stone haunches on the base of the cell;
- removal of the existing Cell 4B Phase 3 temporary bund and connection of the leachate drainage stone layer and associated pipework; and
- geophysical leak detection survey over the basal geomembrane lining system within Cell 4B Phase 4 and 2,000mm up the side walls.

5.4 Groundwater Management

5.4.1 The glaciofluvial deposits beneath Clayton Hall are classified as a Secondary A Aquifer and the underlying bedrock geology is a Principal Aquifer. Shallow/perched groundwater has been identified in the glaciofluvial deposits however it considered that there is no consistent water table within the drift deposits given the discontinuous nature or permeable lenses. Groundwater will be limited to the presence of aquitard lenses.

5.4.2 The groundwater level below the site is in the range of 38 to 40m AOD within deeper glaciofluvial sands and the Sherwood Sandstone deposits, approximately 2 to 4m below the engineered landfill base.

5.4.3 The underside of the engineered barrier systems for each of the landfill cells is at 42mAOD, at least 2 metres above the groundwater level at Clayton Hall. Therefore, it is considered that at no stage during the life cycle of the landfill wastes would lie below the groundwater level.

5.4.4 The possibility of the lined site/PPC area affecting the shallow water in the drift deposits is considered extremely low since the internal drainage, including side drainage in the lined cells precludes significant leachate head on the side liner.

5.4.5 A back drain has been installed under the site containment engineering to intercept any lenses of perched water and transport these to a soakaway. Details of the under cell drainage are shown in drawing ST18115-301.

5.5 Surface Water Monitoring System

5.5.1 There are several springs within the vicinity of the site feeding into nearby rivers including the River Lostock to the east of the site ~55m AOD flowing south to north, and Bryning Brook to the south at ~62m AOD, flowing east to west.

5.5.2 Surface water drainage from the site discharge into the Bryning Brook. The proposed surface water management system is shown in drawing ST18115-003.

5.5.3 Field drains run along the edge of agricultural land to the east of the Site at three points along the foot of the slope bounding the Site to the east, and merge to form a small tributary that feeds into the River Lostock.

5.5.4 Both the River Lostock and Bryning Brook are monitored on a monthly basis via spot samples upstream and downstream of the site to assess for contamination. The water is tested for ammonia, chloride, suspended solids, visual oil/grease, pH and electrical conductivity.

5.6 Gas Management and Monitoring

5.6.1 Landfill gas at Clayton Hall is managed by a third-party gas contractor, YLEM. The gas management company are responsible for the operation, management and monitoring of the in-waste gas collection system.

5.6.2 Landfill gas is managed via an in-waste gas collection system and a Gas Utilisation Plant.

5.6.3 In-waste wells will be monitored on a weekly basis and vacuum pressure will be controlled depending on well conditions. Oxygen will be maintained below the 5% v/v limit. If gas quality of the extracted gas is out of specification, the system will be rebalanced.

5.6.4 In-waste wells are to be monitored for gas composition, pressure and flow. The relationship between vacuum and flow is reviewed across the wells to ensure the correct level of extraction is placed on each of the wells.

5.6.5 All gas monitoring and abstraction infrastructure has been installed under third party CQA supervision.

5.7 Leachate Management and Monitoring

5.7.1 A leachate collection system will be constructed on top of the protection geotextile layer.

5.7.2 The leachate drainage stone and collection pipework will be installed to levels and locations shown on drawing ST18115-303.

5.7.3 An additional extraction sump is not considered to be required as the leachate will be directed to the leachate collection point within the previously constructed Phase 3.

5.7.4 One leachate monitoring point is proposed, to be installed within Cell 4B Phase 4 (in the location of the removed temporary bund). The proposed location of the leachate monitoring point is shown on drawing ST18115-303.

5.7.5 The monitoring points will comprise vertical shafts of HDPE manhole chambers connected using telescopic couplers, installed on a cast in-situ reinforced concrete base slab.

5.8 Emplacement of Waste

5.8.1 The landfill is permitted to accept a range of non-hazardous waste and waste for restoration. Annual waste input limits, specified in Table S1.2 of the Environmental Permit, are 149,000 tonnes per year of non-hazardous waste and 149,000 tonnes per year of waste for and restoration. There are no proposed changes to the non-hazardous waste or waste for restoration already permitted.

5.9 Settlement and Stability

5.9.1 A Stability Risk Assessment (SRA) has been prepared for the new cell. The SRA makes the following conclusions in regard to the basal and side slope sub-grades, basal and side slope lining systems, and waste mass and capping system.

5.10 Basal Sub-Grade and Side Slope Subgrade

5.10.1 The slope stability analysis indicates that a suitable FoS is not able to be reached for the reprofiling of the slope to the formation level. All slopes shall be reprofiled to 1V:2.5H max gradient unless landslip debris material is present, in which a steeper gradient may be adopted, and the buttress cut and replace methodology implemented (discussed below).

5.10.2 Given the site boundary limitations, primarily at the western corner, adopting a more gradual slope profile is not a feasible option. As such, a buttress must be implemented to stabilise the slope at this corner. To mitigate the potential for failure during construction, a cut and replace construction methodology must be adopted. This involves the removal of mobilised landslip debris in max 3m sections and replacing it with buttress fill.

5.10.3 For southeast of the western corner buttress works, a series of counterfort drains are proposed along the slope to pull groundwater away from the slope face. The drains are to be min 2.5m deep and spaced at max 5.0m centres. Counterfort drains shall comprise a min 1m wide trench extending down the slope. The drains shall feature a 110mm diameter perforated punctured pipe wrapped in geotextile situated at the bottom of the trench. The trench shall be backfilled with drainage material (Class 6C of Series 600 of the Specification for Highway Works).

5.11 Basal and Side Slope Lining System

5.11.1 The limit equilibrium analysis indicates that the basal lining system is sufficiently stable and is deemed acceptable. Material parameters for the clay liner material will require validation during the works to confirm consistency through construction phases.

5.12 Waste Mass

5.12.1 The limit equilibrium analysis indicates that the waste mass is sufficiently stable and is deemed acceptable.

5.13 Capping System

5.13.1 The limit equilibrium indicates that the proposed capping system is sufficiently stable and is deemed acceptable. These analyses are required to be revisited once specific materials have been selected and properties confirmed. Interface testing should also be available.

6 PATHWAY CHARACTERISATION

6.1 Climate

6.1.1 Data available from the Met Office website provides the long-term average monthly rainfall from 1991 – 2020 at Blackpool Squires Gate. The average rainfall data is provided in Table 7.1 below.

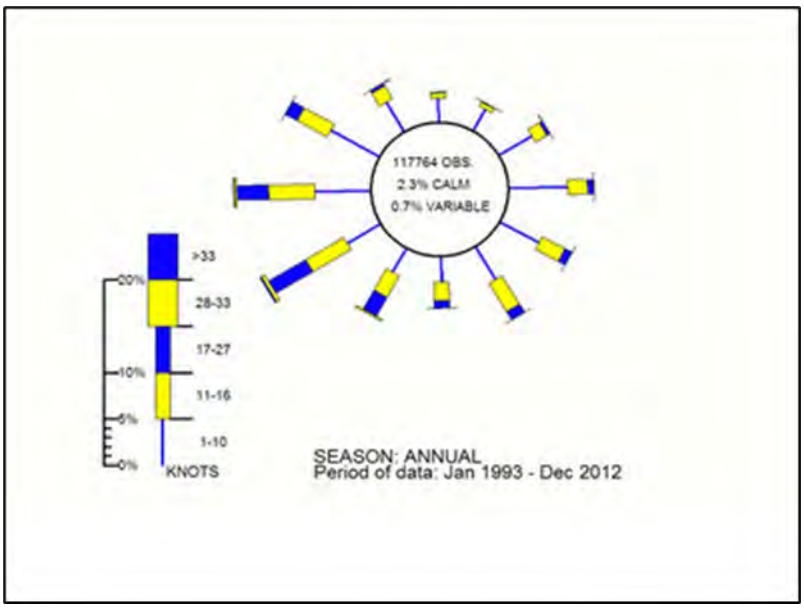
Table 7.1: Long Term Average Monthly Rainfall Data (1991 – 2020) at Blackpool, Squires Gate

Month	Rainfall (mm)	Month	Rainfall (mm)
January	77.77	July	65.95
February	63.98	August	79.93
March	54.44	September	83.48
April	48.66	October	101/35
May	53.99	November	94.67
June	63.10	December	99.09

6.1.2 The average total annual rainfall at Blackpool Squires Gate is 886.41mm, which is lower than the average total for northwest England and North Wales which is 1,337.87mm.

6.1.3 Average wind direction data available from the Met Office for the nearest airfield, Blackpool Airport, which is located approximately 26.7km to the northwest from the Site indicates the prevailing wind direction is from the west/southwest.

Figure 2 - Met Office Windrose, Blackpool Airport (January 1993 – December 2012).



6.1.4 Data showing the long-term average wind speed also available from the Met Office website[1] and is provided in Table 7.2 below.

Table 7.2 - Long Term Average Wind Speed (1991 – 2020) for Blackpool, Squires Gate

Month	Monthly Mean Wind Speed at 10m (knots)	Month	Monthly Mean Wind Speed at 10m (knots)
January	12.05	July	9.90
February	11.68	August	10.07
March	11.05	September	10.22
April	10.01	October	11.00
May	10.07	November	11.43
June	9.75	December	11.60

6.1.5 The annual average wind speed is 10.73 knots. This is slightly higher than the average for the northwest of England and North Wales which is 9.39, and the wider North of England region which is 8.88 knots.

6.2 Climate Change Adaptation

6.2.1 The landfilling undertaken at the Site will result in a permanent feature. The site will be fully restored to an appropriate standard.

[1] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gctcfvseb

7 GEOLOGY

7.1 Introduction

7.1.1 The general geological sequence in the vicinity of the site is described in Table 8.1 below.

Table 8.1: Generalised Geological Sequence

Classification	Unit	General Description[1]	Thickness[1,2]	Presence On-Site
Artificial Ground	Infilled Ground / Made Ground	Made Ground	0.75-19.00m	Within the previously worked quarry void
Superficial Deposits	Glaciofluvial Deposits	Sand and gravel	20.10-41.00m	Present across whole Site
	Till	Diamicton		
Bedrock Geology	Sherwood Sandstone Group	Sandstone part pebbly; conglomeratic in lower part	Variable, maximum >1,500m	Present across whole Site

Notes:
1. Based on British Geological Survey (BGS) lexicon
2. Based on borehole logs .

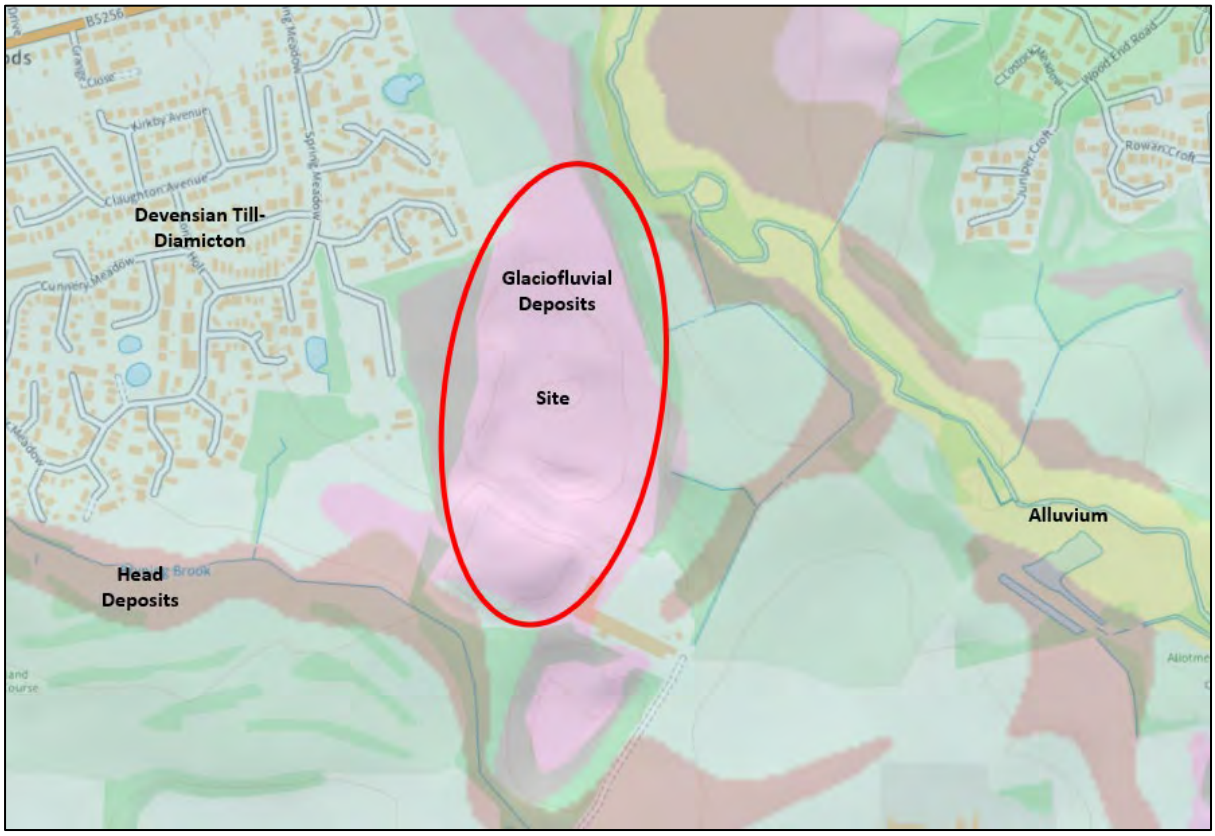
7.2 Superficial Geology

7.2.1 BGS records[2] show superficial deposits at the site comprise of Devensian sand and gravel Glaciofluvial deposits underlain by Glacial Till.

7.2.2 The glaciofluvial deposits extend approximately 17m to 23m below the engineered lined base of the landfill which lies at 42mAOD. The superficial material was deposited by melt water streams during the Quaternary Period. The deposits include mostly coarse-grained sand and gravel with some finer-grained layers of clay and silt and organic lenses.

[2] https://geologyviewer.bgs.ac.uk/?_ga=2.237721024.1775861850.1719999762-1678504759.1719999762

Figure 3 – extent of glaciofluvial deposits

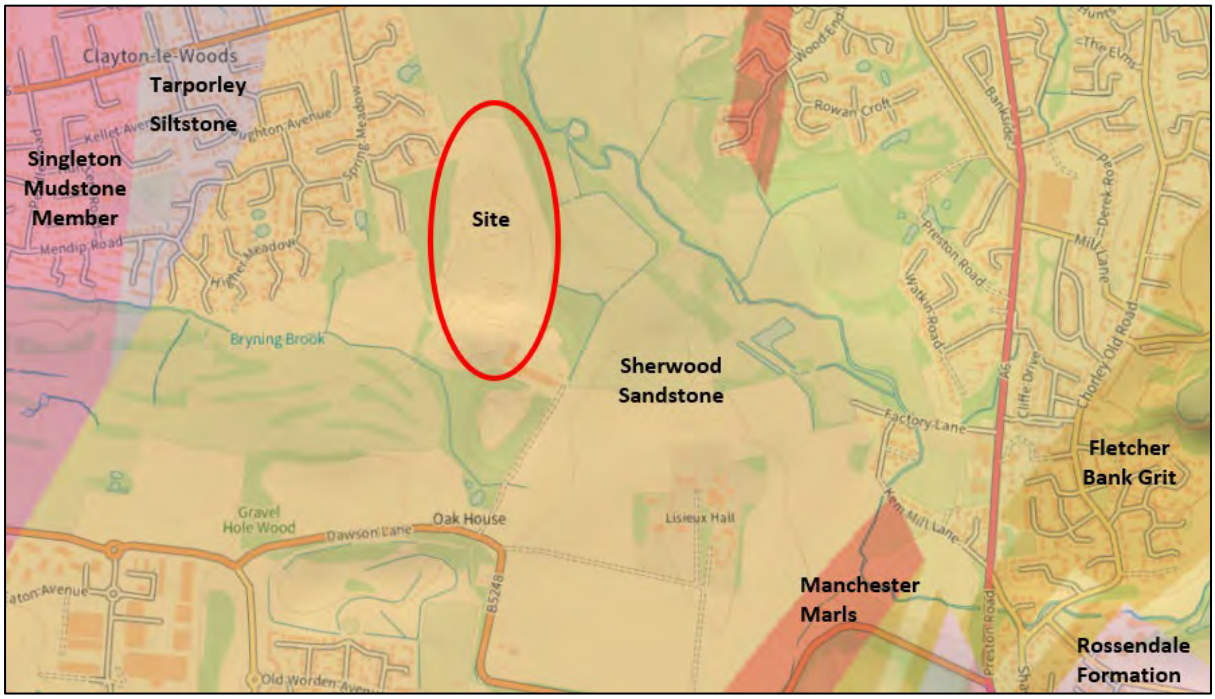


7.3 Bedrock Geology

7.3.1 BGS records also indicate that the bedrock geology under the site is Sherwood Sandstone Group, a moderately weak medium grained sandstone at times part pebbly and conglomeratic in the lower part, with subordinate red mudstone and siltstone layers.

7.3.2 The Sherwood sandstone has a gradational into the Tarporley Siltstone Formation which is shown on Figure 3 where the Tarporley siltstone is dominant over the sandstone to the northwest of the site

Figure 3 – Bedrock Geology (Extract from BGS Geology of Britain Viewer)



8 HYDROLOGY

8.1 Surface Water Features

8.1.1 An updated Surface Water Management Plan was prepared in February 2024 and submitted to the local EA office for agreement. To date, we understand this has not yet been approved.

8.1.2 The nearest watercourse to the Site is an unnamed watercourse located approximately 25m to the east at its closes point. The watercourse discharges to the River Lostock which is classified as a main river and flows north towards Lostock Hall.

8.1.3 Other watercourses in the areas include an unnamed watercourse which is located approximately 10m southwest of the site boundary at its closes point. The unnamed watercourse discharges to Bryning Brook which is also classified as a main river and flows west along Clayton le Woods Boundary.

8.1.4 A dry ditch was identified by WA during a site visit in January 2024, this ditch is located west of the landfill boundary and flows south towards and existing pond.

8.1.5 A lagoon/pond is located approximately 100m to the east of the landfill site near Cuerden Valley Park. This is assumed to have been constructed during the landfilling operations at the site.

8.1.6 The existing drainage at the Site is shown on drawing ST18115-002.

8.2 Water Abstractions

8.2.1 Information on groundwater and surface water abstraction licences was provided by the Environment Agency in September 2024. There are two groundwater abstraction licences within 3.0km of the Site (Table 2-3) and one surface water abstraction licence within 3.0km of the Site (Table 2-4).

Table 8-1: Licensed Groundwater Abstractions within 3.0km of the Site

Licence Number	Site Name	Abstraction Use	NGR	Distance and Direction from Site
2670212020	Borehole At Whittle-Le-Woods	Spray Irrigation	SD57682093	1.3km southeast of the Site
2670212021/R01	Borehole At Bamber Bridge, Preston	Process Water	SD5700924577	2.4km north of the Site

Table 8-2: Licensed Surface Water Abstractions within 3.0km of the Site				
Licence Number	**Site Name**	**Abstraction Use**	**NGR**	**Distance and Direction from Site**
2670212017	High Ash Reservoir At Leyland	General Cooling	SD543235	2.8km northwest of the Site

8.3 Surface Water Discharges

8.3.1 The surface water emission point is SD1 which discharges site into a drainage ditch which flows into Bryning Brook and ultimately the River Lostock.

8.4 Surface Water Quality

8.4.1 The nearest watercourse is Lostock Farington Weir which has ecological classification of moderate, and chemical classification of fail. The overall classification is 'moderate'.

8.5 Flood Risk

8.5.1 The Site is located is in a Flood Zone 1[3] and has a low probability of flooding from rivers and seas.

8.5.2 The site is in an area of low risk of flooding from surface waters[4], meaning the area has a chance of flooding between 0.1% and 1% each year. However, there are small areas at 'Low', 'Medium' and 'High' risk of flooding from surface water due to the presence of low lying areas such as ponds with surface water run off generated within the Site.

[3] Flood risk information for this location - Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)
[4] Your long term flood risk assessment - Check your long term flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk)

Figure 4 – Flood Risk Map

8.5.3 Ultimately watercourses and ponding within the site boundary will all be capped following completion of landfilling. Therefore, much of the surface water flood risk within the boundary of the site will be reduced to 'very low'.

9 HYDROGEOLOGY

9.1 Aquifer Characteristics

9.1.1 DEFRA's Magic Map Tool indicates that the site is underlain by a Principal bedrock aquifer. The Site is also underlain by a secondary A and secondary (undifferentiated) superficial aquifer.

Figure 5 – Aquifer designation map (Bedrock)

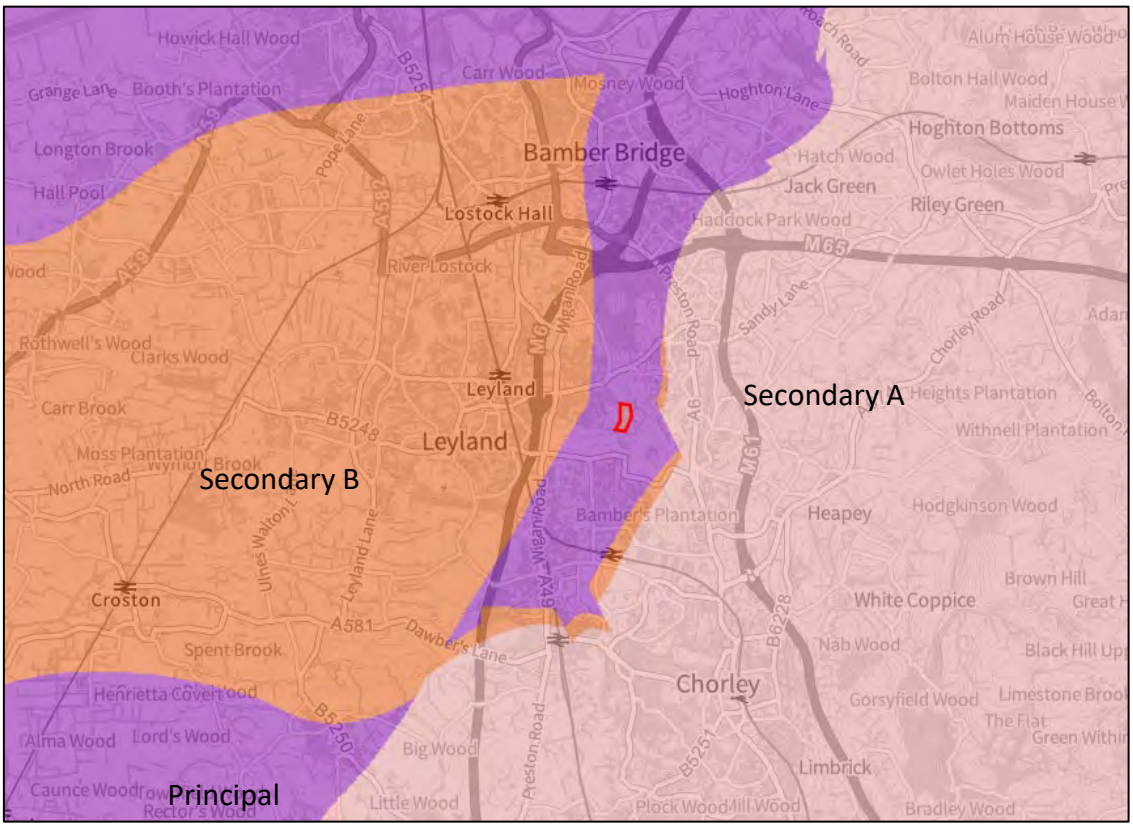
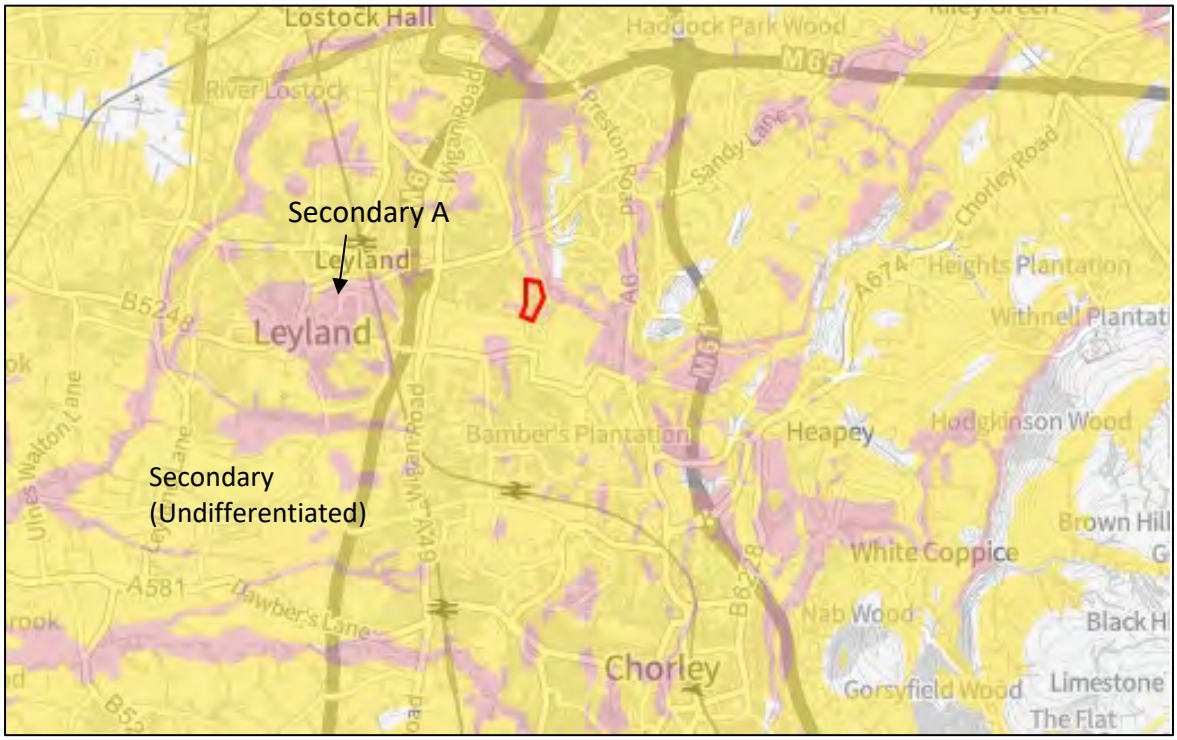


Figure 6 - Aquifer designation map (superficial drift)



9.1.2 The Site is not located within a Source Protection Zone.

9.2 Groundwater Levels

9.2.1 Groundwater elevations in the Glaciofluvial Deposits and the Sherwood Sandstone are generally stable between 2019 and July 2024. Groundwater elevations in the Sherwood Sandstone are consistent with a northerly flow direction recorded in the 2019 HRAR.

9.2.2 Paired boreholes installed in the Glaciofluvial Deposits and Sherwood Sandstone indicate that groundwater elevations in the Glaciofluvial Deposits are around 15m higher than in the Sherwood Sandstone. Average groundwater elevations in BH102S (Glaciofluvial Deposits) are 54.11mAOD compared to 38.66mAOD in BH102D (Sherwood Sandstone), and 57.75mAOD in BH106S (Glaciofluvial Deposits) compared to 40.46mAOD in BH106D (Sherwood Sandstone).

Figure 7 – Superficial Groundwater Levels

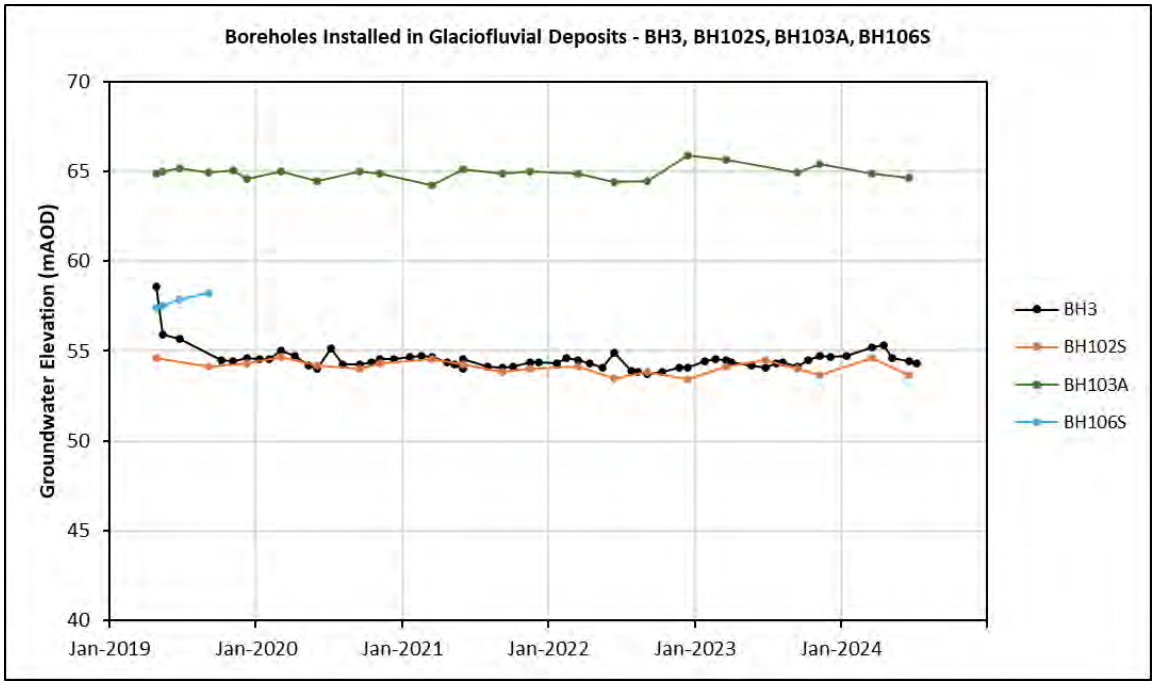
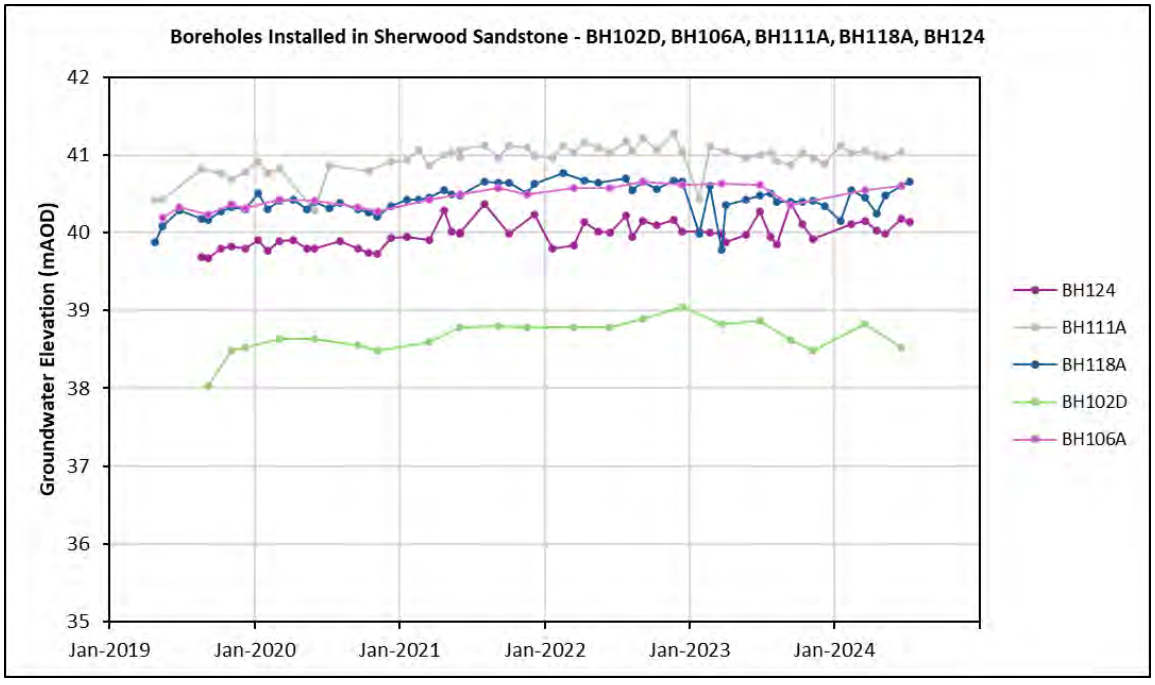


Figure 8 – Bedrock Groundwater Levels



9.3 Groundwater Quality

9.3.1 The HRAR concludes that the main pathways from the PPC landfill (source) to groundwater, is through infiltration of rainwater through the landfill cap (once the final engineered cap is installed) and the waste mass. Leachate generated in the waste mass will migrate through the base of the engineered lining system and migrate through the Glaciofluvial Deposits (Secondary A aquifer) into the Sherwood Sandstone (Principal aquifer).

9.3.2 Attenuation of contaminants will be through sorption and chemical reactions in the Glaciofluvial Deposits and Sherwood Sandstone. Additional fate and transport processes like advection, dilution and dispersion within the Glaciofluvial Deposits and the underlying Sherwood Sandstone will reduce contaminant concentrations further along the flow path.

9.3.3 The LandSim water balance for the extension indicates that when management control ceases infiltration would exceed leakage from the engineered barrier system. There will therefore be a requirement for a passive solution to prevent surface breakout when management control ceases. The detailed design will consider engineering solutions to minimise infiltration and the topography of the cap will be designed to promote surface water runoff and reduce infiltration.

9.3.4 The LandSim results for hazardous substances indicate that maximum modelled 95th percentile concentrations are higher than the EAL for mercury (all cells) and total phenols (Cell 3A, Cell 3B, and Cell 4B). At the 50th percentile mercury and total phenol concentrations remain below the EAL for all cells except Cell 3A. Results for non-hazardous pollutants show maximum modelled 95th percentile concentrations are higher than the EAL for ammoniacal nitrogen and chloride. At the 50th percentile ammoniacal nitrogen concentrations exceed the EAL but chloride concentrations are below the EAL.

9.3.5 The Glaciofluvial Deposits hydraulic containment modelling indicates that non-hazardous pollutants and hazardous substances are below the EALs.

9.3.6 A series of recommendations are included in the HRAR regarding leachate management and the monitoring network.

10 RECEPTOR AND COMPLIANCE POINTS

10.1 Groundwater

10.1.1 Groundwater compliance limits are specified in Table S3.4 of the Environmental Permit for compliance boreholes BH3, BH111, BH113, BH118A and BH124. Borehole BH111 is no longer included in the monitoring schedule, therefore BH111A which is installed within the Sherwood Sandstone in a similar location has been considered in the annual monitoring reports.

10.1.2 The Monitoring Plan has been updated to include a replacement borehole in the Glaciofluvial Deposits to enable monitoring of the Glaciofluvial Deposits for both groundwater levels and quality.

10.1.3 The Monitoring Plan has also been updated to include for monitoring of groundwater quality from the toe drain to be installed as part of the works to install cell 4.

10.2 Surface Water

10.2.1 Surface water monitoring requirements are specified in Table S3.3 (emission limits) and Table S3.10 (other monitoring requirements) of the Environmental Permit.

10.3 Gas

10.3.1 Perimeter gas (monitoring points GS1 – 13) is monitored on a monthly basis for methane, carbon dioxide, oxygen, atmospheric and differential pressure in accordance with Table S3.5 of the environmental permit.

10.3.2 For cells which have not yet had gas extraction systems installed, in-waste gas monitoring is undertaken monthly until gas extraction commences.

10.3.3 There is no proposed change to the perimeter or in waste gas monitoring regime.

10.4 Leachate

10.4.1 Compliance limit for leachate level is 3m above cell base

10.4.2 Leachate is collected via a series of in-waste extraction wells and treated prior to being discharged from the leachate treatment plant to sewer.

10.5 Amenity

10.5.1 The Site is located relatively close to residential receptors (the closest being the Clayton-Le-Woods housing estate located to the west) and accordingly an Odour Management Plan is in place. Daily inspections are also undertaken for noise, litter,

pest infestation, dust emissions and mud being tracked on to the public highway. Further information is provided in the Amenity and Accident Management Plan.

11 SITE CONDITION REPORT

11.1 Site Condition Report

11.1.1 There is no requirement to provide a Site Condition Report for the areas that will be subject to a permanent deposit of material. The purpose of a Site Condition Report is to set out the condition of the land at permit issue so that a permit surrender is possible to demonstrate that there has been no deterioration in the quality of the land. Clearly in the case of permanent deposit of waste the land will not be stored to the same condition that was present at the time of permit issue. Instead, the surrender of the permit will be based on records of the materials accepted and the environmental monitoring carried out during the operational life of the site to demonstrate that the material that has been deposited is not impacting or will not impact the environment.

11.1.2 Fuel and other potentially harmful liquids for use in site plant will be stored in an appropriate tank or container with appropriate secondary containment. Bunds will have a capacity of 110% of the largest tank. Tanks or containers storing fuel or other harmful liquids will be stored on impermeable surfacing.

11.1.3 Topographic and engineering surveys will be completed at the site to record the conditions at the commencement of preparation engineering works to establish the formation levels, upon completion of the preparation of the engineering works to confirm the levels, and on an annual basis in during site operations.

11.2 Restoration and Aftercare

11.2.1 The Site is required, through the planning regime, to be restored to final levels as referenced in the environmental permit.

11.3 Proposed After-Use of the Site

11.3.1 Planning consent for the site requires the site to be capped and restored when complete.

DRAWINGS

DO NOT SCALE FROM THIS DRAWING

KEY :
- PROPOSED PERMIT BOUNDARY
- CELL BOUNDARIES
- WATER FEATURES

356500E
356600E
356700E
356800E
356900E
357000E
422200N
422100N
422000N
421900N

CELL 3A
CELL 3B
CELL 3C
CELL 4A
CELL 4B PHASE 2
CELL 4B PHASE 1
CELL 4B PHASE 3
CELL 4B PHASE 4 PROPOSED EXTENSION AREA

River Leabrook
Bryning Brook
Path
Depot
Drain

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT
NEALES WASTE MANAGEMENT

PROJECT
CLAYTON HALL LANDFILL SITE

DRAWING TITLE
PROPOSED PERMIT BOUNDARY

PRELIMINARY

DRG No.		REV	SUIT. CODE
ST18115-501			
DRG SIZE	SCALE	DATE	
A2	1:1250	05/12/24	
DRAWN BY	CHECKED BY	APPROVED BY	
SJB			

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PART OF SLR

N:\ST\ST18115 - CLAYTON HALL LANDFILL\03 - DESIGN\AUTOCAD\ST18115-501-P0 PROPOSED PERMIT BOUNDARY.DWG

DO NOT SCALE FROM THIS DRAWING

KEY:

- PROPOSED CELL 4 PHASE 4 BOUNDARY
- 53.68 PROPOSED TOP OF LEACHATE DRAINAGE STONE LEVELS (300MM THICK)
- LIMIT OF LEACHATE DRAINAGE STONE
- SAND /FINES PROTECTION LAYER
- LMP 1 / LMP 2 PROPOSED LOCATION OF LEACHATE MONITORING POINT (CELL 4 PHASE 4)
- LMP 1 / LMP 2 PROPOSED LOCATION OF LEACHATE MONITORING POINT (CELL 4 PHASE 3)
- EXISTING LEACHATE EXTRACTION POINT (CELL 4 PHASE 3)
- EXISTING CELL 4 PHASE 3 160MM LEACHATE COLLECTION PIPE (FEEDER PIPE)
- PROPOSED CELL 4 PAHSE 4 225MM LEACHATE COLLECTION PIPE (MAIN)
- PROPOSED CELL 4 PHASE 4 160MM LEACHATE COLLECTION PIPE (FEEDER PIPE)
- CONNECTION OF 160MM FEEDER PIPE CELL 4 PHASE 3 AND CELL 4 PHASE 4

ACTIVE TIPPING AREA

EXISTING LCP

EXISTING TARGET PAD

JN22 JN21 JN20 JN19 JN18 JN17 JN16 JN15 JN14 JN13 JN12 JN11 JN10 JN9 JN8 JN7 JN6 JN5 JN4 JN3 JN2 JN1

A	FIRST ISSUE	15.02.24	DR	EW	AB
REVISION	DETAILS	DATE	DRAWN	CHKD	APPD

CLIENT

NEALES WASTE MANAGEMENT

PROJECT

CLAYTON HALL LANDFILL SITE
CELL 4 PHASE 4

DRAWING TITLE

PROPOSED LEACHATE COLLECTION SYSTEM

DRG No.		REV	SUIT. CODE
ST18115-303		A	
DRG SIZE	SCALE	DATE	
A0	1:200	15-02-24	
DRAWN BY	CHECKED BY	APPROVED BY	
DR	EW	AB	

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N:\ST\ST18115 - CLAYTON HALL LANDFILL\2) DESIGN\AUTOCAD\ST18115-303A PROPOSED LEACHATE COLLECTION SYSTEM.DWG

DO NOT SCALE FROM THIS DRAWING

IDENTIFIED DRY DITCH
(APPROXIMATE LOCATION)
FROM SITE VISIT 05/01/24

RIVER LOSTOCK

UNNAMED WATERCOURSE

DRY POND OUTFALL TO UNNAMED WATERCOURSE

0m 20m 40m 60m 80m 100m

SCALE 1:1000

N:\ST\ST18115 - CLAYTON HALL LANDFILL\03 - DESIGN\AUTOCAD\ST18115-002-A EXISTING DRAINAGE REGIME.DWG

REFERENCE

- LANDFILL SITE BOUNDARY
- PERMIT BOUNDARY
- EXISTING WATERCOURSE/ RIVER
- FLOW DIRECTION
- PHOTO VIEW LOCATIONS
- 1 IN 30 YEAR SURFACE WATER FLOOD RISK
- 1 IN 100 YEAR SURFACE WATER FLOOD RISK
- 1 IN 1000 YEAR SURFACE WATER FLOOD RISK
- CONTOUR LEVEL (m AOD)

NOTES

1. DO NOT SCALE FROM THIS DRAWING, ALL DIMENSIONS MUST BE CHECKED/VERIFIED ON SITE
2. ALL DIMENSIONS AND ARE IN METERS UNLESS OTHERWISE STATED
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. TOPO SURVEY (45064MCLS) FROM SURVEY SOLUTIONS ISSUE DATE 2022-10-12.
5. TO BE READ IN CONJUNCTION WITH SURFACE WATER MANAGEMENT PLAN REPORT (REF ST18115-012).
6. WATERBODIES IDENTIFIED DURING SITE VISIT

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
A	First Issue	06/02/24	HG	CD	EK

CLIENT

NEALS WASTE MANAGEMENT LIMITED

PROJECT

CLAYTON HALL LANDFILL SITE

DRAWING TITLE

EXISTING DRAINAGE REGIME

DRG No. ST18115-002		REV A	SUIT. CODE
DRG SIZE A1	SCALE 1:1000	DATE 06/02/24	
DRAWN BY HG	CHECKED BY CD	APPROVED BY EK	

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DO NOT SCALE FROM THIS DRAWING

ATTENUATION BASIN 1:
REQUIRED ATTENUATION VOLUME: 1489m³
REQUIRED SURFACE AREA: 1794m²
BASIN SIDE GRADE: 1 in 4
BASIN DEPTH: 1m + 0.3m FREEBOARD

HYDROBRAKE FLOW CONTROL
MAXIMUM DISCHARGE RATE 19.7l/s

IDENTIFIED DRY DITCH
(APPROXIMATE LOCATION)
FROM SITE VISIT 05/01/24

CATCHMENT A
1.97ha

CATCHMENT B
1.57ha

CATCHMENT C
1.55ha

CATCHMENT D
0.74ha

CATCHMENT E
1.19ha

CATCHMENT F
1.57ha

WATERCOURSE EASEMENT

RIVER LOSTOCK

ATTENUATION BASIN 2:
REQUIRED ATTENUATION VOLUME: 991m³
REQUIRED SURFACE AREA: 1272m²
BASIN SIDE GRADE: 1 in 4
BASIN DEPTH: 1m + 0.3m FREEBOARD

HYDROBRAKE FLOW CONTROL
MAXIMUM DISCHARGE RATE 32.8l/s

DISCHARGE TO EXISTING
WATERCOURSE

ATTENUATION BASIN 4:
REQUIRED ATTENUATION VOLUME: 651m³
REQUIRED SURFACE AREA: 1013m²
BASIN SIDE GRADE: 1 in 4
BASIN DEPTH: 1m + 0.3m FREEBOARD

HYDROBRAKE FLOW CONTROL
MAXIMUM DISCHARGE RATE 8.83l/s

DISCHARGE TO WATERCOURSE
VIA NEW OUTFALL

UNNAMED WATERCOURSE

ATTENUATION BASIN 3:
REQUIRED ATTENUATION VOLUME: 496m³
REQUIRED SURFACE AREA: 715m²
BASIN SIDE GRADE: 1 in 4
BASIN DEPTH: 1m + 0.3m FREEBOARD

HYDROBRAKE FLOW CONTROL
MAXIMUM DISCHARGE RATE 6.72l/s

DISCHARGE TO WATERCOURSE
VIA NEW OUTFALL

0m 20m 40m 60m 80m 100m
SCALE 1:1000

REFERENCE

- LANDFILL SITE BOUNDARY
- PERMIT BOUNDARY
- EXISTING WATERCOURSE
- EXISTING DRY DITCH
- FLOW DIRECTION
- PROPOSED SURFACE WATER SEWER
- PROPOSED HYDROBRAKE
- CATCHMENT BOUNDARY
- EASEMENT FROM WATERCOURSE
- ATTENUATION BASIN
- INDICATIVE PROPOSED HEADWALL
- PROPOSED SWALE (UNLINED)
- PROPOSED SWALE (LINED)
- PROPOSED DRAINAGE CHANNEL
- 1 IN 30 YEAR SURFACE WATER FLOOD RISK
- 1 IN 100 YEAR SURFACE WATER FLOOD RISK
- 1 IN 1000 YEAR SURFACE WATER FLOOD RISK

NOTES

1. DO NOT SCALE FROM THIS DRAWING, ALL DIMENSIONS MUST BE CHECKED/VERIFIED ON SITE
2. ALL DIMENSIONS AND ARE IN METERS UNLESS OTHERWISE STATED
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. BOUNDARY CAPPING PHASE PROVIDED BY CLIENT.
7. DRAINAGE LAYOUT BASED ON SITE VISIT AND GENERAL SITE LAYOUT PROVIDED BY THE CLIENT.
8. TO BE READ IN CONJUNCTION WITH SURFACE WATER MANAGEMENT PLAN REPORT (REF ST18115-0012).
9. LAYOUT IS INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN
10. BASIN SIZES ARE INDICATIVE ONLY
11. MAX BASIN SLOPES ARE 1 IN 4.
12. BASE OF BASINS CALCULATED TO PROVIDE GRAVITY DISCHARGE GIVEN THE EXISTING GROUND LEVELS.
13. SURFACE WATER FLOOD RISK FROM EA DATA
14. PONDS HAVE BEEN SIZED TO ATTENUATE ALL EVENTS UP TO, AND INCLUDING, 100yr +45%CC AND DISCHARGE TO A MAXIMUM RATE OF GREENFIELD RUNOFF
15. BASIN DESIGN ASSUMED 1m DEPTH AND 0.3m FREEBOARD WITH 1 IN 4 SIDE SLOPE.
16. TIE INS NOT INCLUDED
17. 8m EASEMENT AROUND EXISTING WATERCOURSE
18. LLFA CONSENT REQUIRED FOR WORKS WITHIN 5m OF AN ORDINARY WATERCOURSE

PHASING BOUNDARY

CATCHMENT A : PHASE 1
CATCHMENT B+C: PHASE 2
CATCHMENT D+E+F: PHASE 3

PHASE 1 AREA = 19730.489 m²
PHASE 2 AREA = 31192.878 m²
PHASE 3 AREA = 34979.919 m²

REVISION	DETAILS	DATE	DRAWN	CHKD	APPD
A	First Issue	06/02/24	HG	CD	EK

CLIENT
NEALS WASTE MANAGEMENT LIMITED

PROJECT
CLAYTON HALL LANDFILL SITE

DRAWING TITLE
INDICATIVE SURFACE WATER MANAGEMENT PLAN

DRG No.	REV	SUIT. CODE
ST18115-003	A	

DRG SIZE	SCALE	DATE
A1	1:1000	06/02/24

DRAWN BY	CHECKED BY	APPROVED BY
HG	CD	EK

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DO NOT SCALE FROM THIS DRAWING

KEY:

- PROPOSED CELL 4 PHASE 4 BOUNDARY
- 51.66 PROPOSED TOP OF FORMATION LEVELS
- PROPOSED LOCATION OF SIDE WALL RISER SUMP
- PROPOSED LOCATION SIDE WALL RISER PIPE (UNDERDRAINAGE) FROM PHASE 2 AND PHASE 4
- INDICATIVE LOCATION OF UNDERCELL DRAINAGE SYSTEM (HERRINGBONE SYSTEM)
- INDICATIVE LOCATION OF THE TOE DRAIN

ACTIVE TIPPING AREA

CELL 4 PHASE 2

CELL 4 PHASE 3

1:100

REVISION	DETAILS	DATE	DRAWN	CHKD	APPD
A	FIRST ISSUE	15.02.24	DR	EW	AB

CLIENT: NEALES WASTE MANAGEMENT

PROJECT: CLAYTON HALL LANDFILL CELL 4 PHASE 4

DRAWING TITLE: PROPOSED TOP OF FORMATION AND UNDERCELL DRAINAGE SYSTEM

DRG No. ST18115-301		REV A	SUIT. CODE
ORG SIZE A0	SCALE 1:200	DATE 15-02-24	
DRAWN BY DR	CHECKED BY EW	APPROVED BY AB	

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