Caulmert Limited

Engineering, Environmental & Planning Consultancy Services

Maw Green Landfill Soils Treatment Facility

3C Waste Limited

Environmental Setting and Installation Design - Addendum 2022

Environmental Permit Variation Application

Prepared by:

Caulmert Limited

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Caulmert
engineering environmental planning

APPROVAL RECORD

Site: Maw Green Landfill Soils Treatment Facility

Client: 3C Waste Limited

Project Title: Environmental Setting and Installation Design - Addendum 2022

Document Title: Environmental Permit Variation Application

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Author	Samantha Hayden Environmental Consultant	**Date**	09/12/2022
Reviewer	Andy Stocks Director of Environment	**Date**	09/12/2022
Approved	Andy Stocks Director of Environment	**Date**	09/12/2022

Revision Log			
Revision	**Description of Change**	**Approved**	**Effective Date**
C1	Updated ESID addendum report reference number from 3695-CAU-XX-XX-RP-V-0305 to 5193-CAU-XX-XX-RP-V-0302. Minor amendments to text to reflect permit variation application. Updated site layout plan attached.	AS	14/12/2021
C2	Updated ESID addendum report reference number from 5193-CAU-XX-XX-RP-V-0309. Minor amendments to text to reflect permit variation application, an updated site layout plan and a revised Site Condition Report for additional STF area to west.	AS	10/01/2023

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Environmental Permit Variation Application

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FCC drawing ref. '124A340 Plan 2'	Maw Green Landfill Site Annual Site Plan 2022
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APPENDICES

Appendix 1 Site Condition Report 2022

Appendix 2 ESID Report 2003 SLR Ref. 4D-197-178/ESID

1.0 INTRODUCTION

1.1 Report Context

1.1.1 This report is intended as an updated addendum to the existing Environmental Setting and Installation Design (ESID) report (2003 SLR Ref. 4D-197-178/ESID) for Maw Green Landfill Site and existing 2019 ESID addendum (Caulmert ref. 5193-CAU-XX-XX-RP-V-0302) for the Soil Treatment Facility (STF) at Maw Green.

1.1.2 3C Waste Limited ('the operator'), a wholly owned subsidiary of FCC Environment (UK) Limited, have appointed Caulmert Limited to prepare an environmental permit variation application to vary the existing Maw Green Landfill permit ref. EPR/BS7722ID to add a Section 5.3A(1)(a)(ii) activity to include for the treatment of asbestos in soil. The treatment of soils will be by 3-way screen and handpicking of bound asbestos and is to include an additional area for storage and treatment of solely asbestos contaminated wastes, separate to the current STF bioremediation area. The proposed area for asbestos handling is located to the west of the current STF, however is still within the existing Maw Green Landfill permit boundary.

1.1.3 No changes to the existing ESID for the landfill are required as it is considered the landfill site setting has not changed. The existing ESID report was produced by SLR to support the Maw Green Landfill PPC Application in October 2003. A 2019 ESID addendum was later produced to support a permit variation application for the addition of the then-proposed Soil Treatment Facility (STF) at the site (bioremediation area), which is now installed.

1.1.4 This updated 2022 ESID addendum is included as part of a permit variation application to include for the proposed treatment and storage area for asbestos contaminated soils at the Maw Green STF, adjacent to the existing bioremediation area. It should be noted that, due to space constraints on site, part of the new treatment area will sit on top of permanently capped landfill (see drawing ref. 5193-CAU-XX-XX-DR-V-1807) and the effects of this are also assessed in this report.

1.1.5 The 2003 ESID report details the nearby receptors of the landfill which were updated within the 2019 permit variation application to reflect the addition of the STF to the site. The nearby sensitive receptors have now been updated again as part of this application in the Amenity & Accidents Risk Assessment document ref. 5193-CAU-XX-XX-RP-V-0301 (attached to this application).

1.2 Installation Details

1.2.1 The STF is located at Maw Green Landfill Site, in Coppenhall, Crewe, under environmental permit ref. EPR/BS7722ID. The location of the STF is within the current permit boundary and this application is not seeking to extend the permit boundary. The STF sits within the south-eastern corner of the landfill site. The location of the new proposed treatment and storage area for asbestos contaminated soils is shown on updated Site Layout Plan drawing

ref. 5193-CAU-XX-XX-DR-V-1805. The most recent 'Annual Site Plan 2022' for Maw Green Landfill is attached as FCC drawing ref. '124A340 Plan 2'.

Bioremediation

1.2.2 There are no changes to the bioremediation process as part of this permit variation.

1.2.3 The maximum bioremediation treatment time for soils at the STF is 6 months in general, with the majority being treated in periods of between 8-16 weeks. The STF facility is currently designed to handle up to 50,000 tonnes per annum over a 10-year period. The existing bioremediation treatment area of the STF is to remain as 6,800m^2 with a total storage volume of 38,000 tonnes at any one time.

1.2.4 The existing STF area for the bioremediation of soils is situated on the former compost pad at the site, which is an impermeable pavement to prevent run-off. Drainage to these areas of impermeable pavement are provided by a sealed drainage system which ensures no liquid can run off the pavement other than via the drainage system, and that all liquids entering the system shall be collected in a sealed sump and sent to the water treatment system, and then discharged to sewer following treatment.

Asbestos Soils Treatment

1.2.5 The proposed new area for the treatment and storage of asbestos contaminated soils is to be on a treatment pad approximately 4,100m^2 in size. Treatment will consist of a 3-way screen, conveyor and hand-picking of bound asbestos fragments within an enclosed mobile picking station. The treatment pad will be constructed of crushed concrete with a geo-composite clay liner (GCL) with a permeability of 1 x 10^{-9} m/s, with an installed drainage system that directs surface water run-off to a pumping chamber in the north-east corner of the area before being pumped across to the existing water treatment plant in the eastern STF area. Following treatment, water is discharged to sewer in accordance with the agreed discharge consent in place at Maw Green Landfill Site.

2.0 SOURCE TERM CHARACTERISATION

2.1 Bioremediation Process

2.1.1 The source term characterisation details provided in the 2003 ESID for the landfill remain valid with regards to historical development and landfill for non-hazardous waste, however the area for the storage and treatment of soils was previously permitted for composting of green waste.

2.1.2 The existing STF stores and treats non-hazardous and hazardous soils prior to enabling their use as restoration materials for the landfill. Treatment of the soils involves treatment and removal of organic and inorganic contaminants by a bioremediation process, as detailed below. There will be no change to the existing bioremediation process. The organic contaminants within the waste soils that are treated by the bioremediation process at the STF predominantly comprise (but are not limited to) the following:

- A range of petroleum hydrocarbons (e.g. petrol, heating fuel, diesel, used oils, crude oil)
- Polycyclic aromatic hydrocarbons (PAHs)
- Creosote
- Phenols
- Chlorinated solvents and other volatile organic compounds (VOCs)

2.2 Asbestos Soils Treatment

2.2.1 The new activity to be added to the permit as part of this permit variation includes removing bound asbestos fragments that are removed by 3-way screen and hand-picking in the new proposed area of the STF. Hazardous soils containing bound asbestos will undergo a preassessment to confirm that there are no chrysotile fibres >0.1% and other forms of asbestos >0.01%, and also that airborne asbestos concentrations are within the agreed background reference levels for acceptance at the site. Upon satisfactory results, the soils will then undergo pre-screening and hand-picking before being used in restoration of the landfill.

2.2.2 A mechanical three-way screener will be used to remove oversize material from asbestos containing soils. The screened material is then passed through the picking station to allow the removal of any bound asbestos debris. This is to remove larger items (e.g. lumps of concrete) to reduce the potential of damage to the picking station and make hand picking of asbestos debris more effective. Airborne asbestos fibre monitoring will be undertaken, as per current operations for the existing mobile plant deployment at Maw Green.

2.2.3 The screener currently used under the mobile plant deployment is unmodified. Trials on enclosed screeners with a HEPA filter and uncovered screeners with general dust suppression have shown no difference in emissions as they all meet the method detection limit of <0.0005f/ml. However, the use of enclosed screeners is far slower, prone to significant downtime and uses significantly more energy due to reduced throughput for no

environmental benefit. The use of standard dust suppression with a propriety surfactant has been shown to be entirely effective as secondary mitigation to the waste acceptance criteria. The picking station will be an enclosed mobile unit for hand-picking of bound asbestos fragments by trained site operatives. Monitoring for airborne asbestos emissions will be undertaken in ambient air in close proximity to the operating plant to ensure that operations do not result in fibre emissions detected above limits stated, or above the background reference levels of <0.0005f/ml. All soils with solid asbestos containing materials (ACM) are covered whilst awaiting reception testing results. Once the soils are treated, they no longer pose a risk to human health from asbestos content and can be treated as non-hazardous.

2.2.4 As a result of the proposed additional treatment and storage area for asbestos contaminated soils, the source term has been updated to include for this source term at the site.

Waste Volumes

2.2.5 There is no change to the hazardous and non-hazardous waste volumes to be accepted or stored at the landfill or the STF as a result of this permit variation.

Waste Types

2.2.6 It is proposed to add the following hazardous waste types for treatment and storage of asbestos in soils in the new area of the STF:

- 17 05 03* soil and stones containing hazardous substances.
- 17 06 05* construction materials containing asbestos.

2.2.7 Waste code 17 05 03* will be restricted to those wastes which contain identifiable pieces of bonded asbestos – any particle size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. Waste code 17 06 05* will be restricted to wastes containing discrete pieces of bonded asbestos within the soil matrix only.

2.2.8 There will be no other changes to existing waste types accepted at the Maw Green Landfill Site for landfilling or restoration, or at the STF for bioremediation treatment.

Environmental Issues

2.2.9 It is maintained that the proposed new STF area for the treatment and storage of asbestos contaminated wastes will not result in significant or adverse environmental effects due to the nature and scale of the operations.

2.2.10 Airborne asbestos fibre monitoring is already undertaken for the existing mobile plant deployment at Maw Green for the treatment of asbestos-impacted soils with uncovered screener. Airborne dust samples were supplied on gridded MCE membrane filters and were tested in a laboratory using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS). The test results are contained within the

'Treatment Process Description & BAT Review' report ref. 5193-CAU-XX-XX-RP-V-0312, included within this application. The Maw Green asbestos monitoring results provided by the operator from between August and November 2022 shows no discernible asbestos fibre emissions detected, with all results at or below the limit of detection of 0.0005f/ml, with one concentration above this threshold of 0.0006f/ml; this is still well below the anticipated 0.01 f/ml permit threshold limit.

2.2.11 Similarly, the same mobile plant operation is being undertaken as a licenced deployment by Provectus at Edwin Richards Quarry soils treatment facility, for the physico-chemical treatment of hazardous asbestos-impacted soils using a screener plant and hand-picking of bonded asbestos (see the 'Treatment Process Description & BAT Review' report ref. 5193-CAU-XX-XX-RP-V-0312, included within this application). This operation is undertaken within a building, and airborne dust and asbestos fibre monitoring is undertaken inside the building, with samples tested at the laboratory for the presence of asbestos fibres. The monitoring results obtained from both within the building and at the screener deck, using either covered or uncovered screener, were similar and were significantly below the permit threshold of <0.01 f/ml and were observed to be below or close to the limit of 0.0005f/ml. It was concluded the absence of measurable asbestos emissions from the soil screening operation meant that a review of abatement measures could not be made other than to conclude that the waste acceptance approach at the site is entirely successful in preventing airborne asbestos emissions exceeding permit thresholds.

2.2.12 With reference to the above monitoring results obtained from the Maw Green current deployment operations and those at Edwin Richards Quarry soil treatment facility, it can be concluded that provided the operator undertakes the same stringent waste acceptance procedures and operational procedures as currently at Maw Green and also as shown at Edwin Richards, then the risk of airborne asbestos emissions being produced at the site is negligible. This will ensure both the environment and human health of workers and nearby sensitive receptors is protected.

2.2.13 In order to further validate the results of the monitoring undertaken to date an independent review of asbestos treatment and storage of asbestos contaminated soils, is being undertaken at the Maw Green and Edwin Richards sites. This will be forwarded to the Environment Agency following publication.

2.2.14 As part of the permit variation application an Amenity & Accidents Risk Assessment ref. 5205-CAU-XX-XX-RP-V-0310 has been undertaken to assess the impacts on local sensitive receptors in terms of odour, noise, dust and fugitive emissions. A Dust & Emissions Management Plan (DEMP) ref. 5205-CAU-XX-XX-RP-V-0313, and an Odour Management Plan (OMP) ref. 5205-CAU-XX-XX-RP-V-0314 have also been produced covering the proposed activities, detailing dust and odour control measures to be implemented at the site.

Landfill Gas & Leachate Risk Assessment

2.2.15 This assessment reviews whether there is any additional risk from landfill gas or leachate squeezing to sensitive receptors as a result of installing part of the new asbestos soils treatment and storage pad on top of the permanently capped landfill at Maw Green. The extent of the treatment pad is shown on drawing ref. 5193-CAU-XX-XX-DR-V-1807. Due to space constraints at the site, this has been considered necessary and the risks are considered below.

2.2.16 The placement of the treatment and storage pad and associated additional weight of stored material, treatment plant and mobile plant on the landfill cap has the potential to affect the cap integrity, particularly once settlement of the pad has occurred, and also cause a 'squeezing effect' due to the weight of the pad on the landfill mass (including gas and leachate) below.

2.2.17 The risks due to landfill gas from the current site development has been addressed in the previous ESID report, however this provides an additional assessment scenario specifically related to the construction and operation of the new treatment and storage pad in the proposed location.

Landfill Gas

2.2.18 The proposed new treatment and storage pad at the STF will be approximately 4,100m^2 in size and constructed of crushed concrete and an underlying geo-composite clay liner (GCL) with installed drainage. Part of this new pad will be overlying the permanently capped landfill and so underlying landfilled waste has the potential to deform due to the placement of additional weight above. This in turn may cause gas to be squeezed from voids in the compressed areas and create gas pressure gradients to areas away from the zone of compression. The gas generation and flow will subsequently balance with the new weight and pressure of the deposited materials. The following sections present considerations of the short-term impact of this activity on the distribution of landfill gas to ensure that risks are adequately addressed.

2.2.19 The short-term impact would be that the increased loading may generate a pressure gradient leading to advective gas flow away from the area of compression and into the voids in the surrounding waste. The distance that the gas could migrate depends on the availability of inter-connected pores within the waste mass providing a pathway and is impossible to predict accurately due to the heterogeneity of the waste.

2.2.20 The potential impact of such increased gas pressure gradients differs depending on the area of the site where they occur. The area of landfill to be affected, with reference to the 2003 ESID report and attached drawing 'Annual Site Plan 2022' ref. 124A340 Plan 2, is the eastern margin of Phase 1, which is the oldest cell, landfilled in the 1980s and 1990s, is a land-raise, with a natural clay barrier liner and a clay cap, and likely to contain a heterogenous mix of wastes. Due to the age of the wastes in this area, it is likely the majority of settlement has occurred, and the waste is declining source term, producing less gas viable for abstraction. The nearest leachate well to the area affected is LC1.03 (as shown on the attached FCC

'Environmental Monitoring Plan ref. 124E232 Plan 4A (dated 11.03.20), which according to FCC's monitoring data is a 10.08m deep well. From this is it can be surmised that the depth of waste in this area is at least 10m deep from the surface of the capped landform.

2.2.21 Based on environmental plans for the landfill in-waste gas infrastructure, the new STF area does not affect nearby gas wells therefore no additional wells will be required to be drilled.

2.2.22 The risk of gas migration off site as a result of the proposed activities is not considered to be significant provided the existing gas control measures remain effective. To ensure that risks are managed adequately, gas extraction in the area proposed to be installed with the treatment pad should be carefully managed to match the increased gas flow from this area, if this occurs. Any increases observed in methane concentrations in the perimeter wells near to the proposed new treatment pad should trigger a review of the efficiency of gas extraction within that area. It is considered that these actions would mitigate adequately any impact that the proposed activities may have on the short-term behaviour of landfill gas at the site.

Leachate

2.2.23 It is considered the risk to leachate squeezing from the construction and operation of the proposed storage and treatment pad on the margin of Phase 1 of the Maw Green Landfill to be very low. Due to the age of the wastes, as discussed above in Section 2.1.20, it is likely most settlement has already occurred within the waste mass and the additional weight above this area unlikely to cause significant squeezing.

2.2.24 In addition, the treatment pad will be constructed of crushed concrete with a geo-composite clay liner (GCL) with a permeability of 1×10^{-9} m/s, with an installed drainage system that directs surface water run-off to a pumping chamber in the north-east corner of the area before being pumped across to the existing water treatment plant in the eastern STF area. The area where the treatment pad is to be located, above the landfill cap of Phase 1, will be situated on top of an existing 1m minimum thick engineered clay cap, which will provide a second layer of an impermeable barrier to the downward migration of surface water and rainfall. Therefore, it is likely the generation rate of leachate in this area is likely to decrease and reduce the risks posed by leachate in this area.

<u>Treatment Pad Engineering</u>

2.2.25 The operator will ensure the treatment pad will be constructed to prevent shearing of the landfill cap in Phase 1(below), and potential settlement of the area , by carefully designing the pad to limit differential settlement and spread the weight evenly across the landfill cap surface.

3.0 PATHWAY AND RECEPTOR TERM CHARACTERISATION

3.1 Overview

3.1.1 The pathway and receptor term characterisation within the initial 2003 ESID remains valid for the landfill site for: climate, geology, hydrology, hydrogeology and surface water. See attached 2003 ESID report SLR Ref. 4D-197-178/ESID in Appendix 2.

3.1.2 The sensitive receptors and pathways specifically relating to the STF are detailed within the Amenity & Accidents Risk Assessment report ref. 5193-CAU-XX-XX-RP-V-0310, included within the permit variation documents.

4.0 SITE CONDITION REPORT

4.1 Overview

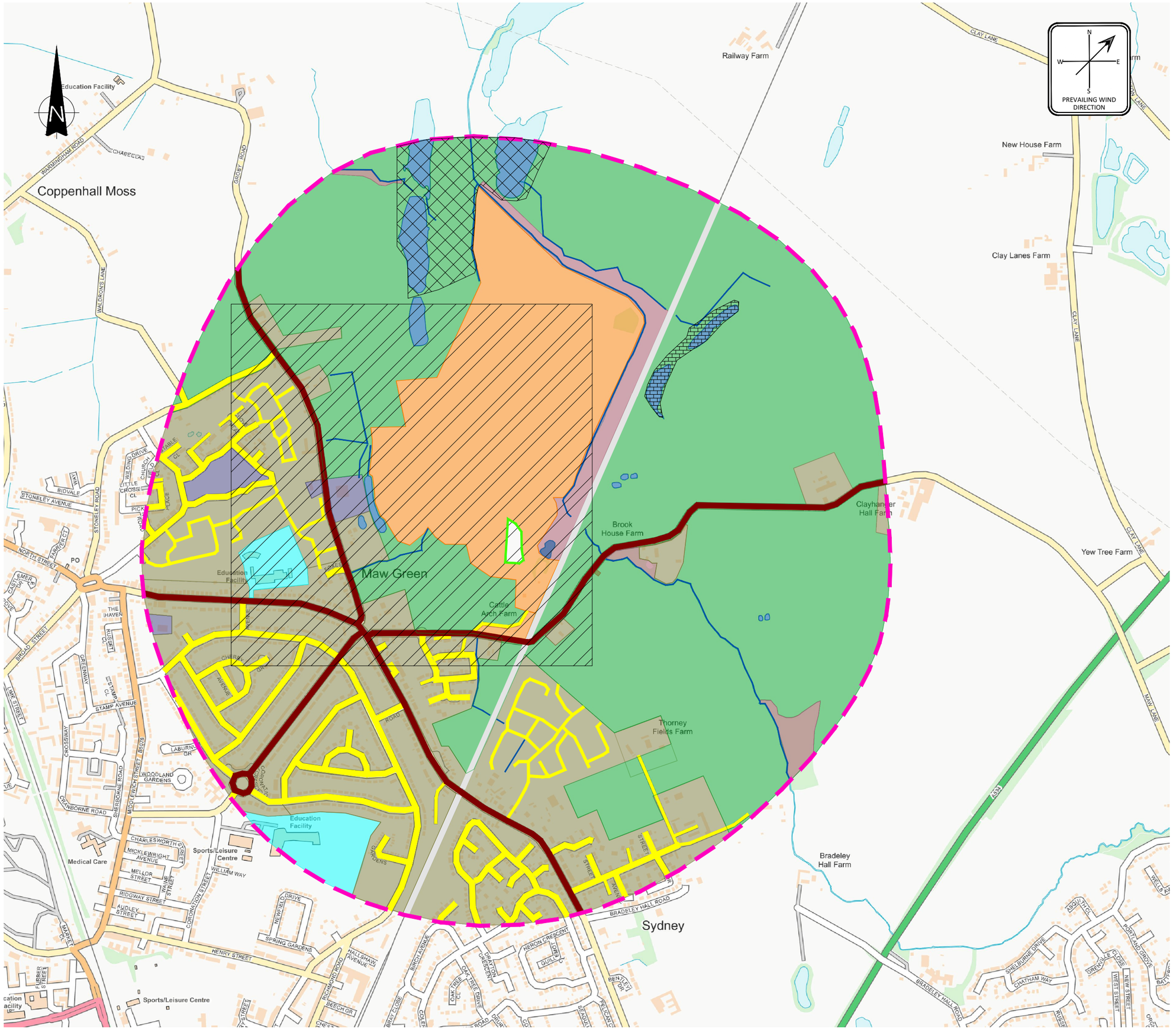
4.1.1 A Site Condition Report was produced as part of a 2019 permit variation for permit ref. EPR/BS7722ID, to add a contaminated soils treatment facility (STF), within the footprint of the former composting facility, within the permit boundary of the existing Maw Green Landfill Site. The STF is now installed and there are no changes proposed to the existing soils bioremediation site operations as a result of this permit variation application.

4.2 Proposed Operations

4.2.1 It is proposed to install a new treatment and storage STF area to the west of the current STF bioremediation area, for the treatment and storage of asbestos contaminated soils, which requires a small part of the treatment pad to be installed on top of the permanently capped landfill mass. Therefore, an updated site condition report is attached as Appendix 1, to account for this additional area. The new STF area is located within the existing Maw Green Landfill permit boundary, and therefore it is not proposed to add additional land to the permit.

DRAWINGS

5193-CAU-XX-XX-DR-V-1804	Sensitive Receptor Plan
5193-CAU-XX-XX-DR-V-1805	Proposed Site Layout Plan
5193-CAU-XX-XX-DR-V-1807	New Treatment Area Location
FCC drawing ref. '124A340 Plan 2'	Maw Green Landfill Site Annual Site Plan 2022
FCC drawing ref. '124E232 Plan 4A'	Maw Green Landfill Site Environmental Monitoring Plan



LEGEND

- ACTIVITY BOUNDARY
- 1000m OFFSET
- SURFACE WATER
- WOODLAND
- COMMERCIAL
- LANDFILL SITE
- RESIDENTIAL
- MAJOR ROAD
- MINOR ROAD
- RAIL
- AGRICULTURAL
- EDUCATIONAL
- RECREATIONAL
- SSSI
- PROTECTED SPECIES - NON FISH
- LOCAL WILDLIFE SITE

REV	MODIFICATIONS	BY	RE	AP	DATE
P01	ISSUED FOR INFORMATION	EJD	SH	SH	19.10.22

PURPOSE OF ISSUE: FOR INFORMATION

STATUS: S2

CLIENT: 3C WASTE LIMITED

PROJECT: MAW GREEN SOILS TREATMENT FACILITY

TITLE: NEW TREATMENT AREA SENSITIVE RECEPTORS PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	SH	SH

DATE	SCALE @ A3	JOB REF:	REVISION
18.10.2022	1:10000	5193	P01

DRAWING NUMBER: 5193-CAU-XX-XX-DR-V-1804

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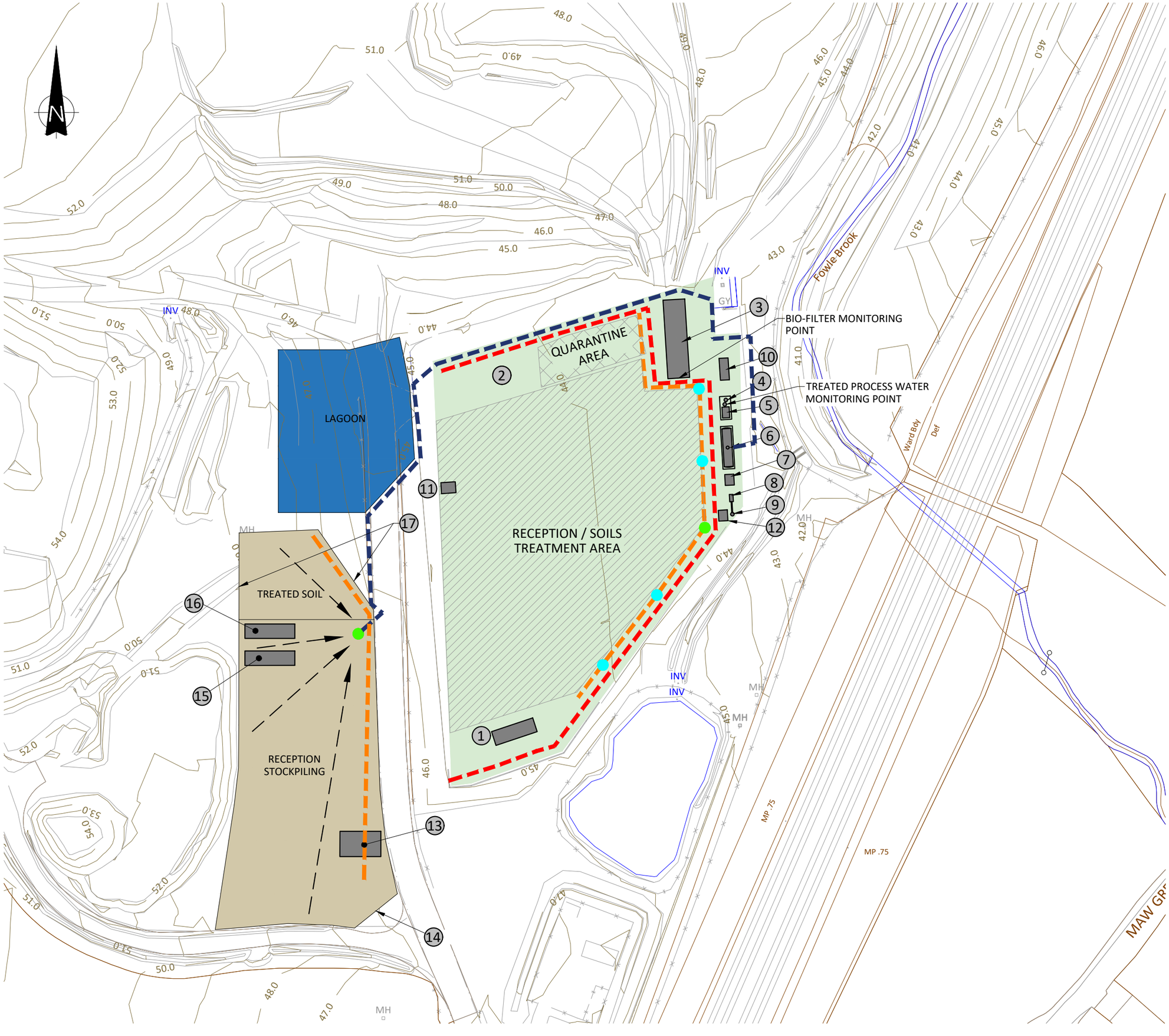

LEGEND

- CONCRETE IMPERMEABLE PAVING
- CRUSHED CONCRETE SITE SURFACING WITH GEO-COMPOSITE CLAY LINER (GCL)
- BOUNDARY KERB LINE
- WATER DRAINAGE PIPE
- DISCHARGE LINE
- FALL OF PAD
- DRAINAGE GULLY
- PUMPING CHAMBER
- 1 SITE OFFICE
- 2 NUTRIENT STORAGE
- 3 BIOFILTER
- 4 GRANULAR ACTIVATED CARBON FILTERS
- 5 TRANSFER TANK
- 6 PROCESS WATER SETTLEMENT TANK
- 7 10ft CONTAINER WITH CONTROL PANEL
- 8 BLOWER
- 9 AIR WATER SEPERATOR
- 10 20ft TOOL STORE
- 11 FUEL STORAGE
- 12 3WV
- 13 DECONTAMINATION UNIT
- 14 RECEPTION ENTRANCE AND EXIT
- 15 SOIL SCREENER
- 16 PICKING STATION
- 17 PLANT ENTRANCE AND EXIT

REV					
P02	UPDATED TO CLIENT INSTRUCTION	EJD	SH	SH	13.12.22
P01	ISSUED FOR INFORMATION	EJD	SH	SH	20.10.22
REV	MODIFICATIONS	BY	RE	AP	DATE

PURPOSE OF ISSUE: FOR INFORMATION
STATUS: S2

CLIENT: 3C WASTE LIMITED

PROJECT: MAW GREEN
SOILS TREATMENT FACILITY
PERMIT VARIATION

TITLE: PROPOSED SITE LAYOUT PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	SH	SH

DATE	SCALE @ A3	JOB REF:	REVISION
19.10.2022	1:1000	5193	P02

DRAWING NUMBER: 5193-CAU-XX-XX-DR-V-1805

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LEGEND

- CRUSHED CONCRETE SITE SURFACING WITH GEO-COMPOSITE CLAY LINER (GCL)
- PERMANENTLY CAPPED LANDFILL

REV	MODIFICATIONS	BY	RE	AP	DATE
P01	ISSUED FOR INFORMATION	EJD	SH	SH	21.10.22

PURPOSE OF ISSUE: FOR INFORMATION

STATUS: S2

CLIENT: 3C WASTE LIMITED

PROJECT: MAW GREEN
SOILS TREATMENT FACILITY
PERMIT VARIATION

TITLE: NEW TREATMENT AREA LOCATION

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	SH	SH

DATE	SCALE @ A3	JOB REF:	REVISION
20.10.2022	1:500	5193	P01

DRAWING NUMBER: 5193-CAU-XX-XX-DR-V-1807

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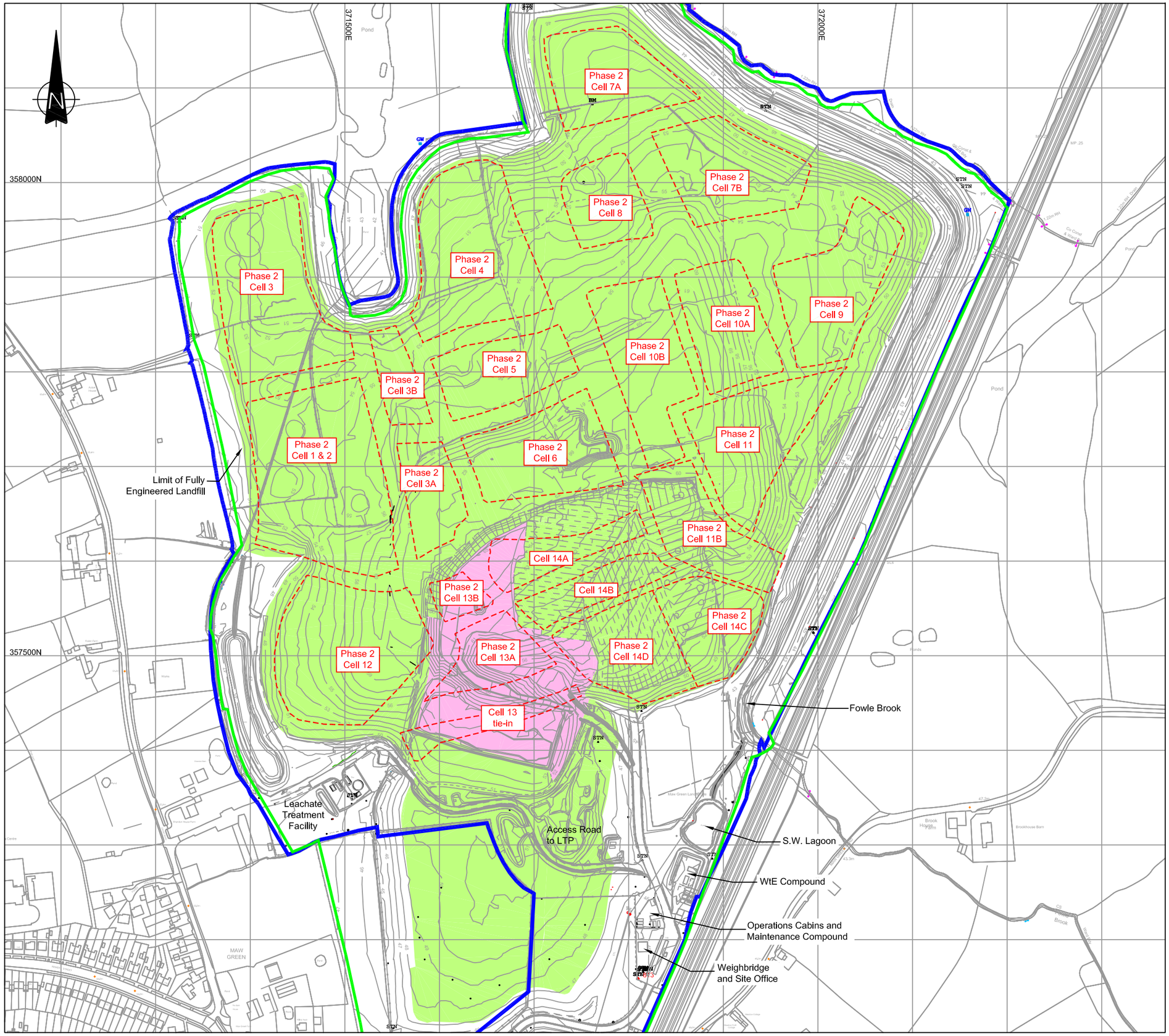


NOTES:

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:

- Leasehold Boundary
- PPC Boundary
- Open Waste Area
- Proposed Area
- Temporary Capped Area
- Permanently Capped
- Construction Area
- Latest Available Ground Contours (100)
- Tax Free Area
- As-built Cell Footprint

Revision:	Date:	Description:	By:	Chk:
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Reference files:
Information taken from plans;

Site Survey: 124W1893A

Cell Footprint: 124B1283

Areas Model: 124A1897

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

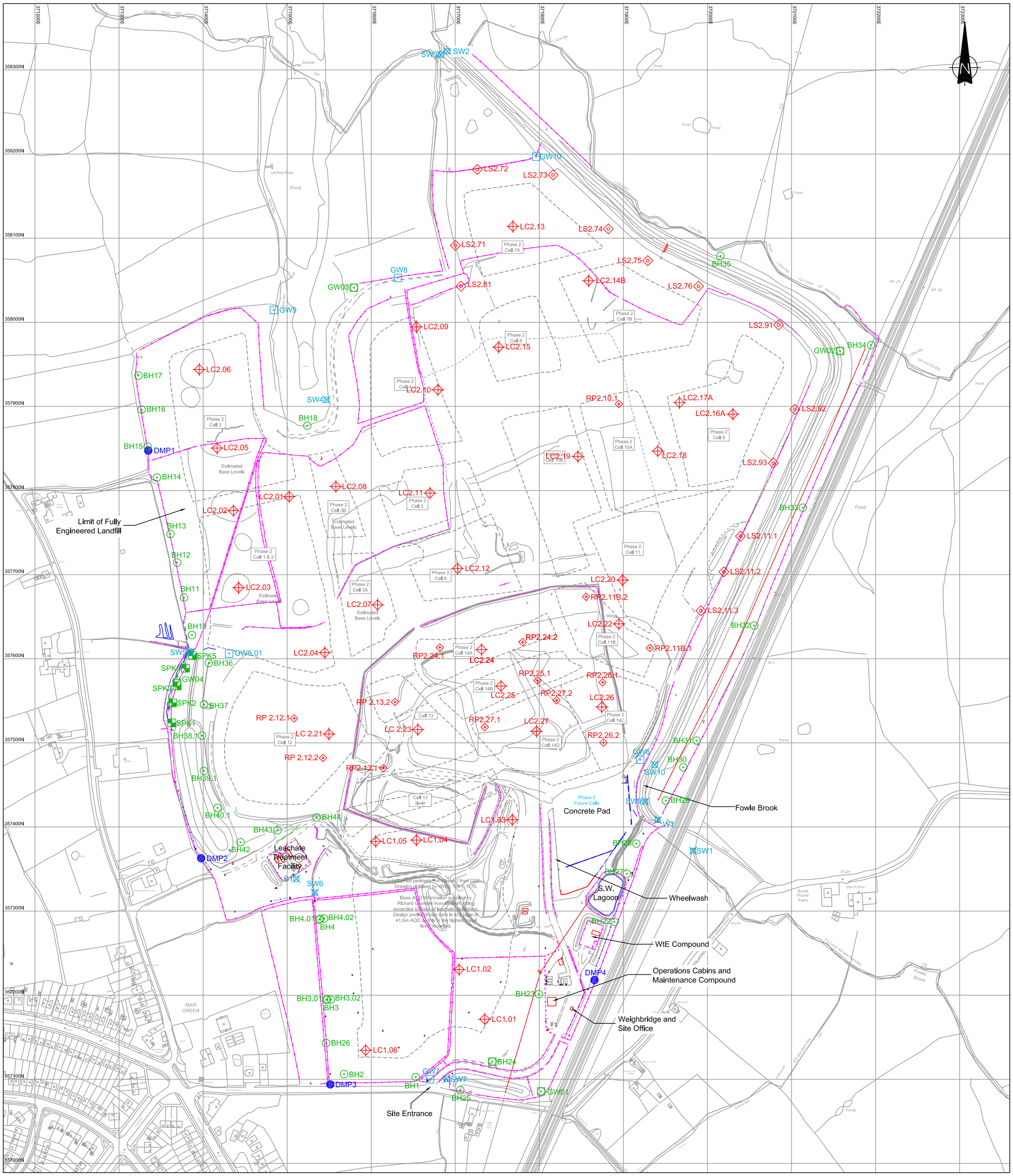
Site: **MAW GREEN LANDFILL SITE**

Drawing Title: **Annual Site Plan 2022**

Drawn By:	Checked By:	Date:	Scale:	Paper Size:
BS	LH	20.01.22	1:2500	A3

Status:	Revision:	Drawing No:	Plan Number:
FINAL	-	124A340	PLAN 2

Last Saved By: Ben.Stocks Date: 20-Jan-22Ref. By:stocks, ben Date: 21-Jan-22



LEGEND:

- Landfill Gas Monitoring Borehole
- Landfill Gas Surface Monitoring Point
- Combined Gas/ Groundwater Monitoring Point
- Gas Flare Stack
- Landfill Gas Extraction/ Leachate Monitoring Point
- Condensate Unit (Knock-out Pot)
- 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
- Spike Wells
- Dust Points
- As-built Cell Footprint

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.

Revision:	Date:	Description:	By:	Chk:
D	11.03.20	Site survey updated & label removed	BS	CS
C	06.01.17	Site survey updated. RP2.26.1, RP2.26.2, RP2.27.1, RP2.27.2, LC2.26 & LC2.27 added	BS	LH
B	16.11.16	Site survey updated	BS	MG
A	12.07.16	LCP added, site survey & title block updated	BS	CS

Reference files:
Information taken from plans:
Site Survey: 124W1856
Monitoring Plan: 124M1323/M1602
Cell Footprints: 124B1448

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

Site: **MAW GREEN** LANDFILL SITE

Drawing Title: **Environmental Monitoring Plan**

Drawn By:	Checked By:	Date:	Scale:	Paper Size:
BS	CS	11.03.20	1:3000	A2

Status:	Revision:	Drawing No:	Plan Number:
FINAL	D	124E232	PLAN 4A

Last Saved By: Ben.Stocks Date: 11-Mar-20Plot By: ben stocks Date: 11-Mar-20

APPENDIX 1

Site Condition Report 2022

1.0 SITE CONDITION REPORT 2022

1.1 Background

1.1.1 It is proposed to add an area of land for a new proposed activity at the Soils Treatment Facility (STF) area at Maw Green Landfill, for the treatment and storage of asbestos contaminated hazardous soils, which will be within the permit boundary of the existing Maw Green Landfill permit ref. EPR/BS7722ID.

1.1.2 The proposed area of land for the new activity at the STF will still be within the south-eastern area of the current footprint of Maw Green Landfill Site. The new area will be adjacent to the existing STF area used for the bioremediation of soils, and a small portion of the total new area will sit on the permanently capped landfill mass to the west.

1.1.3 The Maw Green Site is located approximately 2km northeast of Crewe city centre, adjacent to a railway line, with access gained from Maw Green Road to the south. The centre of the new STF area ('the site') is at National Grid Reference (NGR) SJ 71789 57326, to the west of the existing STF, across the haul road.

1.2 Template for Site Condition Reports

1.2.1 The EA guidance on Site Condition Reports (Horizontal Guidance Note H5) sets out the requirements to prepare and maintain a site condition report for facilities that are regulated under the Environmental Permitting Regulations over the lifetime of the site.

1.2.2 A Site Condition Report template is provided within the guidance. The template is divided into sections to be completed at different life stages of the regulated facility:

Sections 1-3 to be completed and submitted with applications for new facilities: This should include a description of the condition of the land at permit issue and a description of permitted activities at the site.

Sections 4-7 to be maintained during the life of the site: This should include a description of any changes to the activities and any changes to the use or production of dangerous substances at the facility. It should also include records of inspections for all pollution prevention measures, pollution incidents that may have had an impact on land and environmental monitoring.

Sections 8-10 to be completed and submitted with surrender applications: This should include a description of site decommissioning and removal of pollution risk and, where relevant, reference data and details of any remediation. Finally, it should include a 'statement of site condition' that is based on the information provided in the previous sections of the report.

1.2.3 To support the permit variation application, Sections 1 to 3 of the Environment Agency's Site Condition Report Template is addressed below.

1.3 Site Details

1.3.1 The details of the operator and the site are as follows:

Name of operator	3C Waste Limited
Activity address	Soils Treatment Facility, Maw Green Landfill Site, Maw Green Road, Coppenhall, Crewe, CW1 5NG
National grid reference	SJ 71789 57326

1.3.2 In the context of this report, 'the site' refers to the new proposed STF area, for the treatment and storage of asbestos soils, to the west of the existing STF soils bioremediation area.

1.3.3 The site will consist of an area of the STF for the storage and treatment of bound asbestos contaminated soils. The proposed site boundary and layout can be seen from drawing 5193-CAU-XX-XX-DR-V-1805 attached to this 2022 ESID report.

1.4 Site Plans

1.4.1 Site plans showing details of the site and its surroundings are included as part of the application for the facility which include the following detail:

- Site location, the area covered by the site condition report and the location and nature of the activities on the site.
- Locations of receptors, sources of emissions/releases, and monitoring points.
- Site drainage.
- Site surfacing.

1.4.2 The list of drawings included is provided in the table below and are attached to this 2022 ESID report:

Drawing reference	Title
5193-CAU-XX-XX-DR-V-1804	Sensitive Receptor Plan
5193-CAU-XX-XX-DR-V-1805	Updated Site Layout Plan
5193-CAU-XX-XX-DR-V-1807	New Treatment Area Location

1.5 Condition of the land at permit issue

1.5.1 The information presented within this section is based on information obtained from the Environment Agency's website, DEFRA Magic Maps website, the British Geological Survey

(BGS) GeoIndex and other publicly available information and previous permit applications for the site.

Geology

1.5.2 The geology stated in the original 2003 ESID remains valid and is summarised as follows:

1.5.3 The site is situated in the central part of the Cheshire Triassic Basin. Strata of the Mercia Mudstone Group underlie the site. Immediately beneath the site is the Wilkesley Halite Formation. Beneath this is a mudstone, below which is the Northwich Halite Formation and another mudstone. The base of the Mercia Mudstone Group is marked by the Tarporley Siltstone Formation and the Group overlies the Sherwood Sandstone Group. The Triassic strata are overlain by a thick sequence of glacial and post glacial deposits, as shown on the 1:50,000 scale geological map. In the vicinity of the site, glacial till is indicated as predominant. This till is described as firm to stiff, red-brown to blue grey, fairly plastic with varying proportions of rock fragments, rounded pebbles and high clay content sand and silt.

Hydrogeology

1.5.4 The site is located on Devensian Glacial Till deposits (silt, clay, sands and gravels) classified by the Environment Agency as a Secondary (undifferentiated) Aquifer. The superficial deposits are underlain by the Wilkesley Halite Member (Halite and Mudstone) of the Mercia Mudstone Group, which has not been given aquifer status by the Environment Agency.

1.5.5 There are no Source Protection Zones (SPZs) within 2km of the site, with the nearest SPZ (Zone III) located over 8km away to the southeast.

Surface waters

1.5.6 The closest surface water feature is a stream, Fowle Brook, to the 140m to the east-northeast of the site, which runs parallel to the railway line along the northeast site boundary. The Fowle Brook was diverted around the east of the Maw Green Landfill Site and is classified by the Environment Agency as a main river and joins up with the River Wheelock further north.

1.5.7 Approximately 530m to the northwest is a pond, which is located directly south of the water features which constitute Sandbach Flashes SSSI (which are 615m northwest of the site). Brook House Pools are located approximately 400m to the north, north-east of the site.

1.5.8 The site is not located within a flood risk zone.

Topography

1.5.9 The site is in a low-lying area, with general ground elevations around 45m Above Ordnance Datum (AOD). The ground rises very gently to both the west and the east, indicating that the site lies in a wide, open valley. The Fowle Brook flows through this valley in a northerly direction. This brook has been diverted around the site.

1.6 Sensitive Sites

1.6.1 A search was conducted for habitats and environmental receptors within a 2km radius of the site. The sensitive receptors are shown on attached drawing ref. 5193-CAU-XX-XX-DR-V-1804.

1.6.2 From a review of the Magic Maps website the site is not within 2km of any of the following designated sites: Areas of Outstanding Natural Beauty (AONBs), Local Nature Reserves (LNRs), National Nature Reserves (NNRs), Ramsar sites, Special Areas of Conservation (SACs), Special Protection Areas (SPAs), or any Scheduled Monuments and World Heritage Sites.

1.6.3 Sandbach Flashes Site of Special Scientific Interest (SSSI) is located approximately 615m north-northwest of the proposed site. The Sandbach Flashes are made up of 14 live units, which are all found north of the site within a 5km radius. The 3 units within 900m of the site are in favourable condition (closest 615m NNW), with 8 units north of this in an unfavourable (no change) condition, one unit being unfavourable declining, and one more unit 3.4km north being in favourable condition. Sandbach Flashes are defined according to Natural England as:

'Sandbach Flashes is a site of physiographical and biological importance. It consists of a series of pools formed as a result of subsidence due to the solution of underlying salt deposits. The water varies from freshwater, chemically similar to other Cheshire meres, to highly saline. Inland saline habitats are extremely rare and are of considerable interest because of the unusual associations of plants and animals. Most of the flashes are surrounded by semi-improved or improved grassland. Fodens Flash is partly surrounded by an important area of wet woodland.'

1.6.4 It is understood that these flashes are the result of subsidence caused by natural or anthropogenic halite dissolution at depth and it is further understood that water within these flashes ranges from fresh to saline due to the present of saline springs in some pools. There is no evidence of any such springs in the immediate vicinity of the site.

1.6.5 Two Local Wildlife Sites (LWSs) have also been identified nearby: Brook House Pools approximately 400m north-northeast, and also Clay Lane Verges approximately 1.5km to the northeast of the site.

1.7 Pollution History

Pollution incidents

1.7.1 The Environment Agency publishes data on reported pollution incidents which were categorised as either 'significant' or 'major'.

1.7.2 There are no major pollution incidents recorded within 5km of the site boundary.

Historic land-uses

1.7.3 Historical activities on site were summarised in the 2003 ESID site condition report for the wider Maw Green Landfill Site. The historic land uses have been summarised below:

Date	Description	Source
1909-1910	Surrounding land is primarily agricultural with four farms around the north and western perimeter, and the hamlet of Maw Green to the south. Site is bounded to the east by the Crewe-Manchester railway line. A brick and pipe works is shown 250m south of Groby Farm on the western perimeter of what is now the site. A lake appears 750m east of Oaktree Farm. Groby Fox Covert (small wooded area) is located 420m south west of Oaktree Farm. Marshy ground appears on the east side of Groby Fox Covert.	OS County Series, 1:2,500 scale
1911	Hospital for infectious diseases appears 1km to the south west of site. Hall O'Shaw Brickworks lies 1km south of site.	OS County Series, 1:10,560 scale
1954	Area to the south west of Maw Green is beginning to be developed for urban use, marked as Coppenhall.	OS County Series, 1:10,560 scale
1959	Castle Arch Farm has appeared 200m south of site.	OS National Grid Series, 1:2,500 scale
1968	Area to the south west of Maw Green is now recorded as fully developed as an area of housing. 500m north of site a series of lakes have appeared. Foden Farm and 'works' have appeared 200m west of site. Acton House has appeared 100m south of Groby Farm on the western site boundary.	OS County Series, 1:10,560 scale
1992	North of site refuse tip has appeared. The lakes/standing water bodies to the north have changed in shape slightly and have grown.	OS National Grid Series, 1:10,000 scale

Evidence of existing or historic contamination

1.7.4 The nearby 'works' (manure works and meat processing plant) located 200m west of the wider landfill site could be considered a possible source of contamination, however this is at quite a distance from the proposed new area of the STF, in the south-eastern portion of the landfill site permitted area.

1.7.5 The proposed site area is currently permitted as part of the wider Maw Green Landfill facility operated by 3C Waste Limited and is to be used for the treatment (hand-picking of bound asbestos) and temporary storage of asbestos contaminated soils prior to treatment. The area will have a crushed concrete site surface installed with an underlying geo-composite clay liner and installed sealed drainage system. A small strip of the western-most area of the new proposed STF area will be situated on top of the permanently capped landfill mass. This area , according to the 2003 ESID, is the oldest area of tipped waste at the site (Phase 1), which was tipped in the 1980s and early 1990s as a 'land raise'. Therefore, it is likely this is a relatively shallow waste deposit. According to the 2003 ESID:

"It should be noted that the details of the engineering in Phase 1 is unavailable. It is assumed that waste deposited in this part of the site was placed on in-situ clay which can be conceptualised as an in-situ geological barrier. The upper surface of the clay would presumably have been graded and levelled such that the remoulded material would act as an artificial

sealing liner. This process has been formalised and subject to CQA procedures in more recent construction phases"

1.7.6 The existing STF area to the east of the proposed new area for soils bioremediation was previously a composting pad and is now a treatment pad for the bioremediation of soils, accepting up to 50,000 tonnes per annum of hazardous and non-hazardous soils. The maximum storage capacity at any one time is 38,000 tonnes. The maximum treatment time for soils undergoing bioremediation is 6 months in general, with the majority being treated in periods of between 8-16 weeks. There will be no change to the bioremediation process as a result of this permit variation. The bioremediation treatment process involves utilising industry standard biopile technology and moisture control, with the addition of suitable materials to the soil, forced air extraction to encourage micro-organism growth and breakdown of hydrocarbons into by products such as carbon dioxide and water vapour.

1.7.7 Table 1 below summarises the potential sources of contamination and their contaminants:

Table 1 – Potential Contamination Sources

Potential Sources		Potential Contaminants
On-site	Landfill -beneath part of the proposed STF Area for the treatment and storage of asbestos contaminated soils	Tipped wastes as a 'land raise' pre-Landfill Directive (likely 1980s and 1990s) and possible 'overtip' of wastes post-2003 (as per ESID) to achieve restoration levels. The leachate quality information provided in the 2003 ESID appears to be typical of a landfill site receiving a variety of waste types and which has been operational for an extended period of time. A variety of List I and List II Substances of the 1998 Groundwater Regulations were also detected. Hazardous ground gases pose a risk, however currently managed by the landfill's gas abstraction infrastructure.
Off-site	Road network	Possible elevated from pH from surface runoff, and chloride where salt is used on the highway in winter.
	Railway	Various contaminants including PAH, hydrocarbons, asbestos, heavy metals and pathogens. Hazardous ground gases pose a risk.

Baseline soil and groundwater reference data

1.7.8 See Section 5.7.6 above for information on the baseline soil and groundwater conditions extracted from the 2003 ESID. The new proposed area will have a crushed concrete site surface installed with an underlying geo-composite clay liner and installed sealed drainage system, preventing the migration of any substances or surface water down into the underlying ground. Further sampling is therefore not considered to be required during the site operations.

1.7.9 The management of the existing site conditions should be taken into consideration when developing the site.

1.8 Permitted activity

1.8.1 The site is currently permitted under environmental permit ref. EPR/BS7722ID and operated by 3C Waste Limited, a wholly owned subsidiary of FCC Environment (UK) Limited. The former compost pad in the existing STF area was operated under WML 60562/M08. The area of land proposed for the treatment and storage of bound asbestos contaminated soils, to the west of the existing STF, will be partly situated on a small margin of the landfill mass, likely tipped in the 1980s and 1990s, pre-Landfill Directive.

1.8.2 The current landfilling activity at Maw Green has the potential to cause pollution, as does the previous activity at the compost pad which is now closed. The activities that currently take place at the existing STF include the biological treatment, with biofilter incorporated, of both non-hazardous and hazardous waste soils, together with the temporary storage of hazardous waste. The existing landfill has surface water emission points, along with the potential to cause odours and landfill gas which will not be associated with the proposed new area at the Soils Treatment Facility.

1.8.3 The proposed new activity within the new STF area will comprise the treatment of asbestos in soils, which will be by handpicking of bound asbestos, and the temporary storage of hazardous wastes, specifically asbestos contaminated wastes in a separate area, prior to treatment. Soils following successful treatment and removal of asbestos will be used directly for restoration on the landfill, however if some hydrocarbon contamination is present, they can be directed to the bioremediation process at the STF prior to sending for restoration.

1.9 Plan showing activity layout

1.9.1 The proposed activity boundary, layout and drainage detail is shown on drawing ref. 5193-CAU-XX-XX-DR-V-1805.

1.9.2 The location of the proposed treatment pad for the treatment and storage of asbestos-impacted soils is shown in drawing ref. 5193-CAU-XX-XX-DR-V-1807, showing the proposed located relative to the underlying permanently capped landfill mass.

1.10 Environmental risk assessment

1.10.1 An environmental risk assessment has been carried out to support the permit application and is presented separately within the Amenity and Accident Risk Assessment report ref.5193-CAU-XX-XX-RP-V-0310. This report is based on Environment Agency guidance on 'Risk Assessments for Your Environmental Permit' (updated 31st August 2022) and assesses the potential risks from odour, noise, fugitive emissions and accidents.

1.10.2 The risk assessments identify risk mitigation measures such as infrastructure, equipment or operational practices that are required to manage the risks from the site. Identified mitigation measures are incorporated as part of the management system for the site. The identified activities that will be conducted at the site which may lead to land pollution along with the identified preventative measures that are needed to be in place to protect the land are

presented within Table 3 'Fugitive emissions' and within Table 4 'Accidents' of the above report.

1.11 Proposed Operations

1.11.1 3C Waste Limited (a wholly owned subsidiary of FCC Environment (UK) Limited) have appointed Caulmert Limited to prepare an environmental permit variation application to vary the existing Maw Green Landfill permit ref. EPR/BS7722ID to add a Section 5.3A(1)(a)(ii) activity to include for the treatment of asbestos in soil. The treatment of soils will be by 3-way screening and handpicking of bound asbestos and is to include an additional area for storage and treatment of solely asbestos contaminated wastes, separate to the current STF area. The proposed area for asbestos handling is located to the west of the current STF, however is within the existing Maw Green Landfill permit boundary.

1.11.2 There is a significant proportion of construction waste suitable for treatment for restoration use that contains incidental fragments of bound asbestos. This has previously been exported from the local region to one of our other soil treatment facilities for treatment and reuse. The operator proposes to use an area on the Maw Green Landfill Site, to the west of the existing STF, for the screening of asbestos contaminated soils and hand-picking of bonded asbestos. Soil suitable for restoration will be retained on site for restoration of the landfill. Unsuitable material will be removed from the site.

1.11.3 The bioremediation process at the existing STF will not change. The treated soils are used primarily in the restoration of Maw Green Landfill Site. The storage of hazardous waste at the site is already covered by listed activity within the permit: Section 5.6 Part A (1)(a) temporary storage of hazardous waste with a total capacity exceeding 50 tonnes.

1.11.4 The proposed location of the new area of the STF for the treatment and storage of asbestos contaminated soils will fall within the current permit boundary of Maw Green Landfill Site; therefore, this application is not seeking to extend the permit boundary. The new area of the STF will be adjacent to the existing STF area and shall sit in the southern part of the site within the footprint of Maw Green Landfill Site, with a small portion of the new treatment area to be located on top of the permanently capped landfill mass, as shown on drawing ref. 5193-CAU-XX-XX-DR-V-1807.

1.11.5 This application proposes new hazardous waste codes to be included in the permit for the STF for the acceptance of asbestos contaminated soils:

- 17 05 03* soil and stones containing hazardous substances.
- 17 06 05* construction materials containing asbestos.

1.11.6 Waste code 17 05 03* will be restricted to those wastes which contain identifiable pieces of bonded asbestos – any particle size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. Waste code 17 06 05* will be restricted to wastes containing discrete pieces of bonded asbestos within the soil matrix only.

1.11.7 Upon satisfactory pre-acceptance and waste acceptance checks, on arrival to site, the soils will be weighed and directed from the weighbridge to the soils reception area and undergo inspection and sampling for reception analytical testing. Asbestos soils will be stored on the crushed concrete pad with geo-composite clay liner (GCL) provided with bunding and sealed drainage. After placement on the storage area, the soils will be sheeted to reduce the potential for air borne emissions.

1.11.8 The pre-acceptance testing is carried out to confirm that the soil does not contain asbestos fibres above >0.1% for chrysotile and >0.01% for other forms of asbestos to ensure that airborne asbestos fibres cannot be generated at concentrations above the HSE clearance/reoccupation limit of 0.01f/ml at the treatment equipment location and an agreed background reference level at the site boundary. Until this initial reception testing has been completed, the soils will remain sheeted. Following formal compliance with the waste acceptance limits confirming that there are no unacceptable asbestos fibre concentrations, the soil is formally accepted and can be stored un-sheeted and will undergo pre-screening and handpicking for bonded asbestos fragments. Soils containing asbestos of >0.1% for chrysotile and >0.01% for other asbestos types, that are observed to contain asbestos concentrations in excess of the waste acceptance limits, will be rejected from site.

1.11.9 Dust suppression will be provided for the asbestos soil treatment and storage areas. This will be continuous misting sprays with overlapping spray arcs, as a dust and asbestos fibre mitigation measure. In addition, air monitoring will be carried out to assess airborne concentrations of asbestos fibres. Asbestos surfactant will be added to the misting sprays for effective removal of asbestos fibres from the air. The Material Safety Data Sheets (MSDS) are provided within the DEMP. Further detail on controls and mitigation for the release of emissions from the proposed activities are provided in the Dust & Emissions Management Plan, document ref. 5193-CAU-XX-XX-RP-V-0313.

1.11.10 The asbestos soils reception area is shown on drawing 5193-CAU-XX-XX-DR-V-1805, however the exact layout will vary over time dependent upon inputs and treatment timescales. Demarcation of the areas will be managed via suitable signage.

1.11.11 The new hazardous soils storage and treatment pad will be constructed from crushed concrete with underlying geo-composite clay liner (GCL). The treatment pads will be designed to have a fall towards a main water collection drain to ensure that water is continually drained from the pads. Drainage systems at the site will lead to sealed sumps and a treatment plant. No surface water runoff will escape to the environment.

1.11.12 Maw Green Landfill, the Soil Treatment Facility and the associated activities on site are managed by the operator in accordance with a management system.

APPENDIX 2

ESID Report (SLR, 2003)

SECTION A

ENVIRONMENTAL SETTING AND INSTALLATION DESIGN

TABLE OF CONTENTS

TABLES

DRAWINGS

Dwg No	**ESID1**	**Scale**	50,000	**Title**	Location
Detail		Site location in relation to surrounding features			
Dwg No	**ESID2**	**Scale**	10,000	**Title**	Environmental Site Setting
Detail		Installation boundary			
		Residential areas			
		Schools			
		Recreational areas			
		Waterways			
		Water bodies			
		Agricultural areas			
		Urban sites			
		Roads, railways			
Dwg No	**ESID3**	**Scale**	25000	**Title**	Cultural and Natural Heritage
Detail		Natural heritage SSSIs, Cultural heritage Listed buildings Scheduled ancient monuments			
Dwg No	**ESID4**	**Scale**	2500	**Title**	Site Layout and Waste Deposition
Detail		Cell layout			
		Filled areas			
		Pre-settlement contours			
		Security infrastructure			
Dwg No	**ESID5**	**Scale**	2500	**Title**	Restoration
Detail		Post settlement contours			
		Topography 500m outside site			
		Landscape planting proposals			
		Aftercare proposals			
		Infrastructure (tanks, hard surfacing, quarantine areas)			
Dwg No	**ESID6A**	**Scale**	2500	**Title**	Installation Lining Details
Detail		Engineering of basal containment system			
		Groundwater control (not applicable)			
		Surface water management features (not applicable)			
Dwg No	**ESID6B**	**Scale**	2500	**Title**	Installation Capping System Details
Detail		Engineering of capping system			
Dwg No	**ESID7**	**Scale**	2500	**Title**	Leachate Management
Detail		Leachate sumps, abstraction wells, risers etc			
		Leachate treatment plant			
		Monitoring point location/ construction detail			

Dwg No	**ESID8**	**Scale**	2500	**Title**	Landfill Gas Management
Detail		Gas wells (location and construction)			
		In waste monitoring points			
		Perimeter/external monitoring points			
		Flare(s) location			
		Engine location			
Dwg No	**ESID9A**	**Scale**	25000	**Title**	Regional Geology-Drift
Detail		Solid geology (taken from BGS Geological Map)			
		Any appropriate regional cross sections			
Dwg No	**ESID9B**	**Scale**	50000	**Title**	Regional Geology-Solid
Detail		Regional geology (taken from BGS Geological Map)			
		Any appropriate regional cross sections			
Dwg No	**ESID10**	**Scale**	10000	**Title**	Regional Hydrogeology
Detail		Aquifer classification			
		SPZs			
		Licensed and private abstractions from ground and surface water			
		Springs			
		Groundwater vulnerability			
Dwg No	**ESID11**	**Scale**	5000	**Title**	Local Hydrogeology and Hydrology
Detail		Groundwater monitoring points (NB logs in Appendix ESID9)			
		Groundwater contours (for each ground water body)			
		Local springs			
		Surface water monitoring points			
Dwg No	**ESID12**	**Scale**	As shown	**Title**	Hydrogeological Cross Sections
Detail		Groundwater levels (for each groundwater body)			
		Groundwater flow to discharge points			
		Inter-relationship between; site (base and sides), leachate levels, groundwater levels and relevant surface water features			
Dwg No	**ESID13**	**Scale**	2500	**Title**	Source, Pathways, Receptors
Detail		Leachate management plant			
		Landfill gas flares, engines			
		Met station location (if on site)			
		Receptors			
		Surface water Groundwater Amenity			
		Pathways			
		Air- include wind rose			

APPENDICES

1.0 INTRODUCTION

1.1 Report Context

Waste Recycling Group (WRG) has retained SLR Consulting Ltd (SLR) to complete the PPC Re-permit Application for its Maw Green Landfill Site, near Crewe, Cheshire.

The Landfill Regulations 2002 require existing landfills, currently managed under the Waste Management Licensing Regulations 1994, to apply for a PPC Permit under the PPC Regulations 2000. This process is required to implement European Directives on the Landfilling of Waste (The Landfill Directive), and on Integrated Pollution Prevention and Control (IPPC Directive).

The application for a PPC Permit requires the development of a conceptual site model that details the environmental setting of the site and the proposed installation design. Where the installation includes previously landfilled areas the construction and nature of these areas must also be considered. This report therefore details the nature of the site in terms of geology, hydrogeology and local land use, and details the design of the existing installation and that proposed for further development. This report also details the historic development of the site and satisfies the requirements for a Site Report.

The installation comprises the continued operation of a 19 cell landfill of which Cell 10B is currently receiving waste and Cell 12 has been prepared ready for the acceptance of waste. In addition to the presently licensed landfill (known as Phase 2), an area of older landfilling (known as Phase 1) is present in the south of the application site. It is proposed that this area will be partially over-tipped in order to achieve the approved restoration scheme and provide adequate surface water management for the site.

1.2 Installation Details

The southern boundary of the installation is located approximately 2km north of the centre of Crewe (i.e. on the outskirts of Crewe), in the county of Cheshire, its location is indicated on Drawing ESID 1. The site is centred on national grid reference SJ 717 575. Historically, the site has been operated as a co-disposal facility taking both hazardous and non-hazardous wastes. However, under the Landfill Regulations 2002 co-disposal must end, and the installation will therefore become a non-hazardous facility after July 2004.

The installation boundary is indicated on Drawing ESID 2. The site will be secured using fences and gated accesses throughout the period prior to the definite closure of the site. Gates will be locked outside of the permitted opening hours.

The site is in a low lying area, with general ground elevations around 45maOD indicated. Ground rises very gently to both the west and east, indicating that the site lies in a wide open valley. The Fowle Brook flows through this valley in a northerly direction. This brook has

been diverted around the installation on the eastern boundary under authority of the 1995 Planning Permission and with the consent of the Environment Agency (EA).

Drawing ESID 2 indicates the surrounding land use and Drawing ESID 13 identifies the potential receptors in the vicinity of the site. Table ESID 1 below details the receptors identified. Drawing ESID 3 indicates cultural and natural heritage sites (designated at national or international level) within 5km of the site.

TABLE ESID 1: POTENTIAL ENVIRONMENTAL RECEPTORS WITHIN THE VICINITY OF THE SITE

Receptor Name	Type of Receptor	Minimum Distance from Boundary (m)	Direction from Site Boundary	Receptor Reference (Drawing No.ESID13)
Brook House Farm	Residential	220	E	13.1
Meadow Croft Cottage	Residential	70	SE	13.2
Cattle Arch Farm	Residential	10	S	13.3
Windy Nook	Residential	30	W	13.4
Works	Industrial	30	W	13.5
Acton House Farm	Residential	110	NW	13.6
Perimeter Footpath	Recreational	0-5	NE	13.7
Sandbach Flashes SSSI	Nature Conservation	25	N	13.8

Drawing ESID 2 indicates that the site is in a predominantly agricultural setting on the north-eastern outskirts of the town of Crewe. As such, potential environmental receptors include domestic dwellings both within the town and farms surrounding the site. In addition, surface water receptors are present within the Sandbach Flashes Site of Special Scientific Interest (SSSI) to the north and the diverted Fowle Brook to the east being the closest to the site, as indicated in Drawing ESID 13.

The large areas of housing on the outskirts of Crewe are identified as being a significant potential receptor. However, receptor 13.4 is considered to be representative of these locations.

Drawing ESID 2 does not indicate the presence of many potential sources of non-landfill related contamination; the only potentially industrial unit being works, 30m west of the site. Potential non-landfill sources of contamination are discussed further in Section 2 and Section 4.

2.0 SOURCE TERM CHARACTERISATION

2.1 The Development of the Installation

2.1.1 Historical Development

Planning and Licensing History

Planning permission for a land raise operation utilising controlled wastes was granted by Cheshire County Council to itself in 1984, and a resolution was subsequently passed by the County Council Highways Sub-committee acting as Waste Disposal Authority under the Control of Pollution Act 1974 in October 1984 (Licence Number 60562) to permit disposal of controlled wastes under the Act. A new licence was issued to 3C Waste Limited in February 1993 by the County Council acting as Waste Disposal Authority under the Environmental Protection Act 1990 in order to implement the requirements of that Act. This licence was modified in February 1995 to update the conditions and again in September 1995 to permit disposal of wet pulverised waste. Further planning permission for an extension to the site and the demolition of a meat processing plant was granted in 1995 which included permission to divert the Fowle Brook.

A modification to the waste disposal licence was granted in October 1995 requiring the completion of a Regulation 15 Assessment under the Waste Management Licensing Regulations 1994. The Licence was formally converted to a Waste Management Licence by the Environment Agency in June 1998 and the conditions were again updated. It is noted that a composting facility was added to the licence at this time. Further modifications were issued in October 1999 (Licence No. 60562/MO5) and April 2001 (Licence No. 60562/MO6) to further update the licence conditions. In July 2002 a further modification was issued (Licence No. 60562/MO7) to modify the permitted waste types for the site and increase the tonnage inputs.

The planning permissions relating to the site are included in Appendix ESID 1.

Development History

The site was developed primarily on agricultural land as a land raise facility, although latterly up to 8m of clay has been extracted prior to waste deposition in order to provide engineering materials both for the Maw Green Phase 1 site and for other installations. The historic development of the land prior to the deposition of waste is detailed in Table ESID 2.

TABLE ESID 2: HISTORY OF LANDUSE AT THE SITE

DATE	DESCRIPTION	SOURCE
1909 & 1910	Land use is agricultural use, and is a mosaic of fields, most with ponds marked within them, some with marshy ground adjacent to the ponds. Four farms lie on the north and western perimeter. Site is bounded to the east by the Crewe-Manchester railway line. A manure works is shown within the site boundary A brick and pipe works is shown 250m south of Groby Farm on the western perimeter Small lake shown 150m south west of manure works. A lake appears 750m east of Oaktree Farm. Groby Fox Covert (small wooded area) is located 420m south west of Oaktree Farm. Marshy ground appears on the east side of Groby Fox Covert. A stream runs south to north through the middle of the area.	OS County Series, 1:2,500 scale
1911 & 1938	Land use as 1909 – 1910.	OS County Series, 1:10,560 scale
1954	Groby Fox Covert no longer present, agricultural land marked. Lake to the north has increased in size 100%.	OS National Grid Series, 1:10,560 scale
1959, 1968 & 1979	Lake south west of manure works has become marshy ground and has increased in size by 50%. 'Manure works' becomes 'works' (1959). Lake to the north has altered in shape and size. Marshy ground west of previous location of Groby Fox Covert has become a lake and increased in size by 50%. 'Works' have appeared west of the manure plant. Area now criss-crossed by drains (1968) Shandon House becomes Shandon House Farm (1968).	OS National Grid Series, 1:2,500 scale OS National Grid Series, 1:10,560 scale OS National Grid Series, 1:10,000 scale
1990	Area unchanged.	OS National Grid Series, 1:10,000 scale
1992	Shape and size of lakes in northern section has changed. Abattoir has replaced manure works 650m south west of Groby Farm Area surrounding abattoir has become landfill	OS National Grid Series, 1:10,000 scale

Examination of Table ESID 2 indicates that there has been little activity on the site that may have given rise to historic contamination. The only exception is the manure works (latterly an abattoir and meat processing plant). The Fowle Brook, which formerly flowed across the site, has been diverted around the eastern perimeter of the site. The former bed of this stream (if still unexcavated), and those of small ponds shown within the site on older maps could be sources of gases and ammoniacal nitrogen as a result of deposits high in organic content. However, it is understood that several metres of material has been stripped from all areas of Phase 2 prior to landfill construction and as such this is not considered to be a hazard at this site.

It is noted that the installation includes a nissen hut used for the storage and maintenance of vehicles and therefore this area is a potential source of non-landfill contamination, particularly with hydrocarbons. Further, a composting slab and a waste transfer station are present within the installation boundary but these are not considered likely to give rise to significant contamination as they are bunded and positively drained, as required by the current Waste Management Licence. These facilities are not included within this installation and would continue to be regulated via the existing Waste Management Licence until the landfill footprint envelops them and they cease to operate.

2.1.2 Proposed Development

The installation, which has been utilised as a co-disposal site taking both hazardous and non-hazardous wastes, will be operated as a non-hazardous site after July 2004. Appendix ESID 2 details the proposed wastes types to be acceptable under the PPC Permit.

The location of the cells of the current phase, Phase 2, are shown in Drawing ESID 2 and are detailed, along with the approved restoration scheme in Drawings ESID 4 and 5 respectively. The site will be operated in a phased manner with cells being capped and restored once waste deposition in that cell has been completed. It is also required that partial over tipping of the Phase 1 site will need to be undertaken to achieve the approved restoration landform.

Leachate analysis has been undertaken regularly for a range of List II species (as defined in the Groundwater Regulations 1998).

Leachate quality data for ammoniacal nitrogen, chloride, COD, BOD and electrical conductivity is shown graphically in Appendix ESID 3.

Following review of the leachate quality data, the following summary can be made:

- Electrical conductivity values ranged from 449 µS/cm (LC2.02) and 87400 µS/cm (LC2.15).
- Ammoniacal nitrogen concentrations varied between <0.6 mg/l (LC1.01-LC1.06 and LC2.15) and 8220 mg/l (LC2.14).
- Chloride concentrations ranged from 15 mg/l (LC1.01) to 50600 mg/l (LC2.14).
- pH values ranged between 6.3 (LC2.02) and 8.4 (LC2.14).
- The leachate quality appears to be typical of a landfill site receiving a variety of waste types and which has been operational for an extended period of time.

Spot analysis for List I species, as defined in the Groundwater Regulations, have been undertaken and indicate that such substances are present within the leachate. The leachate

analysis, taken from collection chambers in Phase 1 and Phase 2 indicated that the following List I substances are present:

- Mecoprop (147 and 239µg/l)
- Aldrin (40ng/l in LC2.13)
- 1,2,4 trichlorobenzene (117µg/l in LC1.02)
- Chloroethane (13.1µg/l in LC1.02)
- Benzene (4.2µg/l in LC1.02)
- Ethylbenzene (93.4 and 23.6µg/l)
- m-,p-xylene (88.4 and 10.2µg/l)
- o-xylene (51.4 and 8.4µg/l)
- 1,3,5 trimethylbenzene (7.4µg/l in LC1.02)
- 1,2,4, trimethylbenzene (5.9 and 7.4µg/l)
- p-isopropyltoluene (4.7µg/l in LC1.02)
- Napthalene (7.1 and 2.1µg/l)
- 2,4,6 trichlorophenol (2.2µg/l in LC1.02)

Consideration of the waste types that have been and are proposed to be accepted at the site indicate that the landfill has the potential to generate substances on List I and List II of the Groundwater Regulations 1998. In addition, leachate analysis has confirmed the presence of such substances in leachate. Therefore it is concluded that the Groundwater Regulations 1998 do apply to the proposed development as the installation has the potential to give rise to an indirect discharge to groundwater of substances listed in the Regulations. Therefore, it is concluded that a leachate collection system is required at this installation.

The proposed final restoration of the site is indicated on Drawing ESID 5. In summary, the majority of the site will be restored to agricultural pasture land with wooded areas while land in the north will be restored and managed as species rich grassland.

2.2 Installation Engineering

The installation is presently operated on the basis of engineered containment, and the installation will continue to be operated on this basis. The conceptual design of the containment system and the environmental management systems for the proposed installation is detailed below. Table ESID 3 summarises the characteristics of these systems in those parts of the landfill which have already been constructed. The details summarised in Table ESID 3 are taken from Construction Quality Assurance (CQA) reports prepared following construction.

It should be noted that the details of the engineering in Phase 1 is unavailable. It is assumed that waste deposited in this part of the site was placed on in-situ clay which can be conceptualised as an in-situ geological barrier. The upper surface of the clay would presumably have been graded and levelled such that the remoulded material would act as an

artificial sealing liner. This process has been formalised and subject to CQA procedures in more recent construction phases.

TABLE ESID 3A: SUMMARY OF EXISTING LANDFILL ENGINEERING

Phase/Cell	Basal Liner	Side wall Liner	Leachate Collection	Capping system
1	In-situ clay	In-situ clay	Retro-installed extraction wells	Compacted clay overlain by restoration soils
2/1	Compacted clay	Compacted clay	Herringbone drainage system and leachate chambers	Compacted clay overlain by restoration soils
2/2	Compacted clay	Compacted clay	Herringbone drainage system and leachate chambers	Compacted clay overlain by restoration soils
2/3a	Compacted clay	Compacted clay	100mm drainage layer and leachate chamber over 150mm blanket of hard core stabilisation layer including pipework	Compacted clay overlain by restoration soils
2/3b	1993-1994 1m of compacted clay	Assumed to be same as base	100mm drainage layer and leachate chamber over 150mm blanket of hard core stabilisation layer	Compacted clay overlain by restoration soils
2/4	1993-1994 1m of compacted clay	Assumed to be same as base	100mm drainage layer and leachate chamber over 150mm blanket of hard core stabilisation layer	1999 1m of compacted clay overlain by restoration soils
2/5	1994 1m of compacted clay	internal bund only	200mm gravel blanket, geotextile separator and collection pipework. Telescopic leachate shaft	Compacted clay overlain by restoration soils
2/6	1994 1m of compacted clay	internal bund only	200mm gravel blanket, geotextile separator and collection pipework. Telescopic leachate shaft	Compacted clay overlain by restoration soils
2/7A	1m of compacted clay	Assumed to be same as base	200mm gravel blanket, geotextile separator and collection pipework. Leachate chamber and leachate monitoring point	1998-1999 1m of compacted clay overlain by 1000mm of subsoil (Area A) or 750mm subsoil and 250mm topsoil (Area B)
2/7B	1m of compacted clay	Assumed to be same as base	200mm gravel blanket, geotextile separator and collection pipework. Leachate chamber and leachate monitoring point	1998-1999 1m of compacted clay overlain by 1000mm of subsoil (Area A) or 750mm subsoil and 250mm topsoil (Area B)

TABLE ESID 3A (CONTINUED): SUMMARY OF EXISTING LANDFILL ENGINEERING

Phase/Cell	Basal Liner	Side wall Liner	Leachate Collection	Capping system
2/8	1996 1m of compacted clay	1.15m of compacted clay	Tyres and collection pipework. Telescopic leachate shaft	1m of compacted clay overlain by 1m of restoration soils
2/9	1998-1999 1m of compacted clay	1.15m of compacted clay	3m thick tyre drainage blanket Leachate collection chamber and two leachate monitoring points	1999 1m of compacted clay overlain by 1m of restoration soils
2/10A	2000-2001 1m of compacted clay	1.15m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework. Leachate collection chamber and two leachate monitoring points	1mm welded geomembrane overlain by 1m of restoration soils
2/10B	1m of compacted clay	1m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework. Leachate collection chamber and two leachate monitoring points	Currently being filled
2/11	2000-2001 1m of compacted clay	1.15m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework Leachate collection chamber and two leachate monitoring points	1mm welded geomembrane overlain by 1m of restoration soils
2/12	1m of compacted clay	1m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework Leachate collection chamber and two leachate monitoring points	Proposed to use clay regulating layer overlain by 1mm welded geomembrane and in turn overlain by 1m of restoration soils, including an additional clay protection layer

TABLE ESID 3B: SUMMARY OF PROPOSED LANDFILL ENGINEERING

Phase/Cell	Basal Liner	Side wall Liner	Leachate Collection	Capping system
2/13 (proposed)	1m of compacted clay	1m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework Leachate collection chamber and two leachate monitoring points	Proposed to use clay regulating layer overlain by 1mm welded geomembrane and in turn overlain by 1m of restoration soils, including an additional clay protection layer
2/14 (proposed)	1m of compacted clay	1m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework Leachate collection chamber and two leachate monitoring points	Proposed to use clay regulating layer overlain by 1mm welded geomembrane and in turn overlain by 1m of restoration soils, including an additional clay protection layer
2/15 (proposed)	1m of compacted clay	1m of compacted clay	300mm thick gravel drainage blanket underlain by a geotextile separator and including collection pipework Leachate collection chamber and two leachate monitoring points	Proposed to use clay regulating layer overlain by 1mm welded geomembrane and in turn overlain by 1m of restoration soils, including an additional clay protection layer

Notes
1 Proposed cells may be sub-divided or the number of cells may vary.
2 The existing cap on Phase 1 will be left in place prior to over filling, though the restoration soils will be removed.

2.2.1 Groundwater Management System

Examination of the geological logs and of laboratory testing data contained within the CQA documents indicates that the underlying geological materials are of low permeability and therefore that no groundwater management system is required.

2.2.2 Basal Lining System

The installation is underlain by till deposits to a depth of at least 13m as proven in site boreholes, with a proven permeability of not more than $6x10^{-10}$ m/s, and frequently not more than $1x10^{-10}$ m/s. Therefore it is proposed that the in-situ material will be utilised as the geological barrier. Prior to installation of the artificial sealing liner the surface of the in situ clay will be rolled and inspected with any soft areas being removed and replaced with stockpiled natural materials.

The artificial sealing liner will be formed from clay excavated from the site and will comprise 1m of remoulded clay, placed under a CQA scheme to be agreed with the EA. It has been proven that undisturbed samples of reworked and compacted clay, used to form the artificial sealing liner, have a permeability of not more than $1x10^{-9}$ m/s.

A leachate collection blanket will be placed across the base of the site and will comprise a 300mm thick non-calcareous gravel layer. In addition a perforated 150mm (outside diameter) pipe will be laid in the base of each cell along the longest axis of the cell with a fall of 1:50 to the leachate extraction sump as detailed in Section 2.3.2. The leachate blanket will not be extended up external slopes.

A CQA Plan will be agreed with the EA prior to the commencement of works on each cell.

The design of the basal lining system is shown in Drawing ESID 6A.

2.2.3 Side Slope Lining System

The natural till deposits are of sufficiently low permeability (not more than 6 $x10^{-10}$ m/s) that they may form the geological barrier, and given the low permeability of this material a low permeability artificial sealing liner is not required, and therefore a leachate collection layer is not required on the side slopes. Notwithstanding this, clay will be excavated and re-compacted to form an artificial sealing liner on these slopes. The lining system is indicated in Drawing ESID 6A.

2.2.4 Capping System

Following completion of waste deposition within a cell the cell will be capped as soon as practicable. The elements that will make up the capping system are described below and are illustrated in Drawing No ESID 6B. The cap will be placed under a Construction Quality Assurance plan.

A 1000mm clay cap will be provided, above the waste, and overlain by restoration soils.

Alternatively, 1mm geomembrane capping liner will be provided which, when combined with the clay regulating layers described below will minimise infiltration and therefore minimise the generation of leachate. A 300mm thick clay regulating layer will be placed above the waste, onto which the geomembrane cap will be placed. A 300mm thick clay protection layer will be placed above the geomembrane, and this will be overlain by 700mm of restoration soils. It is also likely that a geocomposite drainage layer will be placed above the geomembrane.

2.3 Leachate Management and Monitoring

2.3.1 Leachate Generation

Appendix ESID 4 presents a water balance that estimates the volume of leachate generated by the existing phases and also considers the potential generation from the proposed cells. The appendix also presents the estimation of the size of the proposed cells so as to reduce the volume of leachate generated in the short term.

2.3.2 Leachate Management and Monitoring

Leachate levels are recorded on a weekly and monthly basis at the Leachate Chambers (LC) and Side Slope Risers (LS) in accordance with current licence requirements. Samples are also taken monthly from the leachate collection chambers as detailed in Appendix ESID 3. The samples are analysed for a range of determinands listed below:

1) Monthly for:

pH, electrical conductivity and temperature.

2) Quarterly for:

In addition to the monthly suite: alkalinity, ammoniacal nitrogen, calcium, chloride, magnesium, potassium, sodium, sulphate, biological oxygen demand, chemical oxygen demand, total organic carbon, total oxidised nitrogen and phenol.

3) Annually for:

In addition to the quarterly suite: cadmium, chromium, copper, iron, lead, manganese, nickel, zinc, mercury, total cyanide and List 1 substances.

Leachate will be extracted from a sump within each cell of Phase 2 and will be extracted via retrospectively installed leachate wells from Phase 1 (LC1.01 to 1.06) such that the head of leachate at the base of the liner can be managed. Appendix ESID 4 details the risk assessment undertaken to verify that the proposed design will be capable of providing this control in the remaining cells in Phase 2. A leachate treatment plant will be provided to treat the leachate to a standard where discharge to the United Utilities pubic sewer network is possible as detailed within the discharge consent, dated 6th February 2003 granted by the sewerage undertaker to discharge trade effluent from the site.

Recirculation of leachate is not generally undertaken although the irrigation of leachate onto waste in the active cell may be undertaken if necessary to manage leachate volumes and to utilise absorptive capacity in the waste.

Leachate heads within the site during 2001-2002 are indicated graphically in Appendix ESID 5 and summarised in Table ESID 4. The monitoring points from which these data are obtained are illustrated in Drawing ESID 7.

TABLE ESID 4A: LEACHATE ELEVATION SUMMARY FOR MONITORING POINTS (2001-2002)

Monitoring Point	Count	Leachate depth (m)			
		Min	Average	Max	St. dev
LS2.71	7	1.61	3.80	5.61	1.99
LS2.72	10	1.25	2.56	4.94	1.41
LS2.73	3	3.46	12.24	16.83	7.60
LS2.75	7	0.72	5.73	11.91	4.98
LS2.76	10	3.13	7.87	12.97	4.05
LS2.81	10	2.70	7.19	13.29	3.54
LS2.93	4	1.55	3.11	5.71	1.84

TABLE ESID 4B: LEACHATE ELEVATION SUMMARY FOR COLLECTION POINTS (2001-2002)

Collection Point	Count	Leachate depth (m)			
		Min	Average	Max	St. dev
LC1.01	51	0.08	0.62	1.36	0.21
LC1.02	69	0.07	1.46	5.37	1.54
LC1.03	68	0.00	0.81	3.00	0.47
LC1.04	69	0.07	1.11	5.10	0.99
LC1.05	69	0.25	1.43	4.51	1.15
LC1.06	69	0.05	0.70	2.08	0.35
LC2.01	10	4.73	7.74	10.39	1.70
LC2.02	10	3.10	6.42	11.32	3.10
LC2.03	10	2.99	5.67	7.70	1.18
LC2.04	10	3.48	7.11	8.66	1.52
LC2.05	16	11.84	12.33	13.08	0.38
LC2.06	10	3.12	6.60	9.09	2.64
LC2.07	10	3.91	6.19	10.24	1.69
LC2.08	10	3.40	5.14	7.89	2.14
LC2.09	10	5.33	5.94	6.81	0.55
LC2.10	4	5.78	6.04	6.16	0.18
LC2.11	9	7.07	7.35	7.67	0.18
LC2.12	9	6.49	7.69	8.52	0.74
LC2.13	17	0.03	0.76	1.12	0.35
LC2.14	17	5.60	6.27	7.23	0.46
LC2.15	105	0.31	6.78	8.79	1.92

Examination of the data indicates that leachate heads (i.e. the head of leachate acting on the basal liner in Phase 2 and on the in-situ geological barrier Phase 1) ranges from near zero to 13.08m. It is noted that the current Waste Management Licence sets the maximum leachate head at 1m above the base of the landfill and without a risk based approach being adopted. The hydrogeological risk assessment associated with this application also indicates that the essential and technical precautions at the installation should include a maximum head of 4m within Phase 1 and 6m within Phase 2 as determined within the Hydrogeological Risk Assessment[1].

Leachate quality monitoring has been undertaken regularly as detailed above. In addition, samples from leachate wells were taken in February 2003 for a List I analysis under the Environment Agency framework. The leachate chemistry is detailed in Section 2.1.2.

[1] SLR Consulting Limited, 2003, Maw Green Landfill Site, Hydrogeological Risk Assessment, Ref: 4D-197-178/HRA

As detailed in Section 3.5 the site is not sub-water table, and there is no groundwater management system (Section 2.2.1). Therefore no consideration of interaction between groundwater management systems and leachate is required.

2.4 Landfill Gas Management and Monitoring

2.4.1 Landfill Gas Generation

As part of the landfill gas risk assessment process, total bulk landfill gas production was simulated by GasSim and is also presented within Appendix ESID6. This simulation indicates that the peak predicted gas generation occurs in 2009 with a peak flow of 5,100 m^3 hr^{-1} (50^{th} percentile).

This confirms that flaring and/or utilisation will be required during the landfill's lifecycle in order to comply with the requirements of the Landfill Regulations, 2002[2].

The composition of landfill gas will vary according to the type of waste and the time that has elapsed since deposition within the site. However, typically in a contained site taking biodegradable wastes, landfill gas usually consists of approximately 64% methane, 34% carbon dioxide, 2% nitrogen, <1% oxygen and 1% trace elements such as organic gases and vapours[3].

On-site monitoring of composite landfill gas concentrations, taken prior to flaring, indicates that the landfill gas being generated at Maw Green Landfill historically consists of 53 to 63% v/v methane and 35 to 43% carbon dioxide.

2.4.2 Landfill Gas Management

The landfill gas management system is indicated in Drawing ESID 8 and consists of a network of vertical extraction wells which actively extract gas for use in the on-site electricity generation facility. The gas utilisation plant consists of 4 gas engines with a total capacity of approximately 2400 m^3 hr^{-1}. Should total gas generation exceed this figure or if any of the engines are temporarily out of commission, a flare stack with a maximum capacity of 1000 m^3 hr^{-1} is on site to burn off any residual gases. The engines and flare are located in a compound in the south-east of the installation.

[2] The estimated value exceeds the simplistic benchmark value of 50 to 100 m^3 hr^{-1}, which has been proposed by the Environment Agency as an indication as to whether flaring or utilisation is viable under the terms of the Landfill Regulations, 2002. The benchmark gas flow rate for gas utilisation is 600 m^3 hr^{-1}. These Regulations state that landfill gas must be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and, to the extent possible, used. In addition, landfill gas that cannot be used to produce energy must be flared.

[3] Environment Agency, November 2002. Guidance on the Management of Landfill Gas.

2.4.3 Landfill Gas Monitoring

Landfill gas monitoring is undertaken at monthly intervals from each leachate extraction point and from a series of perimeter gas monitoring boreholes as indicates on Drawing ESID 8. The results of this monitoring are included in Appendix ESID 7 and are summarised graphically.

2.5 Post Closure Controls

Section 2.2 details the engineering controls that will be emplaced during the development of the installation and that will form the basis of the management system after the definite closure of the site. It is noted that these engineering controls meet the minimum requirements specified in the Landfill Regulations 2002. The conceptualisation of the site management measures throughout the life of the site is detailed in Table ESID 5.

It is acknowledged that the performance of some parts of the engineered control system may degrade over time, and the Regulations require the impact of this degradation to be assessed. Landsim 2.5 includes degradation of landfill control systems based on scientific research and this model has been used to assess the performance of the installation over the entire life of the site. The Hydrogeological Risk Assessment[1] therefore demonstrates that the site will comply with the Groundwater Regulations at all times during the landfill's life cycle.

A stability analysis has been carried out for the engineered containment system both prior to and after the deposition of waste. This assessment included the potential impact of differential settlement. The assessment is detailed in the Stability Risk Assessment[4] and indicates that there is a negligible risk presented by the site. It is noted that the solid geology at the site included saliferous beds (Section 3.2), and that dissolution of these strata has occurred by both natural and anthropogenic activities. This dissolution has led to collapse of overlying strata, producing collapse breccias at depth and some subsidence at the surface. This subsidence has led to the creation of a series of shallow pools in the vicinity of Maw Green Landfill which are designated a Site of Special Scientific Interest (see Drawing ESID 3). Brine extraction in this area ceased in 1975 and there have been no recent reports of subsidence, indicating that the area has stabilised.

Under the PPC Regulations the Permit may only be surrendered when it is concluded that the site no longer presents a risk to the environment in the absence of active controls i.e. after the waste has degraded such that emissions from the site are acceptable. Detailed completion criteria are outlined in the specific risk assessments accompanying the permit application. However, the principles on which completion can be assessed are.

- With regards to ***potential impact on ground and surface water***, this means that the site needs to comply with the requirements of the Groundwater Regulations, 1998, following the cessation of active leachate management;

[4] SLR Consulting Limited, 2003, Maw Green Landfill Site, Stability Risk Assessment, Ref: 4D-197-178/SRA

- ***Landfill gas*** completion criteria would be related to when the site no longer poses a potential risk to either humans or the environment following the cessation of active landfill gas management; and

- With regard to ***subsidence*** (settlement) when the rate of subsidence of the restoration landform has become negligible (less than 10mm/yr).

TABLE ESID 5: THE CONCEPTUALISATION OF MANAGEMENT MEASURES AND TECHNICAL CONTROLS THROUGHOUT THE LANDFILL LIFE CYCLE

Landfill Phases	Leachate Management	Landfill Gas Management	Containment System		Landfill Cap
			Artificial Sealing Liner (engineered clay)	Geological Barrier (in situ clay)	
Operational	Ongoing management of leachate heads to ensure compliance with specified limit	Ongoing management of landfill gas	Operates as designed	Operates as designed	Not Applicable
Post Closure and Aftercare Period	Ongoing management of leachate heads to ensure compliance with specified limit. Some degradation (i.e. clogging) of the drainage system	Ongoing management of landfill gas Some degradation (i.e. well clogging) of the abstraction system	Operates as designed	Operates as designed	Operates as designed
Site Completion	Passive management (monitoring only). Complete degradation of the drainage system	Passive management (monitoring only). Some degradation (i.e. well clogging) of the abstraction system	Operates as designed	Operates as designed	Operates as designed except cell 2/10A and future cells (geomembrane cap) where cap degradation can be expected
Post-site Completion	None	None	Operates as designed	Operates as designed	Operates as designed except cell 2/10A and future cells where infiltration will equal effective rainfall

3.0 PATHWAY AND RECEPTOR TERM CHARACTERISATION

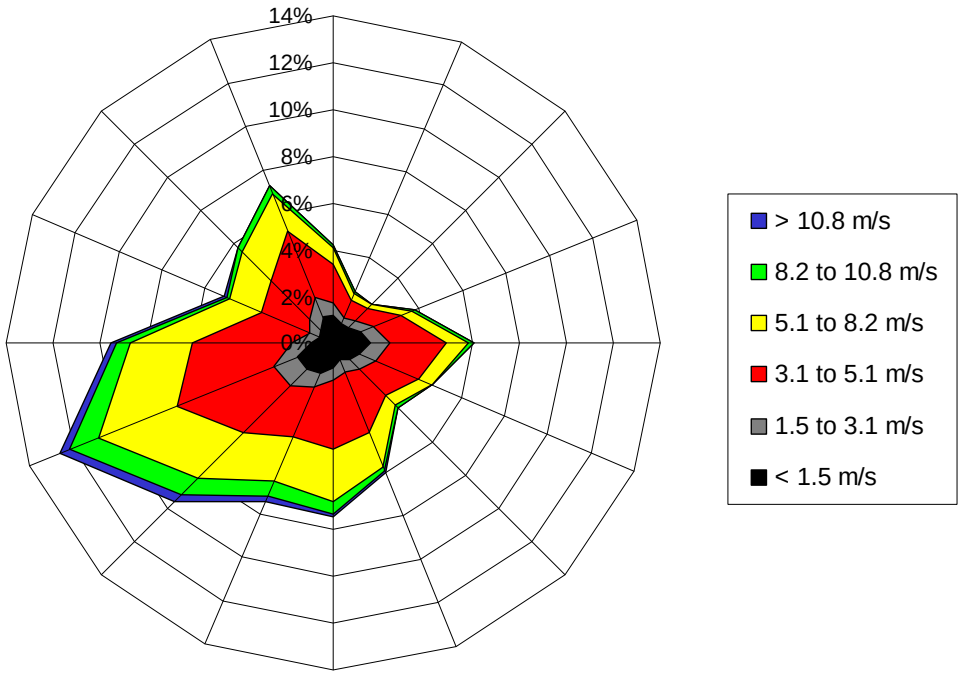
3.1 Climate

The average annual rainfall recorded for the period 1981-1990 recorded for MORECS square 105, which included the site is 822mm, and the effective precipitation, that is rainfall minus evapotranspiration, is 270mm. Monitoring data from the Environment Agency's rainfall gauge at Worleston, located 5km west of the site, indicates average monthly values as shown in Table ESID 6 and an annual average rainfall of 734mm.

TABLE ESID 6: AVERAGE MONTHLY RAINFALL DATA 1971-2001 FOR WORLESTON RAIN GAUGE

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	61.2	45.5	53.3	46.9	52.0	54.2	77.8	57.5	63.3	87.2	67.4	67.9	734.4

Wind direction and strength information is given within the wind rose below which related to Shawbury weather station which is approximately 37 km south east of the application site.



The wind rose indicates that the predominant wind direction is southerly with approximately 12% of wind coming from this direction. Wind strengths are almost entirely below 10.8m/s.

3.2 Geology

The geology of the site has been determined from published geological maps, which are presented in Drawings ESID9A and 9B, and from site investigations undertaken at the site.

3.2.1 Regional Geology

Solid and Structural Geology

The site is situated in the central part of the Cheshire Triassic Basin. Strata of the Mercia Mudstone Group underlie the site. Immediately beneath the site is the Wilkesley Halite Formation (formerly known as the Upper Keuper Saliferous deposits). Beneath this is a mudstone (Middle Keuper Marl), below which is the Northwich Halite Formation (Lower Keuper Marl) and another mudstone (Lower Keuper Marl). The base of the Mercia Mudstone Group is marked by the Tarporley Siltstone Formation (Keuper Waterstones) and the Group overlies the Sherwood Sandstone Group. The 1:50,000 scale geological map for the area[5] suggests that in the vicinity of the site the Mercia Mudstone Group achieves a thickness of the order of 250 metres. The regional geology is indicated in Drawing ESID 9.

The halite deposits are highly soluble and, where they have come into contact with fresh circulating groundwater, removal of halite by solution has resulted in brecciation of the associated marls and collapse of the overlying strata giving rise to subsidence at the ground surface. This process is generally referred to as "Brine Subsidence".

To the west of the site, the Triassic deposits are disrupted by the King Street Fault (otherwise known as the Coppenhall Fault). This is a normal fault, downthrown to the east, with a reported maximum displacement of 600 metres, although the displacement in the immediate vicinity of the site is not known.

Drift Geology

The Triassic strata are overlain by a thick sequence of glacial and post glacial deposits, as shown on the 1:50,000 scale geological map[6]. In the vicinity of the site, glacial till is indicated as predominant. This till is described as firm to stiff, red-brown to blue grey, fairly plastic with varying proportions of rock fragments, rounded pebbles and high clay content sand and silt.

The 1:10,560 scale geological map of the area indicates the presence of a small area of "Middle Sands", to the north of the site and a localised peat deposit associated with a subsidence feature beneath Phase 1 of the site where waste has already been deposited.

[5] British Geological Survey, 1968. Macclesfield. England and Wales Sheet 110.1:50,000 Scale. Solid Edition. BGS, Keyworth.
[6] Institute of Geological Sciences, 1968. Macclesfield. England and Wales Sheet 110. 1:63,360 Scale. Drift Edition. IGS, Keyworth.

However, a review of site investigation data (see below) has not revealed the presence of this stratum.

Site Investigations and Local Geology

The site investigations that have been undertaken at the site are detailed in Table ESID 7. The borehole logs are enclosed in Appendix ESID 8.

TABLE ESID 7: SUMMARY OF INTRUSIVE SITE INVESTIGATIONS

Date	Investigation Summary	
	Boreholes	**Trial Pits**
1984		26
1989	7	9
1991	9	-
1992	4	-
2000	4 (completed as monitoring wells)	-
2003	4 (completed as deep monitoring wells)	-

Examination of the borehole logs included in Appendix ESID 8 indicates that the site is underlain by a thick deposit of occasionally silty and pebbly clay that is generally characterised as a till or boulder clay on the boreholes logs. However, it is noted that the descriptions could equally apply to glacio-lacustrine deposits and this may be considered more compatible with the recorded rounded pebbles of some units. The base of the Quaternary deposits has not been proven in any boreholes or trial pits, and with the exception of a fine sand at 14.8 metres below ground level (mbgl) in borehole GW4 only argillaceous deposits have been recorded in boreholes considered prior to 2003. As this sand was not found in other boreholes around the site it has been concluded that this is an isolated body and therefore it is not considered to be a receptor. Similarly, the rare thin dry sand horizons recorded in some older logs are not considered as receptors due to their isolated nature and the absence of any groundwater recorded in these units.

Boreholes advanced during 2003 encountered sandy water bearing horizons around 19m below ground level as shown on the logs within Appendix ESID 8. These sands were encountered in all four boreholes and, if they form a single unit, it can be postulated that it dips to the north as shown in Drawing ESID 12. Baildown tests were carried out following the drilling of the 2003 boreholes and indicated only slow recovery which may indicate that the sand horizons are thin and/or isolated, or have low permeability. Notwithstanding this, the postulated sand horizon has been identified as the appropriate groundwater receptor beneath the site for the Hydrogeological Risk Assessment.

Alluvial deposits are recorded in the vicinity of the former course of the Fowle Brook with these comprising up to 5 metres of silty and occasionally slightly sandy clays with very occasional peat.

The site investigations have recorded the topsoil thickness as ranging from 0.3 to 0.5m.

3.3 Man-made Subsurface Pathways

As detailed in Section 2.1 excavation of up to 10m of natural material has been undertaken prior to the development of the engineered containment system and as such no shallow man-made pathways are present beneath the landfill footprint. While it is acknowledged that saliferous bodies below the site have been mined by dissolution techniques, and that this has lead to surface subsidence it is considered that, given the thick cover of pliable glacial tills and lacustrine deposits no pathways is present to these deep layers.

Monitoring boreholes previously installed to the south of Cells 1 and 3 have been removed and backfilled as have boreholes in the vicinity of Cell 12 which were compromising operations.

3.4 Hydrology

3.4.1 Off-site Hydrology

The surface water system in the vicinity of the site is indicated on Drawings ESID 2 and ESID 11.

Standing Water

Examination of Drawings ESID 2 and ESID 11 indicate that there are several bodies of standing water in the vicinity of the site. The closest is an unnamed pool 10m north of the installation boundary. Further north a series of elongated bodies, the Sandbach Flashes, are present with these being designated a SSSI. The closest water body that is part of this SSSI is Groby's Flash which is situated 50m north of the installation boundary. It is understood that these flashes are the result of subsidence caused by natural or anthropogenic halite dissolution at depth and it is further understood that water within these flashes ranges from fresh to saline due to the present of saline springs in some pools. There is no evidence of any such springs in the immediate vicinity of the site.

To the east of the site, a small enclosed pool is located within 10m of the site boundary with further pools being located approximately 50m from the boundary to the easy of the railway line. To the south, the closest standing water is located 175m from the boundary. The closest standing water to the west is 300m from the application boundary.

Flowing Water

The Fowle Brook, which formerly flowed northwards through the middle of the site, has been diverted around the east of the installation boundary and now forms the closest flowing water feature. This brook, classified as a main river by the Environment Agency, joins the River Wheelock and then flows into the River Mersey. It is noted that WRG manage the Fowle Brook within the installation boundary. No other flowing water bodies are located within 500m of the application boundary except for a small tributary of the Fowle Brook that rises from a spring 700m north of the site.

Water Quality

Surface water is sampled monthly at 11 surface water monitoring points around the site (shown on Drawing ESID 11) and is analysed for pH, electrical conductivity, ammoniacal nitrogen, chloride, chemical oxygen demand, dissolved oxygen, and suspended solids. A summary of the surface water quality data is presented in Appendix ESID 9 along with time-series graphs of electrical conductivity, ammoniacal nitrogen and chloride concentrations.

Review of the surface water quality indicates the following:

- The majority of determinands were consistently recorded below the UK Drinking Water Standard.

- Concentrations of chloride did not exceed the UK Drinking Water Standard (250mg/l) on any occasion with the exceptions of monitoring location SW11 which recorded four values above 250 mg/l, with a maximum reading of 542mg/l. It is noted that SW11 samples a surface water body within the site and this is known to be impacted by the operations on site (such as stockpiling road salt). All other monitoring locations recorded values less than 100mg/l.

- Average concentrations of ammoniacal nitrogen exceeded the UK Drinking Water Standard (0.39mg/l) at every monitoring point over the monitoring period. Monitoring of off-site surface water quality, including the Fowle Brook both upstream and downstream of the site indicates elevated levels of ammoniacal nitrogen both up and down stream of the site; this suggests a non-landfill source of ammoniacal nitrogen such as agricultural practices.

- Concentrations of manganese exceeded the UK Drinking Water Standard (0.05mg/l) at every monitoring location at least once over the monitoring period, which indicates an upstream source of this metal.

- The loading of suspended solids within the discharge was extremely variable during the review period.

Flood Hazard

Given the diverted nature of the Fowle Brook in this area no indicative flood plain has been defined in the area. However, the new course and geomorphology of the Fowle Brook was designed to ensure that the brook has sufficient capacity to accept the flows previously carried by the pre-diversion water course. The Environment Agency's indicative flood plain map indicates that part of the site was within the indicative flood plain of the old Fowle Brook.

Ecological Importance

The water bodies to the north of the site, which comprise the Sandbach Flashes SSSI, have been designated based on the unusual salt-tolerant vegetation which is rare in an inland setting. The pools are also used by a range of wading birds.

3.4.2 Surface Water Management System

Surface water at the site will be managed using sustainable drainage techniques, to restrict discharges from the site to the greenfield rate of runoff and to minimise any impacts of the development of water quality throughout its life.

3.5 Hydrogeology

3.5.1 Aquifer Characteristics

The application site is located on glacial material classified by the Environment Agency as a non-aquifer with this material in turn being underlain by Mercia Mudstone Group which is also a non-aquifer. Deep boreholes drilled close to the site indicate that the base of the Mercia Mudstone is deeper than 135m below ground level and no outcrop of the underlying Triassic sandstone aquifer system is recorded within 10km of the site. The nearest superficial deposits with the potential to act as an aquifer are fluvial deposits 2km north east of the site associated with the River Wheelock.

It is acknowledged that the halite and gypsum beds within the Mercia Mudstone Group have the potential to contain water, but this water is unlikely to be present in significant quantities due to the nature of the deposits, and is likely to be highly mineralised to the extent where use of the water is impossible.

The permeability of the quaternary clays has been determined on 15 samples prior to the development of Phase 2 and has been found to be less than $6x10^{-10}$m/s. A thin sand horizon has been identified in boreholes drilled in 2003 at a depth of around 19mbgl. This sand, which has been conservatively assumed to be laterally extensive, was water bearing but recharged only slowly which may indicate a limited lateral extent or zero recharge.

The installation does not lie within any source protection zones. The Environment Agency has confirmed that there are no licensed groundwater abstractions within 3km of the application site and Crewe and Nantwich Borough Council has confirmed that they have no records of any private water supplies within 3km of the site.

3.5.2 Groundwater Flow and Elevation

Monitoring boreholes have been installed around the site as indicated in Drawing ESID 11, and water is found in these due to the saturated nature of the low permeability clays. The boreholes logs are reproduced in Appendix ESID 8.

Hydrographs are enclosed in Appendix ESID 10 showing the elevation of the water surface within these boreholes. Examination of the data detailed above indicates that there is limited variation in levels. Further consideration of the data, and previous data obtained from dipping of gas wells, indicate a strong correlation between ground elevation and groundwater level, which suggests a true groundwater flow system is not present within the clay. This agrees with the geological information and the permeability testing discussed above which suggests the site is underlain by very low permeability clays which act as a geological barrier. More recent wells have confirmed the presence of a thin sand horizon at depth which contains groundwater. Groundwater contours drawn based on water levels measured within these boreholes are shown in Drawing ESID 11 and indicate that groundwater flow in this horizon is towards the north of the site.

3.5.3 Groundwater Quality

Water quality has been determined at regular intervals on samples from four monitoring boreholes (GW 1 – 4) installed within the clay around the perimeter of the site, as indicated on Drawing ESID 11. A single sampling round for the recently installed boreholes, GW 5 – 8 which are completed in sand, has also been completed. Samples are analysed for a range of determinands, as listed below:

1) Monthly for:

Field pH, electrical conductivity and temperature; laboratory pH, electrical conductivity, chloride, ammoniacal nitrogen, dissolved oxygen, chloride and chemical oxygen demand.

2) Quarterly for:

In addition to the monthly suite: biological oxygen demand, total organic carbon, potassium, total sulphur, magnesium, sodium, iron, total oxidised nitrogen, alkalinity, nickel, chromium, cadmium, vanadium, copper, lead, manganese and zinc.

Boreholes advanced into a sand horizon at depth below the site during 2003 have been sampled for the range of parameters detailed above and for List I substances. The results are presented in Appendix ESID 11. This sampling exercise indicates that there are no discernable concentrations of organic List I substances in the groundwater beneath the site but that cadmium is discernable in two of the boreholes (GW06, upstream and GW05, downstream) with a concentration of 1µg/l. Elevated levels of chloride, sulphate, iron and manganese and ammoniacal nitrogen are present in all boreholes at the site and therefore it is concluded that the landfill is not the source of these elevated concentrations as they are present upstream of the landfill.

3.6 Off-site Landfill Gas Monitoring

Landfill gas concentrations have been monitored at regular intervals in boreholes installed around the perimeter of the installation as illustrated in Drawing ESID 8. The data are summarised in Table ESID 8 below.

Review of Table ESID 8 indicates that:

- During the review period 1st August 2001 to 31st January 2003, all but two of the boreholes recorded methane concentrations below the 1%v/v trigger value suggested by Waste Management Paper 27.

- The highest methane concentrations were recorded in BH3 (14.1%) in the southwest of the site and BH4.02 (1.3%) in the southwest of the site. The highest average concentration was recorded in BH3 (0.595%), and in all of the other boreholes average concentrations were at least an order of magnitude lower.

- Carbon dioxide concentrations exceeded the Waste Management Paper 27 trigger level of 1.5% in approximately 50% of the boreholes. The highest concentrations (in excess of 10%) were recorded at boreholes BH3 (15.4%) and BH4.02 (20.8%). These elevated concentrations may be due to soil gas as similarly elevated methane concentrations are not observed.

The concentrations of the methane detected in perimeter gas monitoring boreholes indicate the sidewall lining system is working well and preventing landfill gas from escaping to the surrounding environment.

TABLE ESID 8: SUMMARY OF PERIMETER BOREHOLE LANDFILL GAS DATA

Borehole	No of Samples	Methane Concentration (%v/v)			No of Breaches of Trigger Value	Carbon Dioxide Concentration (%v/v)			No of Breaches of Trigger Value
		Min	Average	Max		Min	Average	Max	
BH01.00	18	0	0	0	0	0	0.283	4.9	1
BH02.00	18	0	0.017	0.3	0	0	1.267	7.4	5
BH03.00	74	0	0.595	14.1	8	0	1.938	15.4	31
BH03.01	68	0	0.012	0.6	0	0	1.884	7.5	35
BH03.02	43	0	0.005	0.2	0	0	0.621	2.5	5
BH04.00	73	0	0.003	0.1	0	0	0.241	7.4	2
BH04.01	71	0	0.003	0.2	0	0	1.42	4.7	28
BH04.02	51	0	0.069	1.3	1	0	10.35	20.8	44
BH05.00	17	0	0	0	0	0	0.259	1	0
BH06.00	17	0	0	0	0	0	0.129	0.4	0
BH07.00	17	0	0.012	0.1	0	0	0.176	1	0
BH08.00	17	0	0.018	0.1	0	0	0.412	0.9	0
BH09.00	14	0	0	0	0	0	0.436	1.8	1
BH10.00	16	0	0	0	0	0	1.056	2.8	2
BH11.00	15	0	0.013	0.1	0	0	0.427	1.8	1
BH12.00	17	0	0	0	0	0	0.835	5.6	3
BH13.00	17	0	0.006	0.1	0	0	0.535	2.6	1
BH14.00	17	0	0	0	0	0.2	0.941	2.4	2
BH15.00	16	0	0.031	0.3	0	0.1	0.741	1.8	2
BH16.00	17	0	0.006	0.1	0	0.2	0.782	2.8	1
BH17.00	15	0	0.007	0.1	0	0	0.98	5.4	2
BH18.00	17	0	0.041	0.2	0	0	0.512	2.1	2
BH22.00	17	0	0	0	0	0	0.2	1.3	0
BH23.00	17	0	0	0	0	0	0.035	0.4	0
BH24.00	17	0	0	0	0	0	0.112	0.4	0
BH25.00	17	0	0	0	0	0	0.324	2.1	1
BH26.00	15	0	0	0	0	0	0.3	1.3	0
BH27.00	17	0	0	0	0	0	1.029	4.1	4
BH28.00	12	0	0	0	0	0	1.075	4.4	3
BH29.00	9	0	0	0	0	0	0.067	0.4	0
BH30.00	17	0	0	0	0	0	0.012	0.1	0
BH31.00	17	0	0	0	0	0	0.059	0.6	0
BH32.00	17	0	0	0	0	0	0.082	0.6	0
BH33.00	17	0	0	0	0	0	0.041	0.4	0
BH34.00	17	0	0	0	0	0	0.312	2	1
BH35.00	17	0	0	0	0	0	0.024	0.1	0

Notes:
1. Data supplied by WRG
2. Trigger Values – Methane : 1%v/v, Carbon Dioxide: 1.5%v/v

3.7 Receptors and Compliance Points

Drawing ESID 13 indicates the receptors and compliance points to be used in the detailed risk assessments enclosed with the PPC Application, and are detailed within this section.

Hydrogeological Risk Assessment

As detailed in Section 3.5 there is no groundwater receptor that can easily be impacted by the proposed installation due to the low permeability of the surrounding drift and solid geology which acts as a geological barrier. It is therefore concluded that the appropriate compliance points for both List I and List II substances are the sand horizon beneath and downstream of the site respectively. In practice the compliance points for both List I and II substances will be the downstream boreholes that penetrate the sand. The Fowle Brook is the closest surface water feature and is therefore selected as the primary surface water receptor. In addition, the nearest constituent part of the Sandbach Flashes SSSI (Groby's Flash) is also selected as a receptor for the risk assessment due to its potentially enhanced sensitivity.

Landfill Gas Risk Assessment

The assessment of the risk presented by landfill gas must consider both the possible health and explosion risks presented to local receptors and the risk presented to the global environment due to the escape of harmful or greenhouse gases. The local receptors are indicated on Drawing ESID 13 and are detailed below.

Representative local landfill gas receptors have been selected based on proximity to the installation boundary, as in the absence of any identified preferential subsurface pathways, either natural or anthropogenic; no preferential receptors can be identified. The proposed installation is surrounded by agricultural land on all sides and as such the receptors are farm houses. The risk presented to the nearby town of Crewe will be assessed at Windy Nook Farm, the closest residential property to the landfill in that direction. The receptors for the Landfill Gas Risk Assessment are detailed in Table ESID 9.

TABLE ESID 9: LANDFILL GAS RECEPTORS

Receptor	Receptor Type	Distance & Direction from the Gas Utilisation Plant	Distance & Direction from Centre of Site	Distance & Direction from the Boundary of Nearest Cell
Cattle Arch Farm	Allotment	250m SSW	625m S	75m S
Works	Industrial	550m WNW	425m WSW	75m W
Acton House Farm	Allotment	800m NW	500m WNW	150m W
Brook House Farm	Allotment	275m E	537m SE	250m E
Meadow Croft Cottage	Residential	150m SSE	587m SSE	137m SE
Windy Nook	Allotment	425m WSW	625m SSW	125m W
Railway Farm	Allotment	1525m NNE	1250m NE	775m NE
Bottoms Farm	Allotment	1700m NNW	1275m N	775m N
Oaktree Farm	Allotment	1450m NW	1050m NW	600m NW
Perimeter Footpath	N/A	825m NNE	500m NNE	25m NE
Sandbach Flashes SSSI	N/A	900m N	650m NNE	25m NW

Nuisance and Health Risk Assessment

Appropriate receptors for the nuisance and health risk assessment are identified in Table ESID 1 and illustrated on Drawing ESID 13. An assessment of the potential impact of nuisance features on the neighbouring SSSI is detailed within the nuisance and health risk assessment.

Habitats Risk Assessment

There are no European Wildlife Sites within 5km of the installation and therefore no habitats risk assessment is required.

4.0 SITE REPORT

4.1 Introduction and Background Information

The details of the installation and its setting are given in Section 1.2, with the proposed development being detailed in Section 1.2, 2.1 and 2.2.

Table ESID 2 summarises the historic development of the site and does not indicate the presence of any potentially contaminating activities at the site except for the factory unit in the west of the application site which has been used as a manure works and a meat processing plant. It is noted that as part of the development a significant thickness of clay has been excavated from this area and therefore any contamination associated with this facility will not now be *in situ.* Table ESID 9 summarises the historical development of the surrounding area,

TABLE ESID 10: HISTORICAL DEVELOPMENT OF THE SURROUNDING LAND

DATE	DESCRIPTION	SOURCE
1909 & 1910	Surrounding land is primarily agricultural with four farms around the north and western perimeter, and the hamlet of Maw Green to the south. Site is bounded to the east by the Crewe-Manchester railway line. A brick and pipe works is shown 250m south of Groby Farm on the western perimeter of what is now the site. A lake appears 750m east of Oaktree Farm. Groby Fox Covert (small wooded area) is located 420m south west of Oaktree Farm. Marshy ground appears on the east side of Groby Fox Covert.	OS County Series, 1:2,500 scale
1911	Hospital for infectious diseases appears 1km to the south west of site. Hall O'Shaw Brickworks lies 1km south of site.	OS County Series, 1:10,560 scale
1938	No changes affecting the site are recorded.	OS County Series, 1:10,560 scale
1954	Area to the south west of Maw Green is beginning to be developed for urban use, marked as Copenhall.	OS National Grid Series, 1:10,560 scale
1959	Castle Arch Farm has appeared 200m south of site	OS National Grid Series, 1:2,500 scale
1968	Area to the south west of Maw Green is now recorded as fully developed as an area of housing. 500m north of site a series of lakes have appeared. Foden Farm and 'works' have appeared 200m west of site. Acton House has appeared 100m south of Groby Farm on the western site boundary.	OS National Grid Series, 1:10,560 scale
1979 & 1990	Nothing new affecting the site.	OS National Grid Series, 1:10,000 scale OS Plan
1992	North of site 800m a refuse tip has appeared. The lakes/standing water bodies to the north and north-east of site have changed in shape slightly and have grown.	OS National Grid Series, 1:10,000 scale OS Plan

The historical mapping data indicates that there are no significant off-site potential sources of contamination with the exception of the "works" site to the west of the area. It is noted that the strata immediately underneath the site is clay and therefore it is considered highly unlikely that any contamination emanating from the "works" would migrate onto the application site.

The geology and hydrogeology of the site are set out within Sections 3.2 and 3.5 respectively.

4.2 Objectives of this Assessment

The main objective of the site report is to establish and assess the presence of land contamination within the development area. The report sets out the "initial" condition of the site, prior to operation under the PPC regime, and allows an effective reference point for future comparison. It provides an assessment of the site, by building upon existing site information, and focusing on the soil, surface water and groundwater conditions and their sensitivity.

The baseline report has been compiled following review of documents 'IPPC Part A (1) Installations: Guide for Applicants, Version 2, December 2000', produced by the Environment Agency, and 'IPPC, A Practical Guide, Edition 2, June 2002', produced by the Department for Environment, Food and Rural Affairs.

4.3 Site Investigation (Data Collection) Details

Site investigations undertaken at the site are detailed within Section 3.5 and have been used to develop the site conceptual model. Samples of groundwater have been taken from boreholes around the site for analysis for List I and List II substances as defined in the Groundwater Regulations 1998. The results of this analysis have been summarised within Section 3.5.2.

Surface water samples have been taken from locations upstream and downstream of the site from the Fowle Brook as part of the routine monitoring of the site. These data have been reported in Section 3.4.1.

4.4 Summary of Site Investigation and Analysis Findings

As noted above no additional potential sources of contamination were identified and therefore no additional site investigation has been carried over and above that designed to confirm the geology and hydrogeology of the site and obtain groundwater samples.

Groundwater samples have been analysed by a NAMAS accredited laboratory and the results are presented in Appendix ESID 11.

The borehole results indicate that there are elevated concentrations of chloride, manganese, iron, sulphate and ammoniacal nitrogen in groundwater both up and downstream of the site. The highest recorded concentrations of these contaminants are detailed in Table ESID 10.

The data indicate that the landfill is not having a detrimental effect on stream water quality but that stream water quality is impacted by upstream activities such that the ammoniacal nitrogen drinking water standard is breached both upstream and downstream of the site.

4.5 Data Interpretation

The data indicate that the landfill is not having a detrimental impact on ground or surface water quality although in both ground and surface water some substances are present above the drinking water standards which have been used as a screening tool in this report. These elevated levels are present both up and down stream of the site and as such it is concluded that the landfill is not the source of these elevated concentrations.

It has only been possible to obtain one sample from each borehole and as such these results should be interpreted with caution and the formal determination of the baseline conditions should be made when a statistically significant data set is available.

4.6 Conclusions

Investigations at the site have indicated that the groundwater and surface water in the vicinity of the site show elevated concentrations of some substances relative to the drinking water standards (or the Environment Agency's Minimum Reporting Value in the case of cadmium). Baseline conditions based on the limited data available to date, utilising boreholes GW06 and 7 are presented below Table ESID 11 but it is recognised that these are based on one monitoring event and the derivation of baseline conditions based on the a statistically significant data set should be subject to an improvement condition.

TABLE ESID 11: INITIAL BASELINE CONDITIONS SUBJECT TO IMPROVEMENT CONDITIONS

Determinand	Maximum Concentration (mg/l)
Antimony	0.003
Arsenic	0.007
Barium	0.047
Beryllium	Not Detected
Boron	0.53
Cadmium	0.001
Calcium	510
Chromium	Not Detected
Cobalt	Not Detected
Copper	Not Detected
Iron	0.08
Lead	0
Magnesium	129
Manganese	1.52
Mercury	0.0001
Molybdenum	Not Detected
Nickel	Not Detected
Potassium	7.7
Selenium	Not Detected
Silver	Not Detected
Sodium	383
Tellurium	0.001
Thallium	Not Detected
Tin ,	Not Detected
Vanadium	0.022
Zinc	0.034
Fluoride	0.2
Ammoniacal Nitrogen	0.6
Chloride	333
Nitrate	0.3
Total Inorganic Phosphorus	257
Sulphate	1920
Cyanide	Not Detected

Note: Based on single monitoring round and therefore should be revised based on statistically significant data set

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