ASPALL IED BASELINE REPORT

On behalf of Aspall Cyder Limited

JER1722
Aspall IED Baseline report
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1 INTRODUCTION

1.1 Background

1.1.1 Aspall Cyder Limited (ACL) operate a food and drink manufacturing site in Aspall, Suffolk. The facility is located north of the village of Debenham on the top of a hill, adjacent to a moat circling the large listed house of the previous owner of the site. Operations at the site have been historically taken place from the 18th century without the need for an Environmental Permit. Following the purchase of the company by Molson Coors Brewing Company (MCBC) an investment programme was implemented at the site involving facility improvements and modernisation. The site will therefore have a potential capacity to produce in more than 300 tonnes/day. Aspall Cyder Limited is therefore applying for an installation environmental permit.

1.1.2 As part of the Environmental Permit application, ACL will submit additional information regarding the baseline report under Article 22(2) of Directive 2010/75/EU on industrial emissions (hereinafter referred to as the IED). ACL is required to undertake the following:

- Identify if any of the substances used on site are classified as hazardous under Directive 2010/75/EU on industrial emissions;
- If Hazardous substances are present and having regard to the possibility of soil and groundwater contamination a baseline report will need to be submitted Article 22(2) specifies that a baseline report should contain at least the following information:
- Information on the present use and where available on past uses of the site
- Where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or alternatively new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced, released by the installation concerned.

1.1.3 ACL appointed RPS to undertake the IED reporting pursuant to Annex 1 of Directive 2010/75/EU on industrial emissions defining those activities that fall under the remit of the IED.

1.2 Legislative and Regulatory Framework

1.2.1 The Environmental Permitting (England and Wales) Regulations 2010 and its Amendment (2014) implementing the Directive 2010/75/EU on industrial emissions define those activities that fall under the remit of the IED. The facility operated by ACL is therefore regulated by the Environment Agency and subject to the IED on the following basis:

SCHEDULE 1 Activities, installations and mobile plant

PART 2 Activities

CHAPTER 6 Other Activities

SECTION 6.8 The Treatment of Animal and Vegetable Matter and Food Industries […]

Part A(1) […]

(d) Treating and processing materials intended for the production of food products from— […]

(ii) vegetable raw materials at a plant or in a small waste incineration plant, where the plant or small waste incineration plant has a finished product production capacity of more than 300 tonnes per day (average value on a quarterly basis).

1.2.2 Article 22 of the IED relates to site closure and Article 22(2) states that:

Where an *"activity involves the use, production or release of **relevant hazardous substances** and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a **baseline report** before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013*"

1.2.3 A baseline report means information on the state of soil and groundwater contamination by relevant hazardous substances. As an operational facility, ACL are required to submit a baseline report as they are applying for a new permit after 7 January 2013. The content and approach for delivery of a Baseline Report is described in EU Guidance (referred to as "Communication 2014/C136/03" hereinafter) and involves the eight-stage approach outlined below:

- Stage 1 - Identify hazardous substances used, produced or released at the installation;
- Stage 2 - Identify relevant hazardous substances used, produced or released at the installation from the list of hazardous substances identified in Stage 1;
- Stage 3 – Undertake an assessment of site-specific pollution possibility for relevant hazardous substances;
- Stage 4 – Evaluation of Site History and potential for relevant hazardous substances to be present in soils and groundwater;
- Stage 5 – Evaluation of Environmental Setting to determine the fate of potential emissions of relevant hazardous substances;
- Stage 6 – Site Characterisation that synthesises findings of Stage 5 and 6 on the basis of a Conceptual Site Model;
- Stage 7 – Site Investigation (including sampling strategy)
- Stage 8 – Production of Baseline Report

1.3 Objective

1.3.1 This IED Baseline Report for soil and groundwater builds on that work to deliver Stage 1 to Stage 8 inclusive. The principal objective for this report is to determine whether an intrusive investigation is required to meet the requirements of Article 22(2) of the IED and define the scope for those works should they be required for agreement with the Environment Agency.

1.3.2 To fulfil that objective the following approach has been adopted:

- Evaluation of local site history and expected / known contamination status with respect to soil and groundwater;
- Determine which hazardous substance used, produced or emitted on the ACL Facility constitute Relevant Hazardous Substances (RHS);
- Development of a conceptual model for the facility that considers the interrelationship between the site operations, soils, groundwater and other environmental receptors;
- Delivery of an assessment of site-specific pollution potential of RHS on the basis of the activities and procedures undertaken on the facility; and
- Review of soil and groundwater dataset available for the site, with respect to RHS with a significant site-specific pollution potential and their likely presence as a result of historical activities undertaken on, or near, the site.

1.3.3 RHS are determined from a review of all hazardous substances used, produced and released on the ACL facility, that considers the volumes used, storage, usage and general handling processes.

1.3.4 This report shall pay due regard to the following key industry guidance documents for Food and Drink Industries:

- European Commission BREF working draft in progress document (Final Draft) adopted in October 2018. Best Available Techniques (BAT) Reference Document in the Food, Drink and Milk Industries; and
- The UK Sector Guidance Note EPR 6.10 - March 2009 derived from this BREF and additional guidance for Part A(1) activities listed in Schedule 1 of the Environmental Permitting Regulations.

1.3.5 The site conceptual model shall be developed in accordance with the framework outlined in relevant regulatory guidance for the UK contaminated land regime, most notably The Model Procedures for the Management of Land Contamination (CLR 11) and Remedial Targets Methodology: Hydrogeological risk Assessment for Land Contamination (EA, 2006).

1.3.6 The site-specific pollution potential shall be determined on the basis of the qualitative approach outlined in Section 4.

1.4 Historical Reporting & Limitations

1.4.1 The baseline report presented here is based on an understanding of the site and its setting as defined in the following historical reporting:

- Desk Study Appraisal of Aspall Cyder House. Ref JER1447. Dated July 2018. Issue 1 (RPS, 2018a);
- Factual Report on Ground Investigation, Aspall Cyder House. Dated October 2018. Issue 1. (RPS, 2018b);
- Aspall Cyder House Geoenvironmental Report. Dated January 2019. Final (RPS, 2019)

1.4.2 A site visit was undertaken on the 19th June 2018 in advance of the intrusive site investigation to establish potential areas of contamination from current operational activities and provide recommendation on the nature and spatial distribution of intrusive monitoring locations.

1.5 Report Structure

1.5.1 The subsequent report structure is as follows:

- Section 2: Site Setting – Provides a description of the MCBL facility, operations thereon and site history. A review of the site setting is also provided, and the baseline ground conditions and contamination of the site is reviewed.
- Section 3: Environmental Setting – provides a summary of the environmental setting of that facility and presents the conceptual Hydrogeological Model for the MCBL site.
- Section 4: Assessment of Relevant Hazardous Substances: Provides the assessment of all substances used produced and emitted from the MCBL facility, in accordance with appropriate guidance. This section defines those RHS considered to have a site-specific pollution potential that require consideration with regards to the baseline quality on the site.
- Section 5: Proposed Baseline Characterisation Works – provides a summary of the scope of additional characterisation woks required to the inform the baseline report.
- Section 6: Detailed summary of the ground investigation results and baseline quality dataset.
- Section 7: Summary and Conclusion of the report and proposed additional or on-going monitoring recommendations.

2 SITE SETTING

2.1 Site Location

2.1.1 The Site lies approximately 2 km north of Debenham on the Aspall Road (B1077) and has been occupied since 1702 by the Chevallier family; being developed into a cyder and vinegar manufacturing site in 1728. As shown on Drawing Ref JER1722-IED-001, the Site location plan and Site boundary plan consist in two distinct operational areas.

2.2 Site Land-Use & Operation

Current Site Land-Use

General Land-Use

2.2.1 The Site currently comprises a pressing building with the old cyder house, a tank farm, an effluent treatment plant, a packaging building, an engineering building, a vinegar production area, an office building to the North West. A warehouse and a staff car park are access to the right of the entrance currently provided off the adjacent B1077. Most of the ground between buildings is covered with hardstanding comprising concrete or access roads, with grassed surfaces in the western most and north-eastern extents.

Permitting Status

2.2.2 The Site activity is currently not requiring a permit although the current programme of modernisation and improvements has initiated discussion with the Environment Agency. The process water trade discharge is currently authorised through discharge consent for Aspall Cyder Limited.

Buildings and Structures

2.2.3 Site areas and activities relevant to the permitted activities are listed in Table 2.1 below.

Table 2.1: Site areas, Activities and Sources of Contamination

Activity / Source of Contamination		Contaminants of Concern (Hazard)
Press Hall	Reception of fruits, press and sterilization / Pasteurisation Wash-water released through tank, pipe works to Effluent Treatment Plant (ETP), Clean In Place (CIP).	BOD, pesticides, fungicides
Fermentation Farm Tank	Holding tanks for products Tanks failure, leakage	Products
Packaging Hall	Cyder (Cider), vinegar and fruit juice Packaging CIP system leakage, packaging line drainage system to ETP, Foul effluent from canteen	Products, caustic, phosphoric acid
Vinegar Processing Hall	Product and CIP Tank failure, leakage	Products
Vinegar Storage Farm Tank	Holding tanks for products Tank failure, leakage	Products
Boiler House and Fuel Tanks	Energy generation on Site Tank failure	Oil products
Cleaning-In-Place / Fermentation	Holding tanks for products and CIP	Products, CIP
Effluent Treatment Plant	All liquid waste effluent generated on Site	Mixture (typically high organic load)
Laboratory	QA check of product and chemicals for testing	Products, Chemicals for undertaking analysis

Activity / Source of Contamination		Contaminants of Concern (Hazard)
Engineering	Repair of engine and materials	Oil products
Warehouse	All goods stored Toilet effluent	Products, Foul effluent
Agricultural Store	Currently used as equipment storage but may become on-site shop	Oils products
Chemical Stores	All CIP and solvents stored Leakage of containers	CIP chemicals

Principal Processes and Infrastructures

2.2.4 Aspall cyder is a brewery site with associated aseptic, fermenting, effluent treatment and packaging for cider and vinegar manufacturing activities. The Site receives apples and concentrated apple juice. The apples are washed, graded, crushed and pressed to produce apple juice which is then further processed on-site to produce high quality vinegar and cider products.

2.2.5 The press area incorporates the intake of apples, their pressing to create juice and the aseptic packing of apple juice into 1 tonne combi's or tankers. The juice is used as an ingredient in producing cyder or vinegar. The juice is pasteurised, and storage of juice allows year-round cyder and vinegar production despite the apple harvesting and pressing season being only approximately 6 months between September and January. Waste pomace is removed from the press through a dedicated disposal line and discharges externally into an open topped 25 tonne trailer.

2.2.6 Additions are added to the fermentation vessel, this is primarily a yeast addition to start the fermentation process and is manually weighed and dosed by the operator into the vessel prior to the fill commencing. Temperature is a critical parameter in the fermentation process, not all fermentation vessels currently have chilling available but the upgrades being made in this area will increase chilling ability with glycol jackets and temperature monitoring, allowing for more efficient fermentation and minimised product wastage.

2.2.7 Once fermentation is complete the liquid is to be transferred to a cyder storage tank. This finished cyder is stored in finished cyder tanks from where it can be loaded into a tanker or kept ready for transfer to packaging into either kegs or bottles.

2.2.8 Yeast and other solids will have naturally settled to the bottom of the vessel and so connection points at different heights are used to connect a flexible hose and pump liquid, through a flow meter control, into the storage vessel. The collective solids known as lees are left in the base of the fermentation vessel before being transferred through a tank bottom connection to a dedicated waste lees tank. These are collected by tanker and sent for waste recovery at an AD plant.

2.2.9 The vinegar processing area incorporates the delivery and blending of purchased malt, red wine and white wine vinegar as well as the acetification of cyders to create cyder vinegars. When required the cyder is transferred from the charge tank into one of the vinegar fermenters (1 x 12k litres, 2 x 6k litres). The vinegar fermenters are used to convert the cyder into cyder vinegar. Cyder (10% – 12% alcohol) is placed into the vinegar fermenter and is subject to a bacterial fermentation. Fermentation is controlled with the application of filtered diffused air and temperature control. The vinegars created in this area are either packaged in bulk containers within the area or pumped to the bottling area for further packaging.

2.2.10 The bottling area incorporates the bottling of both cyders and vinegars into a variety of glass bottles. The bottling lines have one common infeed and then the line splits into two fillers before converging again at the secondary packaging stage. The bottles are delivered just in time, filled through one of two fillers and then when palletised are loaded onto a stand trailer ahead of dispatch to a third-party warehouse or later distribution or sent directly to the end customer. The bottling area operates 24 hours 5 days a week across the year. Due to the line set up only vinegar or cider can be run at any one time.

2.2.11 The bottles of cyder / vinegar are conveyed through a series of line-controlled conveyors to the multi pack case erector. When full pallets are produced they are moved over to a pallet wrapping machine where an outer wrapping in applied to the pallets to restrict movement. The pallets are then moved to an air lock via an electric pallet truck. Completed pallets are then removed from the air lock via fork lift truck and placed onto a standard trailer. When full trailers are completed they are removed from Site by a third-party warehouse and distribution company.

2.2.12 Site operates a 3.16 MW steam boiler installed in 2015. The boiler is fired solely on gas oil stored in a 32 m^3 double skinned fuel tank. Other smaller fuel tanks are present on the Site for heating, electricity and forklift truck.

2.2.13 The effluent treatment plant (ETP) is currently being upgraded and discharge permit is being sought as part of the Site Environmental Permit.

Site Drainage

2.2.14 The Site lies at the head of the River Deben catchment in The Gulls sub-catchment. The Site is located on a plateau at approximately 55-57 metres Above Ordnance Datum (mAOD) and bordered by a valley 150 m to the North, flowing west along New Road towards Red House Farm cottage and then South East towards Toll Gate Cottage along Aspall Road (B1077) and then South to Debenham.

2.2.15 Drawing JER1447-ESS-001 presents the hydrology of the surroundings in more details. Drains on the edge of the Site's boundary on the plateau direct waters generated on Site to the northern side of Aspall Wood to a gated lock. An underground drain connects the lock to the valley of The Gulls. Not on the drawing, two road drains splitting surface water run-off from the Site are located to the West alongside the B1077 and direct flow to the north, north of the Site entrance; and to the south, south of the Site entrance.

2.2.16 Despite often having a dry river bed in summer, in times of high rainfall, the River Deben at Debenham village with its restricted river capacity running through its midst cannot cope with a sudden deluge from the watershed and so floods, submerging residential properties, businesses and renders some streets and local roads impassable.

2.2.17 Flood risks have been studied by the Environment Agency and relate to downstream flooding of the village of Debenham. The impacts of potential storage have been modelled on The Gulls (JBA Consulting, 2014) and mitigation measures have been implemented at three locations including at Aspall Hall. It is thought this relates to the lock which can be operated and store a part of the catchment but also any Site discharge if required.

Historical Site Land-Use

2.2.18 The following account of the history of the Site identifying historic land uses is based upon historic maps provided by Landmark and presented in the Desk Study Appraisal report (RPS, 2018a).

2.2.19 The site has been occupied since 1702 by the Chevallier family and developed into a cyder/cider and vinegar manufacturing site since 1728.

2.2.20 The initial production took place in two small buildings still present on site. The manufacturing facility has expanded over the years and production significantly increased in 1971 and 1989. Historic maps and aerial photography demonstrate the expansion of the activity with new areas and buildings moving northward from the Lodge in the South corner and the Cyder House.

2.2.21 A large pond, 50 m long, historically to the North of the site has its size regularly reduced over time. The RPS site visit in June 2018 confirmed the remnant of the pond that was still visible during the May 2016 Audit Site Visit.

2.2.22 A smaller rectangular pond, c. 15 m long and 10 m wide, historically North of the lodge and currently adjacent to the Engineering Hall still remains on the Site, although also reduced in size as shown on historical photos.

2.2.23 The current location of the warehouse and agricultural store to the south of the Site replaced an orchards area.

Surrounding Land-Use

Current

2.2.24 Current land-use surrounding the site is agricultural with either cereal fields or orchards and woods.

2.2.25 The Aspall Hall, a grade II* listed building with a moat surrounding the Hall sits adjacent to the Site to the East.

Historical

2.2.26 Historical land-use surrounding the site is agricultural with either plain wheat fields or orchards and woods.

2.2.27 The Aspall Hall doesn’t seem to have been subject to any significant modifications or extensions.

3 ENVIRONMENTAL SETTING

3.1 Topography and Hydrology

3.1.1 The Site lies at the head of the River Deben catchment in The Gulls sub-catchment. The site is located on a plateau at approximately 55-57 mAOD and bordered by a valley 150 m to the North, flowing west along New Road towards Red House Farm cottage and then South East towards Toll Gate Cottage along Aspall Road and then South to Debenham.

3.1.2 Drawing JER1447-ESS-001 presents the hydrology of the site in more details.

3.1.3 The catchment of the River Deben upstream of Brandeston Bridge (GB105035046200) is a heavily modified waterbody with moderate overall status (2016) due to moderate ecological classification.

3.1.4 The Site lies within surface water and groundwater designated Nitrate Vulnerable Zone (respectively identification number S419 and G78).

3.2 Geology

Regional Geology

3.2.1 The local and regional geology as shown on available British Geological Survey (BGS) maps (sheet 190 Eye at 1:50,000) indicate in the immediate vicinity of the site the superficial geology as Lowestoft Formation with Diamicton and sand and gravel and the solid geology as sand of the Crag Group. Drawings JER1447-ESS-002 presents a summary of BGS data in the immediate vicinity of the site.

3.2.2 Large faults on both side of the Site orientated South-West to North-East are represented on the geological map at a distance of approximately 1-2 km and could affect the White Chalk and locally the Crag formation thickness.

3.2.3 Geological hazards with regards to compressible ground, dissolution landslide, running sand, shrinking or swelling stability were described by the BGS as non-existent to very low.

Site-specific Geology

3.2.4 The Site geology has been adequately defined through the site investigation undertaken in August 2018.

3.2.5 The results of the site investigation are indicative of the local geology with general horizontal units with no significant evidence of faults or structural deformation.

3.2.6 The results of the site investigation indicate Made Ground at varying depths across the Site ranging between 0.25 m (min) – 2.60 m (max) deep across the site comprising of generally brick, concrete, ash, flint and wood. The base of the Made Ground lies at a typical elevation of 56 mAOD but ranging from 54.50 mAOD where water features, the ponds, have been historically located to 59.40 mAOD on the Eastern edge of the Site at a local high point.

3.2.7 The Made Ground overlies a thick layer of Superficial Deposits of the Lowestoft Formation (Diamicton sands and gravels) proven up to 18.95 m thick. The Lowestoft Formation is composed of generally stiff sandy gravelly clay with gravels and occasional cobbles. Gravel is usually angular to sub angular fine to medium flint and chalk.

3.2.8 The last 2 m of the base of the Lowestoft Formation becomes interbedded with fine to coarse sand marking the transition to the Crag Group. The base of the Lowestoft Formation lies typically at an elevation of between 37.34 mAOD to 40.50 mAOD.

3.2.9 The Crag Group bedrock is below the Lowestoft formation site with proven thickness between 14.5 m to 18.95 m. The Crag Group was generally recovered as dense brown slightly clayey gravelly fine to coarse sand with gravels.

3.3 Hydrogeology

3.3.1 Groundwater body present under the Site include the Waveney and East Suffolk Chalk & Crag (GB40501G400600) with an overall water body designation as poor due to poor quantitative and qualitative status. The main pressures identified by the Environment Agency (EA) have been associated with agriculture and rural land management.

3.3.2 The groundwater vulnerability based on the 1:100,000 East Suffolk hydrogeological map indicates soils of low leaching potential. Pollutants are unlikely to penetrate these soils because water movement is largely horizontal, or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contributes to groundwater recharge elsewhere in the catchment.

3.3.3 Three active licensed and private groundwater abstractions have been recorded within 2 km of the site and sites holding a licence are listed below:

- J. Haddow (7/35/06/*G/0023) bore at Blood Hall, Debenham from the Chalk / Perpetual licence at 1,196 m from Site.
- O.H. and J.F. Knowland (7/35/06/*g/099) borehole at Hill Farm from the Chalk / Perpetual licence at 1,897 m from Site.
- A.A. Owen (7/35/06/*G/0116) borehole At Hill Farm, Debenham from the Chalk / Perpetual licence at 1,900 m from Site.

3.3.4 Regional groundwater contours from the Southern East Anglia hydrogeological map only provides groundwater elevation in the Chalk for August / September 1976. The groundwater levels under the site in the Chalk and Crag were estimated at 30 mAOD.

3.3.5 The hydrogeological map indicates the Boulder Clay has the potential to yield little water from sandy layers.

3.3.6 A water strike encountered within the Crag Group at 34.45 mAOD and at 36.40 mAOD after 20 mins during drilling (13/08/2018) at BH-01-EP was not found during the sampling round 8 days later (21/08/2018). Small amount of water seepage was identified in two of the trial pits and in one window sample within the upper Lowestoft Formation. The groundwater present in the made ground is found at an elevation of 55 mAOD consistent with the base of the Made Ground.

3.3.7 The site investigation provided evidence of deep groundwater within the Crag Group. Similarly, the presence of shallow or perched groundwater within the upper geological formation, i.e. Boulder Clay / Lowestoft Formation, has been identified although its extent and capacity to be defined as an aquifer remains to be determined.

3.3.8 The site lies within a Zone 3 Total catchment Source Protection Zone (SPZ).

3.4 Environmental Receptors

3.4.1 An ancient woodland (Aspall Wood) is recorded immediately southeast of the Site.

3.4.2 The nearest and only statutory land-based designations identified comprise Mickfield Meadow Site of Special Scientific Interest (SSSI) at a distance of 3.4 km and the site therefore lies just outside of the Impact Risk Zones.

3.4.3 The bedrock geology – the Crag Group – is classed as Principal and Secondary aquifer and the groundwater vulnerability is classified as being high within major and minor aquifers.

3.5 Conceptual Hydrogeological Model

3.5.1 A conceptual Hydrogeological model (CHM) has been developed to identify potential pathways for pollutants and identify potential receptors.

3.5.2 The published geology of the area and ground investigations at the site have indicated that the site is underlain by Made Ground, which overlies a thick layer of Superficial Deposits of the Lowestoft Formation (Diamicton sands and gravels) on top of the Crag bedrock, a dense brown slightly clayey gravelly fine to coarse sand with gravels. The bedrock is classified as primary aquifer of high productivity. The geology is summarised in Table 3.1 below.

Table 3.1: Geology and Hydrogeology Summary

Strata	Description	Observed Thickness (m)	Typical base depth (mAOD)
Topsoil as alluvium / Peat bands	Typically recovered as soft to stiff greyish brown to black silly pseudofibrous peat identified in WS-GT-04 and WS-SC-11 only.	0.2 – 0.7	57.0
Made Ground	Soft brown sandy gravelly clay with ash and some cobbles of flint, whole brick and concrete. Observed as heterogeneous with some areas comprising clayey sandy gravels.	0 – 2.5	56.0
Superficial Deposits - Lowestoft Formation	Diamicton – glacial deposits Lowestoft Formation forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. Potential presence of groundwater acting as a pathway to deeper geological formation or directly connected to surface water network. The site investigation described the materials from this formation as typically soft to firm grading too stiff from 4.0 m. Brown to orange brown slightly gravelly very sandy clay. Gravels comprise angular to sub angular fine to medium flint clasts. Infrequent bands of soft grey clays and cobbles present.	14.5 – 17.3	39.0 – 40.0
Crag Group	A suite of shallow-water marine and estuarine sands, gravels, silts and clays deposited on the southwest flank of the North Sea Basin with flints. The sands are characteristically dark green from glauconite. Likely to be supporting winter base flow of local surface water streams, the Gulls and potentially dry in the summer. Only the upper part of the Formation was seen and recovered as medium dense to dense light brown to brown clayey sandy gravel of angular to sub angular flint and occasional chalk.	> 5.0m	NA

3.5.3 Localised perched groundwater was identified underneath the site during the 2018 site investigation in the made ground. There is no indication of vertical flow from the groundwater in the made ground to the underlying Crag aquifer due to the significant thickness (c. 20 m thick) of the Lowestoft Formation.

3.5.4 Groundwater was observed seeping during the intrusive investigation within the Lowestoft Formation between 2 and 2.1 m BGL, in 2 no. locations at TP01 and TP06 and at 5.0 m BGL at WS-SC-08. TP01 and TP06 are near the moat and local description of 0.2 to 0.3m bands of more sandy materials is likely to contain enable a limited flow when disturbed.

3.5.5 The only observed groundwater raising within constructed borehole is at BH-EP-01 where groundwater was observed at a depth of 22.5 mBGL raising to 20.5 mBGL placing groundwater level in the Crag Group at approximately 35 mAOD.

4 ASSESSMENT OF SITE-SPECIFIC POLLUTION POTENTIAL

4.1 General Approach

4.1.1 Communication 2014/C136/03 describes the requirements of Stage 1 to 3 of the baseline report:

- Identification of hazardous substances (HS) used, produced or emitted on the facility;
- Identify which substances constitute Relevant Hazardous Substances (RHS) capable of contaminating soil or groundwater; and
- Identify the possibility for soil or groundwater contamination at the site of the installation.

4.1.2 These three stages are described for the ACL facility below with the detailed assessment provided in the Master Summary Table provided in Appendix A.

4.2 Substance Inventory

4.2.1 Through liaison with ACL all substances used, produced and released on the Site have been identified. A total of 42 substances or mixture of substances were identified for the ACL facility, that were grouped in the following general categories:

- Raw materials (10);
- Ancillary substances (23);
- Potential emissions (4); and
- Wastes (5).

4.2.2 The full list of substances is summarised in the first sub-table in the Master Summary Table provided in Appendix A (See Columns B to F). The Safety Data Sheets for substances used on ACL Facility are provided in Appendix B.

IED Hazardous Substances

4.2.3 For the purpose of an IED baseline report, a Hazardous Substance (HS) mean a substance or a mixture as defined in Article 3 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (herein after referred to as the 'CLP' Regulations).

4.2.4 Of the 42 substances used, produced or emitted on the ACL facility 27 were considered to contain Hazardous Substances on the basis of the CLP Regulations. The full list of Hazardous Substances is summarised in the second sub-table of the Master Summary Table provided in Appendix A (See Columns H to K).

IED Relevant Hazardous Substances

4.2.5 Article 3(18) and Article 22(2) of the IED define Relevant Hazardous Substances (RHS) as those substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on the classification, labelling and pack aging of substances and mixtures (CLP Regulation) which, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater and are used, produced and/or released by the installation. Communication 2014/C136/03 states that those HS that are incapable of contaminating soil or groundwater can be excluded from further consideration, although a justification and record of the decision to exclude a HS is required as per Article 22(2), first subparagraph.

4.2.6 For the purpose of this report a simple screening of HS identified for the facility has been undertaken on the basis of the quantities of the substances used, produced or emitted and the manner of their use and handling on the facility. The evaluation of which substances used, produced or released from the ACL facility constitute an RHS is summarised in the third sub-table in the Master Summary Table provided in Appendix A (See Columns M to N).

4.2.7 A summary of the relevant hazardous substances and the specific Contaminants of Concern associated with those substances is presented in Table 4.1 below.

Table 4.1: Relevant Hazardous Substances and Contaminants of Concern

Relevant Hazardous Substance Used, Produced or Emitted from the ACL Facility		Principal Contaminants of Concern
Ancillary Substances	Pentasan 451	Sodium Hydroxide Sodium Hypochlorite Solution Cl active
Ancillary Substances	Pentasol H15	Sodium Hypochlorite solution Cl active
Ancillary Substances	AM 3 Plus	Orthophosphoric Acid Sodium alkylamine Dicarboxylate
Ancillary Substances	Pentasol Perosan 5	Hydrogen peroxide solution Acetic acid Peracetic acid
Ancillary Substances	TFC 4 Thin Film Cleaner	Sodium Hydroxide Sodium Hypochlorite solution Cl active Sodium Xylene Sulphonate N,N-Dimethyltetradecylamine N-Oxide Alkyl C9-C13 Sulphate, Sodium salt
Ancillary Substances	Nalco 77211	Sodium bisulphite Cobalt sulphate
Ancillary Substances	Pentasol Aquafloc 240	Various alcohols and hydrocarbons
Ancillary Substances	Gasoil	Gas Oil Petroleum Hydrocarbons, some BTEX and PAHs
Emission	Particulates and volatiles from main stack boiler and other generators on site	Combustion products including COx, NOx, SOx, dust, dioxins, furans and water
Emission	Particulates and volatiles from laboratory fume cupboard	Various volatile organic compounds
Waste / Effluent	Waste Oils	Gas Oil Petroleum Hydrocarbons, some BTEX and PAHs
Waste / Effluent	Waste Water Effluent	Metals, organic

4.2.8 Many ancillary substances are used in small quantities, stored in the main warehouse building or within special chemicals cabinet and used internally within the main site buildings. They are not therefore considered to represent RHS used, produced or released from the facility.

4.2.9 A number of chemicals stored in IBCs (1 m^3) and their potential failure (loss of containment) is unlikely to constitute a significant risk in itself due to the Environmental Management System (EMS) in place, the storage conditions on hardstanding and biodegradability of most chemicals present on site.

Risk Matrix for Site-specific Pollution Potential

4.2.10 For each RHS identified in Table 4.1 a risk matrix approach has been developed that considers the likelihood of an accidental release occurring and the likelihood of the soil or groundwater receptor being affected by that release. It must be noted that the risk matrix approach does not consider the likely magnitude / severity of that affect (i.e. in terms of harm) should the release scenario and associated pollutant linkage be realised. It is assumed that the process for the identification of RHS should provide an adequate assessment of whether the quantities of the substance used on the ACL facility have the potential to result in measurable impact on the receptors in question. However, for any RHS where site-specific pollution risk is determined to be greater than low, it may be prudent to evaluate the possible magnitude of that impact should it be realised although this evaluation has not been undertaken as part of the assessment presented herein.

Likelihood of Accidental Release / Emission Occurring

4.2.11 By consideration of the processes each RHS are used in (in terms of storage / handling / use) and measures implemented on the ACL facility that minimise the potential of a release to occur (during routine use or by accidental emission) the likelihood of a release that could potentially affect a receptor is assessed:

- Highly Likely: A routine process involving the RHS that is uncontrolled and the RHS could be readily lost to ground / air / water without mitigation. The nature of handling / storage and absence of mitigation measures makes the potential for an accidental release by the release scenario identified probable.
- Likely: The process involving the RHS or the manner of its handling / storage is by nature is likely to result in a loss to ground, air or water. However, the activity associated with the release scenario include mitigation measures and/or are undertaken in an engineered / designed facility. The condition of equipment and infrastructure (e.g. storage tanks) is poor, cannot be verified or is poorly maintained. There are no control measures and/or associated staff training to mitigate accidental release.
- Unlikely: Owing to the nature of the process and/or characteristics of the RHS release scenario involved a release is considered improbable. The process does not involve the RHS being exposed or used in a high-risk manner (e.g. storage of small quantities in bunded or sealed areas) and there are measures to prevent release including in by design (e.g. secondary / tertiary containment, sealed drainage, impermeable membranes). The quantities involved are small and manageable. Site records demonstrate the absence of an accidental releases occurring. The condition of equipment and infrastructure (e.g. storage tanks) is good and well maintained. There are robust control measures and/or associated staff training to mitigate accidental release;
- Very Unlikely: As for “unlikely” but the probability of release is considered to be even lower (e.g. an accidental release scenario that is of low probability).

Likelihood of Receptor being Affected

4.2.12 For a named receptor (i.e. soil or groundwater), the likelihood of an accidental release, once it has occurred, to affect that receptor is determined. This assessment is based on the CSM developed for the site and mitigations relevant to the pathway identified. The likelihood classes used in this qualitative assessment are as follows:

- Highly Likely: A direct, active pollutant linkage exists. A large quantity of the RHS is used in a mobile form relevant to the receptor. There is an absence of mitigation measures to control the release or emergency response should accidental emission occur. There is an absence of any other attenuation measures that may mitigate the release before the receptor is affected;

- Likely: An active pollutant linkage exists. The quantity of product used, or the manner of its use may render pollution prevention measures ineffective. The condition or implementation of pollution prevention control measures is poor or cannot be verified. There are historical incidences of accidental releases that affect the receptor.
- Unlikely: A possible pollutant linkage exists but is either complex / indirect or has characteristics likely to mitigate any releases. The quantity of material release is likely to be small or of a form unlikely to be allow the receptor to be reached. Requires secondary process to present before receptor can be affected (e.g. solid going into solution);
- Very Unlikely: Although a theoretical pathway to a receptor can be envisaged it is considered extremely unlikely to be active, although cannot be discounted entirely.

4.2.13 These two key elements of the risk assessment are combined using the risk matrix presented in Table 4.2.

Table 4.2: Risk Matrix for Determining Site-specific Pollution Potential

Risk Matrix		Likelihood of receptor being affected by release			
		Highly Likely	Likely	Unlikely	Very Unlikely
Likelihood of Release Occurring	Highly Likely	Extremely High	High	High	Moderate
	Likely	High	High	Moderate	Low
	Unlikely	High	Moderate	Low	Extremely Low
	Very Unlikely	Moderate	Low	Extremely Low	Negligible

4.2.14 Where no plausible pollutant linkage connecting a contaminant source with a named receptor has been identified a risk classification of negligible is applied.

4.2.15 For the purpose of baseline reporting, those RHS with release scenarios that have a “site-specific Pollution Potential” above low are considered of sufficient risk ranking to merit further consideration with respect to the baseline quality of soils and groundwater on the ACL facility. The risk matrix outline above does not consider the actual harm an effect may have should the release scenario and pathway to the receptor be realised.

4.3 Conceptual Site Model

4.3.1 The receptors considered as part of the assessment include:

- Soils: Shallow exposed Made Ground and soils in areas devoid of hardstanding;
- Soils: Deeper soils that from potential pathway from shallow soils to deeper receptors (i.e. perched groundwaters);
- Shallow Perched Groundwater: Areas of saturated Made Ground and/or residual sandy Lowestoft Formation perched upon the underlying Crag Group;
- The Crag Group, a dense brown slightly clayey gravelly fine to coarse sand with gravels.

Contamination Sources

4.3.2 The majority of processes undertaken on the ACL facility occur inside the principal structures / buildings, on areas of continuous hardstanding. As such a pathway to soils and potential groundwater is largely absent particularly where the quantity of the substances involved is generally low. Risk is further reduced by the emergency measures and inspection / integrity testing regime implementation on the ACL facility through its EMS.

4.3.3 The majority of release scenarios that are considered likely to the have an effect on soils or groundwater of sufficient concern further to merit further consideration typically occur at the Effluent Treatment Facility and in the Cyder Tank Farm both to the North of the facility in the vicinity of or directly on exposed Made Ground / soils situated outside the apron of hardstanding. The Vinegar Tank Farm also constitutes the second largest liquid storage area potentially capable of release scenarios, albeit on hardstanding and draining to the Effluent Treatment Plant.

4.3.4 The emissions associated with the steam boiler are considered negligible, on the basis of the size of the unit and air quality modelling undertaken as part of the permitting of the facility. Furthermore, the chloride concentration of diesel fuel is very low and therefore the potential to generate dioxins and furans is not likely from this source term.

4.3.5 Furthermore, the design and height of the flue stack will remove any real potential for particulates to be deposited within the boundary of the site.

4.3.6 Based on the foregoing it is considered there is no significant source of emissions to air and deposition at the site and therefore this has not been considered further as part of this assessment.

Release Scenarios

4.3.7 Release scenarios considered are presented in Appendix A for each substance and typically consist in activities with Standard Operating Procedure (SOP):

- Accidental release from tankers transferring products (cyder) from tanks during delivery (SOP238),
- Accidental release from tankers transferring products (gasoil) to ASTs during delivery,
- Accidental release from transfer of products between tanks (SOP246)
- Tank leak/failure from caustic acid tanks in process building and ETP,
- Tank leak/failure from tanks in cyder or vinegar tank farms,
- Tank leak/failure from gasoil AST supplying boiler or waste oil storage area,
- Accidental release from IBCs during transfer of products from IBCs to other tanks or during transport.

Pathways and Associated Pollution Prevention Measures

4.3.8 General pollution prevention measures and mitigation measures associated with processes and Relevant Hazardous Substances on the Facility are presented in the Master Summary Table (Appendix A) and described below.

4.3.9 An accidental release to ground in external areas of the Facility will be to tarmacadam or concrete hardstanding in curbed areas and would be dealt with through the implementation of the emergency spill response developed for the site and delivered by trained personnel. The tarmacadam is in good condition. The concrete is heavily degraded under some tanks with apparent reinforced steel apparent although the thickness of the concrete is sufficient, and ground covered.

4.3.10 These measures result in a limited potential for any release to affect surface soils or the ground beneath the Facility and groundwater at depth. A large release to ground in external areas could potentially enter the surface water drainage system depending on its location. The effects of such a release shall be minimised by the presence of oil water interceptor installed on that drainage system that is subject to routine servicing / maintenance.

4.3.11 Any accidental release in internal (covered) areas will also be to concrete hardstanding. In the press, vinegar, kegging or bottling buildings such a release would enter the underground drainage network and be directed towards the ETP.

4.3.12 Leakage from the sumps and/or drains within the site could result in a release to the unsaturated zone and groundwater beneath the site. This is mitigated by routine inspection of the system.

4.3.13 The ETP (sump and tanks) could release to the unsaturated zone and groundwater beneath the site. This risk is mitigated by the nature of the geological formations surrounding the tanks (clay) and raised tank sides in the primary holding tank.

4.3.14 The AST with gasoil for the boiler is double skinned construction with a visible level gauge at point of delivery. All deliveries are on hardstanding material, with dedicated oil spill kits present. In the event of a significant oil loss reaching surface water drainage these locations have oil interceptors fitted at discharge points to the horse pond and from the warehouse ensuring no release to environment.

4.3.15 A formal environmental management system has not historically been in place although site does operate both quality and H&S systems, the quality system being BRC accredited.

Accidental Emission Recording and Reporting

4.3.16 Procedures have been developed to address those operations deemed a risk, this includes emergency scenarios such as spills or leaks and fire response.

4.3.17 Additionally, an incident reporting and investigation procedure is in place. This captures incidents on site or reported to site by external parties such as neighbours and ensures all incidents are investigated and appropriate corrective and preventative actions put in place.

Receptors

4.3.18 As detailed above the receptors considered as part of this report are soils and groundwater.

4.3.19 Soils are restricted to small areas in the west of the site, near the kegging and bottling building and site boundary. Groundwater forms a continuous controlled water body beneath the site at depth in the Crag.

4.3.20 Groundwater in the made ground and superficial deposits of the Lowestoft Formation is dis-continuous and limited laterally and vertically mainly fed by the adjacent moat and on-site pond. This groundwater is unlikely to be suitable for any use and is not considered a receptor

Assessment of Site-specific Pollution Risk

4.3.21 The qualitative assessment of the site-specific pollution to soil or groundwater is presented in Appendix A and summarised below:

- Sodium hydroxide / Sodium hypochlorite Cl active (liquid) – Ancillary Substances used for CIP of the facility, large volume used across the facility over the year makes and repeated process need provide potential repeated release to the environment. Safe operating procedure and small quantities used each time (0.2 m3) reduce potential release of significant volume of substances. Low Risk
- Alcohols (liquid) – Accidental release of ancillary substances used for CIP of the facility from containers (25 litres) during delivery and/or pipework used during production. Products (Cyder / Vinegar) released from tank farm failure or during transfer between tanks, tankers transports or tank farm bund failures. Moderate Risk
- Acetic acid/Peracetic acid with hydrogen peroxide (liquid) – Release from vinegar manufacturing building and tank farm through failure and leakage from tanks and pipe-works. Moderate Risk

- Sodium bisulphite and cobalt sulphate (liquid) – Oxygen scavenger for boiler water stored in chemical store and used in boiler room.
- Accidental loss to ground during transport of lubricating, hydraulic and machining oils to point of use: Most petroleum-based oils are used in small quantities on the site. Small releases to ground would be to hardstanding and would be managed using spill kits. The lubricating oils and hydraulic oils in larger quantities could be lost to ground but are delivered to site in appropriate containers. An accidental release may enter the drainage system, but the use of interceptors would protect surface water bodies. In general, accidental loss during transport around the site seems a low risk to soil or groundwater. Low Risk
- Leakage / release gasoil from the storage AST: The AST is situated in bunds which should contain any accidental releases due to connection issues when filling / emptying, overfilling or loss of primary containment. Such a release is minimised by routine visual inspection of the tank integrity, standard operating protocols for filling / emptying tanks. Low Risk
- Deposition of airborne contaminants, dioxins and furans, released from the stacks associated with the boiler. Largely controlled by air filtration and monitoring. Low Risk

5 BASELINE QUALITY ASSESSMENT

5.1 Potential for the Release of Relevant Hazardous Substances

5.1.1 The assessment for the ACL facility has identified RHSs that are considered to have a significant site-specific pollution potential that may affect soil and groundwater quality in areas of exposed Made Ground / soils outside of buildings, structures and surroundings apron of hardstanding. These areas are located principally on the south edge of the site and to the North East of the site.

5.1.2 As identified in Section 1.4, a number of historical intrusive investigations have been undertaken and a reasonable coverage across the ACL Site has been achieved.

5.2 Summary of Historical Intrusive Investigations

5.2.1 The scope and findings of these key documents is summarised in Table 5.1. Full reports are provided in Appendix C.

5.2.2 The soil and groundwater samples collected during these intrusive investigations has been the subject to a suite of analyses that typically includes the following:

- Metals and metalloids;
- A range of non-metal compounds and physico-chemical parameters;
- Petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons (PAHs);
- Volatile organic compounds (VOcs);
- Semi-volatile organic compounds (SVOCs); and
- Asbestos.

5.2.3 The general suite reflects the historical operations undertaken on or near the ACL facility. The analytical suite does not include the entire list of RHS identified in Table 4.1 with the notable exception of dioxins and furans.

Table 5.1: Overview of Historical Investigations & Reporting

Title	Purpose / Objectives	Desk Study	Intrusive Investigation Details	Assessments / Findings
Aspall Cyder House Geoenvironmental Report. Dated January 2019. Final (RPS, 2019)	The key objectives for the Geoenvironmental Baseline Report were: To establish baseline conditions at the site by describing and recording the condition of the land and groundwater pre-permit application. To enable quantified comparisons to be made in the future between the baseline and the site at permit surrender. To develop a 'Conceptual Site Model' to identify potential risks from operational activities and where a risk is identified establish a method to demonstrate the land and groundwater will be protected.		None	The initial engineering appraisal has identified piled foundations founded within the lower Lowestoft formation or Crag Group are likely suitable for the proposed processing plant and tank bases. Pad foundations are likely to be acceptable for smaller ancillary structures. The Made Ground deposits are not considered suitable as a founding horizon without ground improvement comprising removal and replacement. The clays have generally been identified as of moderate volume change potential and compressibility and this should be allowed for with design including suspending floor slabs including provision for volume change associated to mature trees onsite. The investigation has identified a cover of Made Ground of variable thickness across the proposed development footprint over the Lowestoft Formation. The Crag group was identified from between 16.8 to 18.5 m BGL under a thick layer of Superficial Deposits of the Lowestoft Formation (Diamicton sands and gravels) proven up to 18.95 m thick. The investigation has identified a perched groundwater body at the base of the Made Ground and upper Lowestoft Formation, with a main groundwater body in the Crag Group. There is no indication of vertical flow from the groundwater in the made ground to the underlying Crag aquifer due to the significant thickness of the Lowestoft Formation. There are no significant concentrations of contaminants present below the proposed development footprint at the Assessment Site. Low concentrations of petroleum hydrocarbons and products (ethanol, methanol and acetic acid) have been found in a number of locations in soil. It is assumed that the concentrations recorded in this baseline report are a consequence of uncontrolled release from the historical process at the Site. One location is showing higher level of contamination when compared to all the other monitoring locations, i.e. baseline. The level of contamination at WS-SC-11 remains constrained to a small area with adjacent monitoring locations demonstrating typical baseline concentrations of site-specific hazardous substances.

Title	Purpose / Objectives	Desk Study	Intrusive Investigation Details	Assessments / Findings
Factual Report on Ground Investigation, Aspall Cyder House. Dated October 2018. Issue 1. (RPS, 2018b)	The GI aims to support a Site environmental liability appraisal, determine current environmental baseline conditions and, inform future Environmental Permit Application for the proposed expansion of facilities and construction of new buildings at the Site. The Ground Investigation (GI) has been undertaken to establish the physical ground conditions and the presence or otherwise of ground gas and soil contamination associated with the historical activities undertaken upon and adjacent to the Proposed Development only.	None	**Geotechnical** Advancement of 3no. Cable Percussion boreholes, to a maximum depth of 20.0m below ground level (mbGL). In situ geotechnical testing is required using a combination of UT100/UT75 and SPT/SPT(c) (specific to ground conditions encountered). 3 no. gas and groundwater monitoring wells to be installed to a nominal depth of 3.0m in the vicinity of the infilled pond. Concrete coring with an advancement of 4 no. 300mm diameter cores. Windowless Sampling, for advancement of 5 no. windowless sample exploratory holes, to a maximum depth of 3 to 4m. Geo-environmental laboratory analysis of the Made Ground soil samples for a suite of inorganic and organic contaminants (as identified within the DSA). Geotechnical laboratory testing to include index properties, consolidation and QUU triaxial tests, as well as concrete class (BRE SD1). **Geoenvironmental** Advancement of 7no. Cable Percussion boreholes, 2 no. to a maximum depth of 25.0 mbgl; 5 no. to a maximum depth of 10.0 mbgl to target the groundwater conditions below the Boulder Clay; Advancement of 11 no. Windowless Sampling exploratory holes to 5 m or until refusal; Geo-environmental laboratory analysis of samples for a suite of inorganic and organic contaminants.	

Title	Purpose / Objectives	Desk Study	Intrusive Investigation Details	Assessments / Findings
Desk Study Appraisal of Aspall Cyder House. Ref JER1447. Dated July 2018. Issue 1 (RPS, 2018a)	The objectives of this report consisted in: Obtaining information (reports, drawings) within the area of the site. Identify possible ground related geotechnical and contamination hazards that may affect the proposed development. Produce a Phase I Conceptual Model identifying Contaminants of Concerns present on site, potential sources of contaminants, pathways and receptors. Provide advice and recommendations for Phase II intrusive investigation. This report describes and records the condition of the land and groundwater at a site based on information and report collected by the site. This is supplemented by information collected during a site visit. The report presents a factual “baseline” account of the land that could be compared against the findings of any subsequent site monitoring, or the results of other investigations. It allows potential pollutants/chemicals that were used and or stored on site prior to the issue of the permit to be distinguished from those that occurred during its operation under the permit.	British Geological Survey. Eye. Sheet 190 Eye (Scale 1:50,000) Solid and draft geology. Landmark EnviroCheck Professional report Reference 169917924. Internal Standard Operation Procedures and drawings	None	The site long history of industrial activity is associated with very limited occurrence and evidence of contamination (spills of cyder (cider) or exceedance of discharge consent). The potential nature of contamination is organic by nature and to a low level due to the magnitude of the activity. This is unlikely to results in high level and persistent contaminants in most of the site areas. The small quantities of oil and lubricants used on site are also unlikely to have given rise to significant level of pollution.

5.3 Historical Soil and Groundwater Quality Dataset

Soil

5.3.1 42 soil samples were analysed during the site investigation in August 2018. Soils samples were submitted to ALS laboratories for geo-environmental analytical suite. The test schedule for soils samples is presented in Table 5.2 and the results are summarised in Table 5.3.

Table 5.2: Geo-environmental Testing Suite for Soils

Test Scheduled	No of samples scheduled
Asbestos	5
Alkalinity	37
pH, Ammonium + Cl + SO4 in 2:1 leachate, TOC, Sulphur, Sulphate, Magnesium, Nitrate	4
Metal Suite (As, Ba, Be, B, Cd, Cr, Cu, Pb, Ni, Se, V, Zn)	38
ANC at pH6, ANC/BNC at pH4	38
Speciated THPs, VOCs, BTEX	38

5.3.2 In general terms, available soil quality data is characterised by low levels of organic (alcohols and TPH) and inorganic contamination in soils. Asbestos was not detected. Soil contamination is essentially constrained to two locations with one area to the North East, between the tank farm and the solid waste area, characterised with WS-SC04 and WS-SC-07 and another area North of the site pond adjacent to the engineering department and Vinegar Production area, characterised with WS-SC-11. All the contamination was identified within the shallow made ground and upper part of the Superficial Deposits of the Lowestoft Formation (Diamicton sands and gravels).

Table 5.3: Summary of Soil Samples Results

Determinand	Units	No Analysis	No analysis below LOD	Concentrations range		Location and depth of maximum Concentration
				Min	Max	
Metals and inorganics						
pH	pH Units	4		8.03	8.56	TP08 / 1.8
ANC at pH 6	mol/kg	38	1	0.031	6.73	TP06 / 0.9
Anc/Bnc At Ph4	mol/kg	38	1	0.0602	6.97	WS-SC-05 / 1.2
Chloride 2:1 water/soil extract BRE	g/l	4	0	0.0063	0.0682	TP07 / 1
Nitrate (BRE)	g/l	4	0	0.00043	0.224	TP07 / 1
Soluble Sulphate 2:1 extract as SO4	g/l	4	0	0.0348	0.227	TP07 / 1
Sulphate	%	4	1	0.0205	0.0661	TP07 / 1
Elemental Sulphur	%	4	0	0.025	0.1	BH-GT-02 / 3.5
Total Organic Carbon	%	38	0	0.28	7.21	WS-SC-11 / 1.3
Alkalinity Total	mg/kg	37	0	122	519	WS-SC-01 / 0.9
Ammoniacal N as NH4 in 2:1 extract	g/l	4	0	0.000882	0.00369	TP08 / 0.6
Arsenic	mg/kg	38	0	6.39	18.4	TP02 / 0.6
Barium	mg/kg	38	0	29.8	230	WS-SC-11 / 0.4
Beryllium	mg/kg	38	0	0.421	1.2	TP02 / 0.6
Cadmium	mg/kg	38	13	0.023	0.708	WS-SC-11 / 1.3

Determinand	Units	No Analysis	No analysis below LOD	Concentrations range		Location and depth of maximum Concentration
				Min	Max	
Chromium	mg/kg	38	0	11.3	29.7	TP02 / 0.6
Copper	mg/kg	38	0	6.78	70.1	BH-EP-02 / 1
Lead	mg/kg	38	0	6.44	92.6	WS-SC-11 / 1.3
Nickel	mg/kg	38	0	10.8	51	TP02 / 0.6
Vanadium	mg/kg	38	0	24.4	63.8	TP02 / 0.6
Zinc	mg/kg	38	0	37.4	620	WS-SC-11 / 1.3
Boron	mg/kg	38	27	1.16	3.21	WS-SC-11 / 1.3
Organics						
Aliphatics & Aromatics >C5-44	ug/kg	38	6	1,110	554,000	WS-SC-11 / 1.3
Aliphatics >C12-16	ug/kg	38	24	544	26,200	WS-SC-07 / 0.4
Aliphatics >C16-21	ug/kg	38	20	912	106,000	WS-SC-07 / 0.4
Aliphatics >C21-35	ug/kg	38	9	1,000	121,000	WS-SC-04 / 0.3
Aliphatics >C35-44	ug/kg	38	20	645	111,000	WS-SC-04 / 0.3
Aliphatics >C12-44	ug/kg	38	9	1,000	285,000	WS-SC-07 / 0.4
Aromatics >C12-16	ug/kg	38	27	264	3,190	WS-SC-07 / 0.4
Aromatics >C16-21	ug/kg	38	16	131	36,500	WS-SC-11 / 1.3
Aromatics >C21-35	ug/kg	38	6	1,110	310,000	WS-SC-11 / 1.3
Aromatics >C35-44	ug/kg	38	10	302	102,000	WS-SC-04 / 0.3
Aromatics >C40-44	ug/kg	38	16	1,240	53,400	WS-SC-04 / 0.3
Aromatics >C12-44	ug/kg	38	6	1,110	431,000	WS-SC-11 / 1.3
GRO >C5-12	ug/kg	38	35	160	223	BH-EP-02 / 1
Aliphatics >C5-6	ug/kg	38	36	11.7	18.3	TP09 / 1.3
Aliphatics >C6-8	ug/kg	38	34	12.4	58.5	BH-EP-02 / 1
Aliphatics >C8-10	ug/kg	38	33	16.8	48.8	TP09 / 1.3
Aliphatics >C10-12	ug/kg	38	31	10.2	61.3	WS-SC-04 / 0.3
Aromatics >C6-7	ug/kg	38	38	<LOD	<LOD	
Aromatics >C7-8	ug/kg	38	38	<LOD	<LOD	-
Aromatics >C8-10	ug/kg	38	34	16.3	32.9	TP09 / 1.3
Aromatics >C10-12	ug/kg	38	34	16.4	41.3	WS-SC-04 / 0.3
Organics (VOCs and SVOCs)						
Acetone	ug/kg	38	25	55.2	1050	WS-SC-11 / 1.3
Ethanol	ug/kg	38	24	122	3050	WS-SC-11 / 1.3
Methanol	ug/kg	38	12	112	7530	WS-SC-11 / 1.3
Benzene	ug/kg	38	37	14.1	14.1	TP06 / 0.9

Certificates of Analysis in Appendix E

Groundwater

5.3.3 Six groundwater samples were analysed during the site investigation in August 2018. Groundwater samples were submitted to ALS laboratories for geoenvironmental analytical suite. The test schedule for groundwater samples is presented in Table 5.4 and a summary of the groundwater chemical quality in Table 5.5

Table 5.4: Geo-environmental Testing Suite for Groundwater

Test Scheduled	No of samples scheduled
BOD, COD, TOC, Dissolved CO_2 Gas	6
Ammoniacal Nitrogen, pH, Redox potential, Chloride, TON, Alkalinity	6
Metal Suite (As, Ba, Be, B, Cd, Cr, Cu, Pb, Ni, Se, V, Zn)	6
Speciated TPHs	6
Gasoline Range Organics	6
PAHs	6
BTEX	6

5.3.4 The water quality dataset provided is representative of the groundwater in the made ground and Superficial Deposits of the Lowestoft Formation (Diamicton sands and gravels). No groundwater was available for sampling in the Crag, although groundwater level was observed during drilling.

5.3.5 The groundwater is typically good with the notable exception at WS-SC-11 which shows high level of organic compounds. The groundwater quality shows low levels of RHSs identified for the vinegar production area and engineering department (PAHs, TPH).

5.3.6 Groundwater was not found in all the borehole locations with many boreholes dry, supporting the assumptions that groundwater within the made ground and Lowestoft Formation is discontinuous and shallow.

Table 5.5 Summary of Groundwater Chemical Quality

Determinand	Units	No Analysis	No analysis above LOD	Concentrations range		Location and depth of maximum Concentration
				Min	Max	
Metals and inorganics						
Biological Oxygen Demand	mg/l	6	2	2.17	419	WS-SC-11
Dissolved Organic Carbon	mg/l	6	0	6.32	35	BH-EP-06
COD	mg/l	6	0	17.3	1,250	WS-SC-11
Carbon Dioxide, Gaseous	mg/l	6	0	13.2	88.3	WS-SC-11
Total Water Hardness	mg/l	6	0	224	4,610	WS-SC-11
Ammoniacal Nitrogen as N	mg/l	6	2	0.263	9.79	BH-EP-06
pH	pH Units	6	0	7.25	7.97	BH-EP-03
Redox	mV	6	0	26	192	WS-SC-08
Chloride	mg/l	6	0	82.7	632	BH-EP-04
Total oxidised nitrogen	mg/l	6	3	0.347	23.5	WS-SC-08
Arsenic	ug/l	6	0	0.829	6.58	WS-SC-11
Barium	ug/l	6	0	70	3,020	WS-SC-11
Boron	ug/l	6	0	63.2	719	WS-SC-11
Cadmium	ug/l	6	3	0.118	0.137	WS-SC-12
Chromium	ug/l	6	4	7.13	9.67	BH-EP-03
Copper	ug/l	6	1	1.86	10.1	WS-SC-12
Lead	ug/l	6	4	0.212	0.498	BH-EP-04
Nickel	ug/l	6	0	2.95	56.8	BH-EP-06
Selenium	ug/l	6	1	1.8	24	BH-EP-04
Vanadium	ug/l	6	2	1.06	2.69	WS-SC-12
Zinc	ug/l	6	0	5.17	1,840	WS-SC-11

Determinand	Units	No Analysis	No analysis above LOD	Concentrations range Min	Max	Location and depth of maximum Concentration
Organics (PAHs)						
PAH, Total Detected USEPA 16	ug/l	6	2	0.163	168	WS-SC-11
Acenaphthene	ug/l	6	3	0.0146	1.85	WS-SC-11
Acenaphthylene	ug/l	6	3	0.0106	0.91	WS-SC-11
Anthracene	ug/l	6	3	0.0287	2.44	WS-SC-11
Benzo (g,h,i) perylene	ug/l	6	2	0.0093	10.7	WS-SC-11
Benzo(a)anthracene	ug/l	6	3	0.1590	10.3	WS-SC-11
Benzo(a)pyrene	ug/l	6	1	0.0045	14	WS-SC-11
Benzo(b)fluoranthene	ug/l	6	2	0.0187	19.8	WS-SC-11
Benzo(k)fluoranthene	ug/l	6	2	0.0121	12.8	WS-SC-11
Chrysene	ug/l	6	2	0.0114	12.4	WS-SC-11
Dibenz-a-h-anthracene	ug/l	6	3	0.0437	3.2	WS-SC-11
Fluoranthene	ug/l	6	0	0.0067	27.7	WS-SC-11
Fluorene	ug/l	6	3	0.0139	6.18	WS-SC-11
Indeno(1,2,3-cd)pyrene	ug/l	6	2	0.0101	10.6	WS-SC-11
Napthalene	ug/l	6	2	0.0150	0.938	WS-SC-11
Phenanthrene	ug/l	6	2	0.0112	10.8	WS-SC-11
Pyrene	ug/l	6	0	0.0133	23.6	WS-SC-11
Organics (TPH and VOCs)						
Aliphatics & Aromatics >C5-35	ug/l	6	2	59	9,850	WS-SC-11
Aliphatics >C12-35	ug/l	6	2	55	7,330	WS-SC-11
Aliphatics >C16-C35	ug/l	6	2	55	7,280	WS-SC-11
Aliphatics >C12-16	ug/l	6	5	52	52	WS-SC-11
Aliphatics >C16-21	ug/l	6	5	148	148	WS-SC-11
Aliphatics >C21-35	ug/l	6	2	45	7,130	WS-SC-11
Aromatics >C12-35	ug/l	6	5	2,430	2,430	WS-SC-11
Aromatics >C12-16	ug/l	6	5	56	56	WS-SC-11
Aromatics >C16-21	ug/l	6	5	257	257	WS-SC-11
Aromatics >C21-35	ug/l	6	5	2,110	2,110	WS-SC-11
GRO >C5-12	ug/l	6	5	92	92	WS-SC-11
Aliphatics >C5-6	ug/l	6	6	0	0	
Aliphatics >C6-8	ug/l	6	6	0	0	
Aliphatics >C8-10	ug/l	6	5	31	31	WS-SC-11
Aliphatics >C10-12	ug/l	6	5	20	20	WS-SC-11
Aromatics >C6-7	ug/l	6	6	0	0	
Aromatics >C7-8	ug/l	6	6	0	0	
Aromatics >C8-10	ug/l	6	5	21	21	WS-SC-11
Aromatics >C10-12	ug/l	6	5	13	13	WS-SC-11
Total BTEX	ug/l	6	6	0	0	
Methyl tert-butyl ether (MTBE)	ug/l	6	5	6	6	BH-EP-06

5.4 Gap Analysis

5.4.1 Site-specific Pollutants identified in Section 4 are compared with the results of the Site Investigation presented in Section 5. Table 5.6 summarise identified RHS and relevant SI dataset.

Table 5.6: Gap Analysis

RHS identified	Analysed	Location on Site
Sodium hydroxide / Sodium hypochlorite Cl active (liquid)	Nitrate (BRE) in soil Ammoniacal Nitrogen and Total Oxidised Nitrogen (TON) in groundwater	TP7 (0.224 g/l) Ammoniacal nitrogen in BH-EP-06 (9.79 mg/l) and WS-SC-11 (9.33 mg/l)
Alcohols (liquid)	Methanol and Ethanol in soil	Across entire site in made ground and shallow superficial formations. Highest concentrations near tank farms (Cyder and Vinegar) and .
Acetic acid/Peracetic acid with hydrogen peroxide (liquid)	Ethanol, acetone degradation by-products	Across entire site in made ground and shallow superficial formations. Highest concentrations near tank farms (Cyder and Vinegar).
Sodium bisulphite and cobalt sulphate (liquid)	Sulphur and sulphate	No significant concentration found in soil at BH-GT-02, TP07, TP08.
Oil, Petroleum Products	TPH and PAHs	Waste storage area (WS-SC-04 461 mg/kg and WS-SC-07 467 mg/kg) Vinegar and Engineering area (WS-SC-11 171 & 554 mg/kg)
Airborne Contaminants (dioxins and furans)	Not analysed	-

5.4.2 The following gaps between identified RHSs and current available chemical dataset from Site investigation shows:

- RHSs Sodium bisulphite and cobalt sulphate (liquid) used as oxygen scavenger for boiler water stored in chemical store and used in boiler room is not well characterised on site in the absence of cobalt analysed and sulphate analysed only for part of the site only.
- Deposition of airborne contaminants, notably dioxins and furans, released from the stacks associated with the boiler. Dioxins and furans have not been analysed.

5.5 Recommendations for Additional Baseline Quality Characterisation

5.5.1 The results of the Baseline Quality Assessment indicate limited gap in the chemical dataset currently available to the Facility. The current available monitoring network is based on the findings presented in the Baseline Quality Assessment in Section 5.

Groundwater Monitoring Location

5.5.2 The IED groundwater monitoring network comprises nine pre-exiting boreholes identified on the ACL facility. Ten boreholes comprise a monitoring installation completed within the made ground and superficial deposit of the Lowestoft Formation. One borehole (BH-EP-01) has been terminated in the Crag beneath the Lowestoft Formation.

5.5.3 The location of IED groundwater monitoring boreholes is based on those activities / process involving Relevant Hazardous Substances (RHS) that were identified in the Geoenvironmental Baseline Report (RPS, 2019) as having a significant site-specific pollution potential and the Baseline Quality Assessment Section.

5.5.4 The IED monitoring points have been selected basis of the location of existing infrastructure surrounding the main processing activities (and their associated effluent sumps) and the Effluent Treatment Plant. The location of the ten IED groundwater monitoring boreholes is shown in Drawing JER1722-IED-001 and includes:

- BH-EP-01 to BH-EP-07; WS-SC-05, WS-SC-11 and WS-SC-12.

5.5.5 Geological logs for these boreholes and photographs of each monitoring installation are provided in Appendix E.

5.5.6 It is recommended monitoring of the facility is undertaken during winter month, when groundwater levels are high in the Crag Formation (BH-EP-01). The current monitoring data has been collected following drilling and installation of the borehole and wells. Appropriate development of the monitoring locations should be sought to obtain groundwater samples avoiding potential effects from drilling activities.

Monitoring Frequency

5.5.7 Article 16(2) of the IED 2010 defines the monitoring frequency required for soils and groundwater:

"The frequency of the periodic monitoring referred to in Article 14(1)(e) shall be determined by the competent authority in a permit for each individual installation or in general binding rules. Without prejudice to the first subparagraph, periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination."

5.5.8 The following monitoring frequency is therefore proposed:

- Groundwater: Once every 5 years (second sample in 2019);

5.5.9 The outline monitoring programme and method statements provided in Appendix D shall be updated once the first comprehensive sample round (including Soil) has been completed.

6 SUMMARY & CONCLUSION

6.1.1 A baseline Report has been undertaken prior to permit application and as part of the supporting information for the permit application to ensure the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for article 22(3) of the IED. The report shall contain information, supplementary to that already provided in application Site Condition Report, needed to meet the information requirements of Article 22(2) of the IED.

6.1.2 A desk-based review has therefore been undertaken that conforms to the requirements of Communications 2014/C136/03 for a Baseline report that includes the following:

- Stage 1 - Identify hazardous substances used, produced or released at the proposed installation;
- Stage 2 - Identify relevant hazardous substances used, produced or released at the installation from the list of hazardous substances identified in Stage 1;
- Stage 3 – Undertake an assessment of site-specific pollution possibility for relevant hazardous substances;
- Stage 4 – Evaluation of Site History and potential for relevant hazardous substances to be present in soils and groundwater;
- Stage 5 – Evaluation of Environmental Setting to determine the fate of potential emissions of relevant hazardous substances;
- Stage 6 – Site Characterisation that synthesises findings of Stage 5 and 6 on the basis of a Conceptual Site Model;
- Stage 7 – Site Investigation (including sampling strategy)
- Stage 8 – Production of Baseline Report

6.1.3 The Relevant Hazardous Substances identified for the ACL Facility have been shown to include the following:

- Sodium hydroxide / Sodium hypochlorite Cl active (liquid);
- Alcohols (liquid);
- Acetic acid/Peracetic acid with hydrogen peroxide (liquid);
- Sodium bisulphite and cobalt sulphate (liquid);
- Oil, Petroleum Products;

6.1.4 The site-specific pollution potential, with respect to soils and groundwater, for each of the RHS has been evaluated and principally considered the following:

- Airborne RHS associated with the stack emissions;
- Petroleum hydrocarbons in the form gasoil and light fuel oil stored in bunded ASTs on the site;
- Waste effluent stored in the Effluent Treatment Plants;
- Storage of aqueous sodium bisulphite and cobalt sulphate used as oxygen scavenger in the boiler room and stored in small quantities in the chemical stores on site.

6.1.5 The risk to soil and groundwater has been minimised through a variety of measures and controls delivered through design and operational protocols for the facility. These include amongst others:

- Hardstanding (reinforced concrete and tarmacadam) up to 0.32 m thick across the site with the exception of a pond and infilled areas currently subject to construction.
- Materials handling / processing to be undertaken within internal structures;

- Fuel oil ASTs are located in an engineered, impermeable bund area to 110% of the tank capacity (double containment);
- No USTs present on site with the exception of sumps and pumping chamber associated with the drainage of the site to the ETP;
- Routine inspection and integrity testing of storage structures, bunding and concrete hardstanding;
- Site Standard Operating Practices for a range of high-risk activities (filling of ASTs, emergency response, transfer of liquid…);

6.1.6 The site-specific receptors considered included: soils in landscaped area; deep soils forming the unsaturated zones beneath hardstanding on the facility; shallow groundwater in the made ground and Lowestoft Formation; and groundwater in the Crag at depth.

6.1.7 The assessment of the site-specific pollution potential concluded that RHSs used, produced or emitted on the ACL facility represent a “negligible”, “Low” and “Moderate” risk to soil and groundwater receptors on the site.

6.1.8 The monitoring data available for deep groundwater is limited due to the absence of groundwater available for sampling at the time of the site investigation. However, it is expected the level of protection provided by the Lowestoft Formation up to 20 m thick is sufficient to prevent any contamination from reaching this aquifer.

6.1.9 On the basis of the assessment of site-specific pollutant potential presented herein the following additional baseline characterisation and monitoring works has been recommended:

- Groundwater sampling in the 10 No. monitoring locations during winter months when groundwater levels are “high”, and sampling can be taken from the Crag Formation.

6.1.10 Subject to regulatory agreement of the findings presented in this IED Baseline Report an appropriate sampling and monitoring strategy shall be developed and agreed with the Environment Agency. A plan of indicative monitoring locations for soil and groundwater is provided in Drawing JER1722-IED-001.

DRAWINGS

APPENDICES

Appendix A

Master Summary Sheet

Appendix B

Summary Inventory & SDS

Appendix C

Historical Reporting

Appendix D

Outline Monitoring Programme

Appendix E

Baseline Quality Dataset