

PRECIOUS METALS RECOVERY FACILITY, MERSE ROAD - PERMIT APPLICATION SUPPORTING DOCUMENT

Kaug Refinery Services Limited

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Oaktree Environmental Ltd
Waste, Planning & Environmental Consultants



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Version	Issue date	Author	Checked	Description
1.0	17/04/2023	DY		Draft for client review
1.1	09/05/2023	DY		Updated draft following client comment
1.2	16/05/2023	DY		Further amendment to Section 2
1.3	17/05/2023	DY		Submitted to WRS with Part B permit application

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- Appendix II - Environmental Management System**
- Appendix III - Emissions Modelling Assessment**

1 Introduction

1.1 Overview

1.1.1 This document contains supporting information which accompanies the Part B Environmental Permit (EP) application being submitted for the operation of a small scale metal decontamination appliance and small scale gas and electrical induction furnaces at a facility for the recovery of precious metals from wastes at 10 Merse Road, North Moons Moat, Redditch, B98 9HL. This application has been completed on behalf of Kaug Refinery Services Limited by Oaktree Environmental Limited.

1.2 Proposed Activities

1.2.1 The operation will include a number of processes for the extraction of precious metals from wastes. This will include physical and chemical treatment processes, which will be regulated by the Environment Agency (EA) in accordance with a bespoke waste EP. In addition, the process will include the operation of a small scale thermal appliance for the removal of organic compounds from metal bearing waste and the operation of two small scale furnaces for the melting of precious metals to form ingots. A Part B EP is required for the operation of the thermal treatment processes, which will be regulated by Worcestershire Regulatory Services (WRS). These are the subject of this application. The thermal appliances will be regulated under the Environmental Permitting (England and Wales) Regulations 2016 (“the regulations”), as follows under Schedule 1 Part 2 of the regulations:

“Section 2.2 Part B (a) Melting, including making alloys of, non-ferrous metals (other than tin or any alloy which in molten form contains 50 per cent or more by weight of tin), including recovered products (such as refining or foundry casting) in plant with a melting capacity of 4 tonnes or less per day for lead or cadmium or 20 tonnes or less per day for all other metals; and,

Section 2.2 Part B (b) Heating in a furnace or any other appliance any non-ferrous metal or non-ferrous metal alloy for the purpose of removing grease, oil or any other non-metallic

contaminant, including such operations as the removal by heat of plastic or rubber covering from scrap cable, if not related to another activity described in this Part of this Section.”

1.3 Details of Site Operator

1.3.1 This permit has been applied for by Kaug Refinery Services Limited.

1.4 Permit Boundary

1.4.1 Reference should be made to Appendix I for a map showing the proposed permit boundary for the site.

1.5 Documents Consulted

1.5.1 The following guidance documents have been consulted for the purpose of completing this supporting document:

- Process Guidance Note 2/09(13): Statutory guidance for metal decontamination processes and installations, DEFRA, July 2013; and,
- Process Guidance Note 2/03(13): Statutory guidance for electrical furnaces, DEFRA, July 2013.

2 Operating Techniques

2.1 Overview

2.1.1 The proposals are for the development of a facility for the recovery of precious metals from wastes at Merse Road, Redditch. A series of chemical, physical and thermal treatment processes will be used.

2.1.2 Reference should be made to Appendix I for the proposed site layout plan.

2.2 Description of Process

2.2.1 The proposals are for the operation of a specialist facility for the recovery of precious metals from various metal containing wastes. The types of wastes accepted will typically include the following:

- Printed circuit scrap and edge connectors;
- Connectors, switches and pins;
- Reel to reel;
- Webbing & stamping scrap;
- Gold rags, wipes, bottles etc;
- Screen printing waste;
- Lithographic waste;
- China;
- Gold colour;
- Gold plating solutions and dragouts;
- Gold stripping solutions;
- Silver solutions;
- Platinum, Palladium and Rhodium solutions;
- Ion exchange resins;
- Filters;
- Carbon packs;

- Anodes;
- Polishings and sweeps;
- Lemels and cuttings;
- Bombing (stripping) solutions;
- De-burring;
- Fan dust;
- Polishing grain;
- Casting scrap;
- Crucibles; and,
- Clean scrap.

2.2.2 Due to the nature of the waste to be received at site, the quantity will be relatively modest, with up to 250 tonnes per annum of wastes to be accepted on site. A proportion of the waste received will not undergo physical processing on site. The majority of precious metal bearing circuit boards will be sorted/batched and shipped on for further recovery.

2.2.3 The site will include a number of processes to extract and recover various precious metals. including processes such as shredding, acid and alkali digestion, operation of a small scale thermal appliance for removal of non-metal contaminants and small scale metal smelting processes. The chemical and physical treatment operations will be regulated by the EA in accordance with a waste EP. The metal smelting furnaces and small scale thermal appliance will be regulated by WRS in accordance with a Part B permit.

2.2.4 Essentially, the processes undertaken on site will be the same as currently undertaken by the permit applicant at their existing site, operated under permit no. FP3691FN/V004, which is regulated by the Environment Agency (EA). The following table summarises plant and equipment to be used, function and confirmation on the relevant permit and regulator.

Table 2.1 – Unit Operations and Permits Required

Plant Description	Purpose/Function	Required Permit and Regulator
Steam boiler (200KWh rated thermal input) (x 2)	Steam raising for acid and alkaline digestion processes	Bespoke waste EP (to be regulated by EA)
225 litre glass lined steam jacketed vessel (x 4)	Dissolution of precious metal away from other substrates using acid	Bespoke waste EP (to be regulated by EA)
Acid solution precipitation tanks	Precipitation of precious metals from acid solutions	Bespoke waste EP (to be regulated by EA)
Acid scrubber	Fume abatement from acid dissolution process	Bespoke waste EP (to be regulated by EA)
1000 litre stainless steel steam jacketed kettle 450 litre stainless steel steam jacketed kettle 80 litre stainless steel steam jacketed kettle	Chemical precipitation of precious metals from alkaline solutions	Bespoke waste EP (to be regulated by EA)
Alkaline strip line	Surface stripping of precious metals within alkaline solutions	Bespoke waste EP (to be regulated by EA)
Chiller	Provides cooled water for condensers	Bespoke waste EP (to be regulated by EA)
1KW electric oven 12KW electric oven	Drying of precious metal precipitates	Bespoke waste EP (to be regulated by EA)
50kg crushing and grinding mill (x2) 100kg crushing and grinding mill	Grinding and crushing of precious metal bearing material	Bespoke waste EP (to be regulated by EA)
Small scale thermal appliance for metal decontamination (500KWh rated thermal input)	Thermal treatment of precious metal bearing material to remove organic material	Part B permit (to be regulated by WRS)
60KW electrical induction furnace 112KW gas fired furnace	Melting of precious metals to form ingots	Part B permit (to be regulated by WRS)
Shredder	Shredding of circuit boards	Bespoke waste EP (to be regulated by EA)
Laboratory	Precious metal analysis	Bespoke waste EP (to be regulated by EA)

2.3 Part B Activities

- 2.3.1 The Part B activities to be installed include a small scale thermal appliance for the removal of organic contaminants from precious metal bearing materials and a gas and electrical induction furnace for melting precious metals to form ingots.
- 2.3.2 The small scale thermal decontamination unit will be an Addfield G20B unit. This will be used to remove organic contaminants from precious metal bearing waste by combustion at high temperature to remove non-metal contaminants. The thermal input of the appliance will be 500KW.
- 2.3.3 The furnaces will be used to melt precious metal material to form ingots. The gas furnace will be a Bentone furnace, model no. STG146/2 and have a thermal input of 112KW. The electric induction furnace will be a Radyne furnace, model no. 20TQ50 and will have a thermal input of 60KW.

2.4 Environmental Management System

- 2.4.1 An Environmental Management System (EMS) will be implemented on a day to day basis at the site. This will contain measures and procedures to ensure operations and associated emissions are sufficiently controlled to prevent potential for adverse impacts on air, land or water and to ensure that site staff are appropriately trained to carry out their duties with protection of the environment as a fundamental requirement. Reference should be made to Appendix II for a copy of the EMS for the operation. It should be noted that this EMS is an overarching document which covers all operations on site, including both waste and Part B permitted activities.

3 Potential Atmospheric Emissions and Control

3.1 Point Source Emissions to Air

3.1.1 Emissions from the small scale melting furnaces and thermal decontamination appliance will be directed to a dedicated abatement system and then released via an elevated flue, as shown on the layout plan, denoted by emission point A4.

3.1.2 The thermal decontamination appliance will be subject to Emission Limit Values (ELVs) contained with Process Guidance (PG) Note 2/09(13)¹, whilst it has been agreed with the regulator that the melting furnaces will be subject to ELVs contained within PG Note 2/03(13). Emission limits for these processes are outlined within the table below.

Table 3.1 – Emission Limits – Emission Point A4

Pollutant	ELV/Emission Concentration for Exhaust from Thermal Decontamination Unit, Expressed at 273.1K, 101.3KPa, dry gas, 11% oxygen (mg.Nm⁻³)	ELV for Melting Furnaces (mg.Nm⁻³) (Expressed at 273.1K, 101.3KPa, no correction for oxygen or water vapour)
Total particulate matter	20	20
Chloride	10	-
Organic Compounds	20	-

3.1.3 The following abatement will be used to control point source air emissions associated with thermal appliances:

- Sorbent injection including a mix of activated carbon and sodium biocarbonate to control emissions of acid gases and organic compounds; and,
- Bag house filtration system to control potential emissions of particulate matter.

¹ PG 2/09(13) – Statutory Guidance for Metal Decontamination Processes and Installations, DEFRA, July 2013.

- 3.1.4 The metal decontamination appliance will be fitted with a secondary combustion chamber, which will ensure the gases are raised to a minimum of 850C for a minimum of 2 seconds, to ensure complete combustion and control of emissions. Wastes will not be loaded to the unit until the temperature of the secondary chamber has reached 850C. The temperature of the secondary chamber will be continuously monitored. The residence time will be achieved by suitable sizing of the secondary chamber.
- 3.1.5 An elevated flue will be used to dilute and disperse residual emissions from the abatement plant serving the metal decontamination furnace and melting furnaces. The stack will be 9.44m in height from ground level. The height has been verified as adequate by the emissions modelling assessment. A copy of this report is included within Appendix III.
- 3.1.6 The flue will be cleaned on a regular basis as part of routine maintenance to prevent accumulation of materials.
- 3.1.7 The PG note advises that a target exit velocity of $15\text{m}\cdot\text{s}^{-1}$ should be maintained from the flue. A stack exit velocity of $9.16\text{m}\cdot\text{s}^{-1}$ is expected to be achieved from the flue. Although this is lower than the target velocity outlined in the guidance, the emissions modelling assessment within Appendix III has demonstrated that this will be sufficient to achieve acceptable air quality impacts at surrounding locations.

3.2 Fugitive Emissions to Air

- 3.2.1 The treatment processes will be contained within a building and also be very small scale in nature. As such, fugitive emissions will not be significant.
- 3.2.2 Metals which have been decontaminated in the thermal appliance will not be removed from the combustion chamber until all combustible contaminants have been completely burned, or until no further smoke or visible emissions are likely to arise.
- 3.2.3 Should spillages occur, these will be cleaned and returned to the job as they would contain valuable precious metals.

3.2.4 Good housekeeping will be maintained on site at all times.

3.3 Preventative Maintenance

3.3.1 In addition to the physical abatement methods used, regular servicing and preventative maintenance will be undertaken on the appliances to ensure efficient operation.

3.4 Odour

3.4.1 Due to the nature of materials to be handled, odour is not expected to be a significant issue. The high temperatures used in the thermal appliances will result in destruction of odour and the release of residual exhaust gases via an elevated flue will result in dilution and dispersion of any residual odours.

3.4.2 Despite the above, a complaints procedure will be implemented during the day to day operation to ensure full investigation and remedial action for odour related issues. Reference should be made to the EMS within Appendix II for complaint reporting procedures.

4 Emissions Monitoring

4.1 Extractive Emissions Testing

4.1.1 In accordance with the Part B EP, periodic emissions monitoring is required on the exhaust serving the thermal appliances. Residual emissions from these processes are released via emission point A4, as shown on the layout plan. The emission limits which apply and monitoring requirements are outlined in the tables below.

Table 4.1 – Emission Limits and Monitoring Requirements – Metal Decontamination Appliance

Pollutant	Emission Limits (mg.Nm ⁻³) Expressed at Reference Conditions of 11% O ₂ , 273.1K, 101.3kPa, dry gas	Monitoring Frequency	Monitoring Method
Total particulate matter	20	Continuous indicative	Opacity dust monitor
		Annual extractive test	EN 13284-1
Organic compounds excluding particulate matter	20	Annual extractive test	EN 12619:2013
Chloride compounds excluding particulate matter	10	Annual extractive test	EN 1911

Table 4.2 – Emission Limits and Monitoring Requirements – Electric and Gas Fired Melting Furnaces

Pollutant	Emission Limits (mg.Nm ⁻³) Expressed at Reference Conditions of 273.1K, 101.3kPa, no correction for oxygen and moisture content	Monitoring Frequency	Monitoring Method
Total particulate matter	20	Annual extractive test	EN 13284-1

4.1.2 The process is highly specialised and small scale and the thermal treatment processes are operated on a batch basis, as and when required. Therefore, it may not always be possible to provide the regulator with 7 days notice of proposed emissions monitoring.

4.1.3 Results from the above non-continuous monitoring exercises will be forwarded to the regulator within 8 weeks of completion of the sampling. Any adverse/non-compliant results will be investigated as soon as the results of the monitoring are received and the operator will:

- Identify the cause and take corrective action;
- Clearly record as much detail as possible regarding the cause and extent of the problem, and the remedial action taken; and,
- Re-test to demonstrate compliance as soon as possible; **and** inform the regulator of the steps taken and the re-test results.

4.2 Visual Monitoring

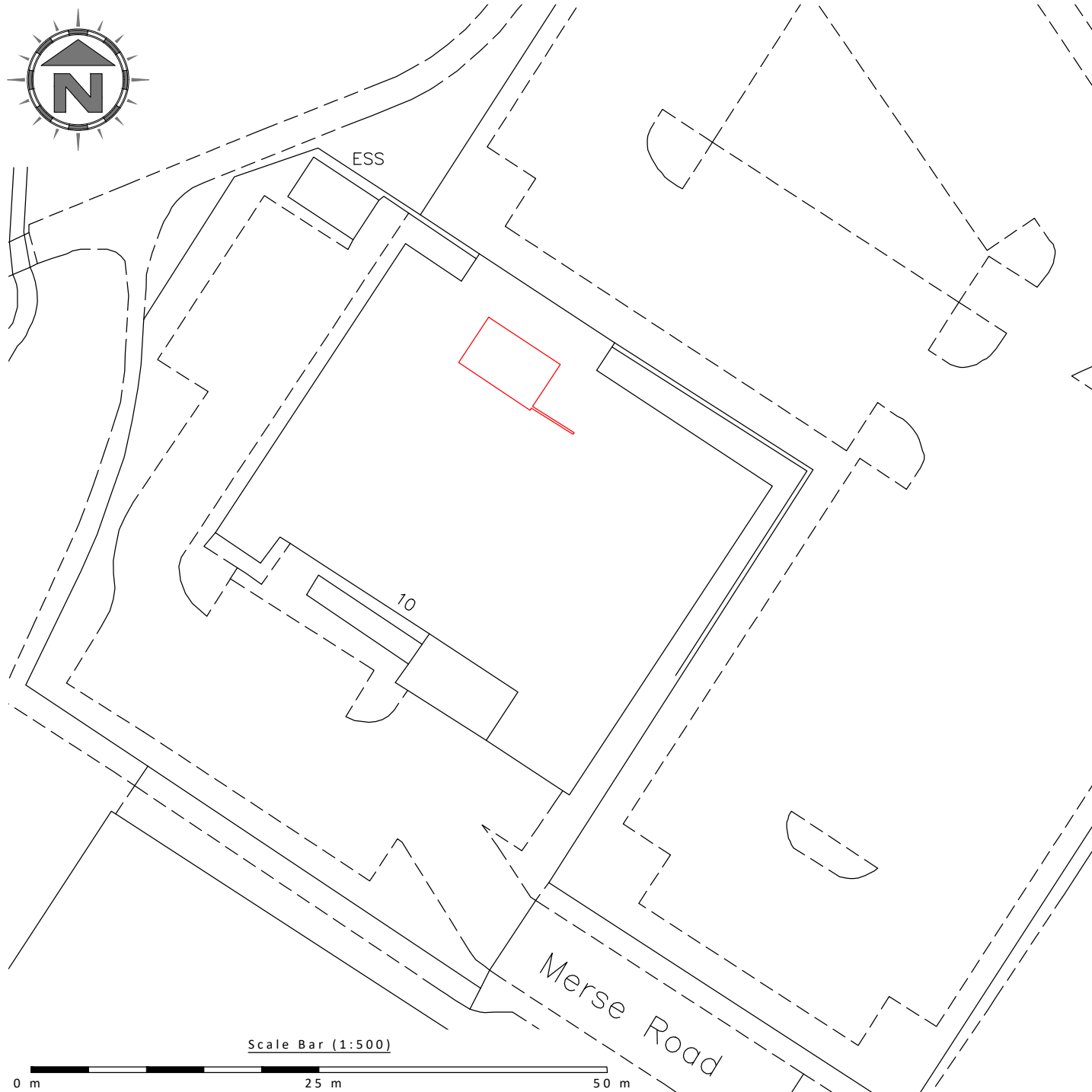
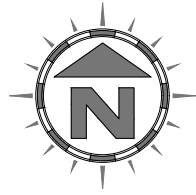
- 4.2.1 Emissions from the combustion process should be free from visible smoke and not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:2009. All emissions from air should be free from droplets and persistent visible emissions. Stack emissions will be visibly monitored on an ongoing basis by site staff and at least one inspection per day will be made during operation of the thermal appliances.
- 4.2.2 A complaints procedure will be implemented during the day to day operation to ensure full investigation and remedial action for air emission related issues. Reference should be made to the EMS in Appendix II for reporting procedures.
- 4.2.3 All monitoring results and subsequent actions will be recorded in the site log book and kept on-site and made available for WRS to examine for a minimum period of two years. Any records of monitoring kept off-site should be made available for inspection by WRS within one working week of request by WRS.

5 Potential Impacts on the Environment

- 5.1 Detailed assessment (modelling) has been undertaken to assess potential impacts associated with point source emissions from the thermal treatment processes. Reference should be made to document ref: 2765-009-C within Appendix III for a copy of this assessment. This has demonstrated that potential impacts on the environment will not be significant.

Appendix I

Permit Boundary Plan and Site Layout Plan




NOTES

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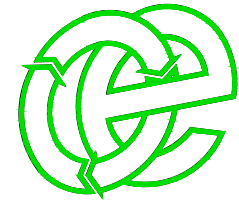
REVISION HISTORY

Rev:	Date:	Init:	Description:
-	22.03.23	IA	Initial drawing
A	17.04.23	IA	Drawing amendments

KEY:

 Part B permit boundary

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants



DRAWING TITLE

PART B PERMIT BOUNDARY PLAN

CLIENT

Kaug Refinery Services Ltd

PROJECT/SITE

10 Merse Road, North Moons Moat, Redditch, B98 9HL

SCALE @ A4

1:500

CLIENT NO

2765

JOB NO

011

DRAWING NUMBER

2765-011-02

REV

A

STATUS

Issued

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JH/IA

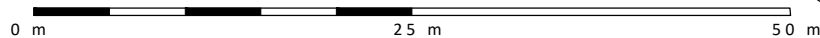
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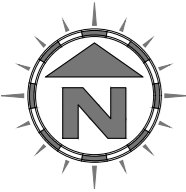
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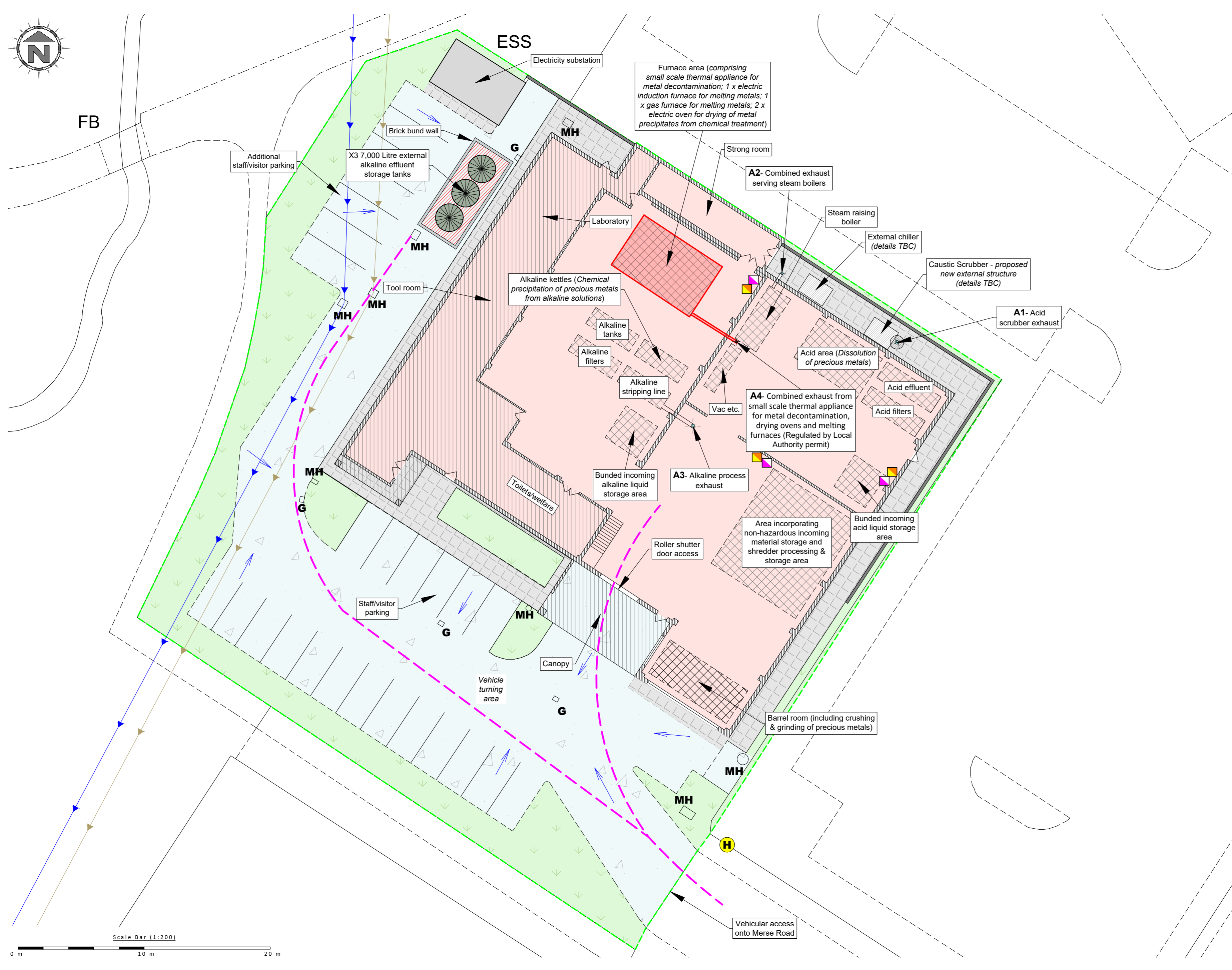
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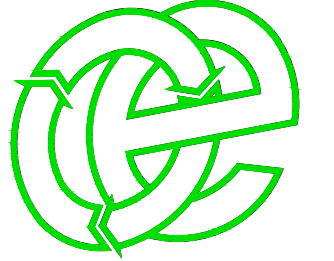


NOTES
 Site survey undertaken using Intel Falcon 8+ drone in September 2022. Ordnance Survey data reproduced with the permission of the controller of H.M.S.O. Crown copyright licence No. 100022432. This drawing is copyright and property of Oaktree Environmental Ltd.

Rev:	Date:	Init:	Description:
-	05.12.22	JH	Initial drawing
A	15.12.22	IA/JH	Drawing amendments
B	05.01.23	IA	Address update
C	22.03.23	IA	Layout changes
D	17.04.23	IA	Drawing amendments
E	04.05.23	IA	EA comments

- KEY:**
- Waste EP Permit boundary (regulated by Environment Agency)
 - Part B Permit boundary (regulated by Local Authority)
 - Sealed buildings
 - Concreted areas
 - Un-surfaced areas
 - Spill kit
 - Firefighting equipment
 - Access routes for emergency vehicles
 - H Hydrant
 - MH** Manhole
 - G** Gully
 - Fall direction arrows
 - Paved areas

Oaktree Environmental Ltd
 Waste, Planning and Environmental Consultants



DRAWING TITLE
 SITE LAYOUT PLAN

CLIENT
 Kaug Refinery Services Ltd

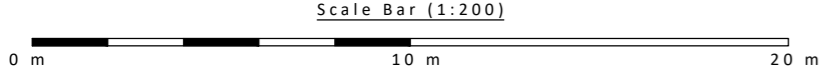
PROJECT/SITE
 10 Merse Road, North Moons Moat, Redditch, B98 9HL

SCALE @ A2 1:200 **CLIENT NO** 2765 **JOB NO** 010

DRAWING NUMBER 2765-010-03 **REV** E **STATUS** Issued

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Appendix II

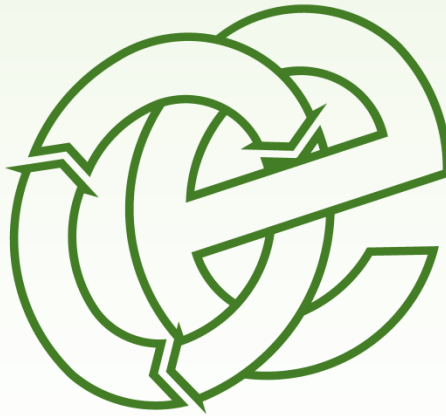
Environmental Management System

ENVIRONMENTAL MANAGEMENT SYSTEM

10 Merse Road, Moons Moat North Industrial Estate, Redditch B98 9HL

Kaug Refinery Services Limited

Version:	1.5	Date:	17/05/2023		
Doc. Ref:	2765-010-A	Author(s):	IA	Checked:	KRS
Client No:	2765	Job No:	010		



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1.0	03/08/2022	IA	DY	Internal draft
1.1	04/01/2023	IA	DY	Updated draft
1.2	18/01/2023	IA	DY	Summary submitted with waste EP application
1.3	17/04/2023	IA	DY	Updated for Part B Permit Application
1.4	04/05/2023	IA	DY	Amended following client comment
1.5	17/05/2023	IA	DY	Further amendment following client comment

THIS DOCUMENT IS DUE FOR REVIEW IN **MAY 2025** OR AS A RESULT OF ANY INCIDENTS WHICH MAY LEAD TO THE REQUIREMENT FOR IMMEDIATE REVIEW, WHICHEVER IS THE SOONER

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Appendix I - Drawings

Drawing No. 2765-010-02 – Permit Boundary Plan – EA Regulated Waste Operations

Drawing No. 2765-011-02 – Permit Boundary Plan – Part B Permit

Drawing No. 2765-010-03 – Site Layout and Fire Plan

Appendix II - Record Keeping Forms (advisory only)

KRS/RF/2 - Rejected Waste

KRS/RF/4 - Site Diary/Inspection Form

KRS/RF/6 - Employee Training Needs Assessment / Review

KRS/RF/7 - Complaints Form

****The above forms are advisory only, alternative forms of the operator may be used electronically**

Appendix III - Environmental Permits

Appendix IV - Health & Safety – Conditions of Site Use for Staff and Visitors

Appendix V - Permitted Waste Codes

Site Information & Key Contacts List

Site Address:	10 Merse Road, Moons Moat North Industrial Estate, Redditch B98 9HL		
Site Operator:	Kaug Refinery Services Limited	National Grid Ref:	407336, 268807

CONTACT	DESCRIPTION	OFFICE HOURS	OUT OF HOURS
Adrian Coldicutt	TCM	(0121) 7724029	N/A
<u>Alexandra Hospital</u> Woodrow Dr, Redditch B98 7UB	Local NHS Hospital (Main)	01527 503030	999
<u>Redditch Police Station</u> 105 Archer Rd, Redditch B98 8DJ	Local Police Non-Emergency	03003333000 or 101	999 or 112
<u>Hereford and Worcester Fire & Rescue Service</u> Redditch Fire station, 226 Birmingham Rd, Redditch B97 6EL	Fire and Rescue Service (in Emergency Dial 999)	01527 62223	999
<u>Environment Agency</u>	Environmental Regulator	03708 506506	0800 807060
<u>Redditch Borough Council</u> The Town Hall, Walter Stranz Square, Worcestershire, B98 8AH	County Council General Enquiries	01527 881770	999 or 112
<u>Severn Trent Water</u>	Mains water supplier	0800 783 4444	0800 783 4444
<u>Oaktree Environmental Ltd</u> Lime House, 2 Road 2, Winsford, Cheshire CW7 3QZ	Specialist Advisor (Waste and Planning Issues)	01606 558833	999 or 112 or 0800 807060

1 General Considerations

1.1 Site operator/permit holder

1.1.1 Kaug Refinery Services Limited are the operator of the permitted site. The site will be operated predominantly under a bespoke Environmental Permit (EP) for chemical and physical treatment and storage activities. The EP will be regulated by the EA under the Environmental Permitting (England & Wales) Regulations 2016. In addition, a small scale thermal appliance for metal decontamination and small scale melting furnaces will be operated at the site. These will be regulated by Worcestershire Regulatory Services (WRS) in accordance with a Part B permit. An EMS has been created to enable the operator to achieve compliance with both EPs.

1.2 Relevant contacts

1.2.1 The contact details for the operator are as follows:

Kaug Refinery Services Limited	Contact: Adrian Coldicutt
10 Merse Road, Moons Moat	Position: Director
North Industrial Estate, Redditch	E-mail: adrian@kaugrefinery.co.uk
B98 9HL	

1.2.2 Oaktree Environmental Ltd have been engaged to act as consultants for Kaug Refinery Services Limited to assist in the preparation of this Environmental Management System (EMS). This EMS has been prepared to meet the requirements of the Environmental Permitting (England and Wales) Regulations 2016.

1.2.3 Contact details for Oaktree Environmental are as follows:

Oaktree Environmental Ltd	Contact: David Young
Lime House	Position: Principal Consultant
2 Road Two	Tel: 01606 558833
Winsford	E-mail: david@oaktree-environmental.co.uk
Cheshire CW7 3QZ	

- 1.2.4 A full list of relevant contacts (including key emergency contact numbers) are provided in the Site Information & Key Contacts List section in the pre-pages of this document.

1.3 Site location

- 1.3.1 The site is located on Land at 10 Merse Road, Moons Moat North Industrial Estate, Redditch B98 9HL as shown on Drawing No. 2765-010-02.

1.4 Permit area/waste management operations

- 1.4.1 The operations will be regulated in accordance with a bespoke waste EP and a Part B EP. The waste EP will be regulated by the EA and Part B Permit by WRS. The waste EP permit boundary is outlined on Drawing No. 2765-010-02 and Part B permit boundary shown on Drawing No. 2765-011-02. This EMS should be read in conjunction with the site's Fire Prevention Plan (FPP) which is referenced as 2765-010-B.

- 1.4.2 An EP is required for the storage (keeping) prior to removal, and treatment (all types of handling/processing) of waste and also for the operation of small scale thermal appliances.

- 1.4.3 Specified waste management operations include waste disposal and waste recovery operations listed Annex IIA and IIB of The Waste Framework Directive 2008/98/EC.

1.5 Hours of operation

- 1.5.1 The site will typically be operated in accordance with the following hours for the delivery and receipt of waste on site; including depositing, sorting, moving, storing, treating and removing waste:

Monday to Friday	06:00 – 17:00
Saturday	No operations
Sundays, Bank/Public holidays	No operations

- 1.5.2 During periods of overtime, the above hours may be increased to 06:00 to 22:30.

1.5.3 The only other activities on site which will be permitted outside of operational hours, will be maintenance works, emergency deliveries of waste/ plant machinery and general office use.

1.5.4 During the times when the site is closed and not operating, the site buildings will be locked and secured to prevent unauthorised vehicle and/or pedestrian access.

1.6 Waste Storage, Types and Quantities

1.6.1 The locations of the operational and storage areas are shown on Drawing No. 2765-010-03.

1.6.2 A detailed breakdown of the waste types allowed for acceptance at the site will be shown in the environmental permit.

1.6.3 The site will accept a maximum of 250 tonnes of precious metal containing wastes per annum.

1.7 Exempt waste activities

1.7.1 Activities which are outside the scope of the waste EP for the site (listed in Schedule 3 of The Environmental Permitting (England and Wales) Regulations 2016) may be carried out at the site and the relevant details would be registered with the EA prior to commencement.

1.7.2 Current and future exemption notifications and register entries will be held in the site office. Registered exemptions are valid for a period of 3 years. If the activity is to be carried on after 3 years, a renewal will be submitted to the EA.

1.7.3 Wastes brought onto site as part of any exempt waste activities will be kept clearly segregated and identified from those wastes imported for the specified waste management operations and be shown on Drawing No. 2765-010-03.

1.8 Staffing and management

1.8.1 The table below details the staff structure of the site when operating at full capacity.

Table 1.1 - Staffing numbers and responsibilities

Position	Employees	Responsibilities
Directors	2	Overseeing management of the site
Factory Manager	1	Management of the site and responsible for day-to-day operations
Deputy Factory Manager	1	Responsible for day-to-day operations
General operatives	7	Responsible for day-to-day operations

1.9 Health and safety

1.9.1 All operations on site will be carried out in accordance with the relevant requirements of the Health and Safety at Work Act 1974. Conditions of site use for employees, visitors and contractors are shown in Appendix IV. These conditions will be shown to all site users and must be signed prior to using the site. Anyone refusing to comply with the conditions of use will be asked to leave the site.

1.10 Fit and proper persons

1.10.1 The site will assign a Technically Competent Manager (TCM) who will provide the required attendance time at the facility as required by guidance periodically issued by the EA. A copy of the appointed TCM's Certificate of Technical Competence (COTC) will always be made available in the site office.

1.10.2 The company, through the TCM, will ensure that a nominated deputy is sufficiently trained and familiar with the EP and this EMS document in addition to all relevant company procedures who, in the absence of the TCM, will act the competent person. If either the TCM or deputy is changed, the EA will be informed of the change and the relevant details of the replacement as soon as possible.

1.11 Convictions

- 1.11.1 At the time of application, neither Kaug Refinery Services Limited nor any of the relevant people within the company had been convicted of a relevant offence.

2 Site Engineering and Infrastructure

2.1 Site description

2.1.1 The site is located as shown on Drawing No. 2765-010-02. The site benefits from a number of parking spaces for staff, visitors, HGV's and trailers, as shown on Drawing No. 2765-010-03.

2.2 Access and parking

2.2.1 The site is accessed from Merse Road and parking is also available on site as shown on Drawing No. 2765-010-03.

2.3 Site office

2.3.1 The site office will be located as shown on Drawing No. 2765-010-03. The documents listed below will be retained in the site office.

Documents to be retained in site office
Environmental Permits (original & any subsequent variations)
This Environmental Management System
Current site diary (to record all inspections/visitors to the site)
Environment Agency Inspection (CAR) forms
Local Authority Inspection forms
In-house inspection sheets/recording forms
Duty of care transfer notes (for 2 years minimum)
Hazardous waste consignment notes (kept for 5 years)
Waste delivery tickets
Accident book (& 1st aid kit)

2.4 Notice board and signs

2.4.1 A notice board will be erected at the site entrance displaying the following information:

- The site name and address.
- The name of the permit holder and operator.
- The Environmental Permit numbers and accompanying statement stating that the site is permitted by the EA and WRS.
- Environment Agency contact details,
- WRS contact details.
- Operator's "out of hours" emergency contact details.
- Operating hours.

2.4.2 Additional signs will be displayed around the site for operational / health & safety purposes. All staff and visitors will be required to comply with the requirements of all signs whilst on site.

2.5 Site security

2.5.1 The main entrance/exit gates are located as shown on Drawing No. 2765-010-03 and are of steel construction. The gates are padlocked at all times when the site is unmanned to prevent vehicular access.

2.5.2 The site security measures will be inspected on a daily basis and any defects which impair the effectiveness of the security will be repaired by the end of the working day. If this is not possible, temporary measures will be put in place to ensure no unauthorised access to the site can be gained until the proper repairs can be carried out as soon as practicably possible.

2.5.3 The site will include fully monitored 24hr CCTV and alarm system.

2.5.4 If unauthorised access becomes apparent as a problem at the site the security measures will be reviewed and improvements implemented.

2.6 Fuel storage

2.6.1 No fuel storage is currently proposed, but in the event that fuel is to be stored, procedures for fuel storage on site will be as follows:

- Tanks will be surrounded by a bund capable of containing a minimum of 110% of the volume of fuel stored in the tank.
- All pipework and associated infrastructure will be enclosed within the bund.
- A lock will be fitted to the tank valve to prevent unauthorised operation.
- All valves and gauges on the bund will be constructed to prevent damage caused by frost.
- No combustible waste will be stored within 6 metres of the tank.

2.6.2 The tank will be clearly marked showing the product within and also its capacity.

2.7 Rejected Waste

2.7.1 Any waste which is rejected will be stored in the quarantine area removed from the site as soon as practicably possible.

2.8 Drainage

2.8.1 The drainage for the site is clearly shown on Drawing No. 2765-010-03.

2.9 Vehicles, plant and equipment

2.9.1 Waste will be handled using the plant listed below. Only trained operators will be permitted to drive/operate the plant listed below. Any changes to the list will be notified to the regulator prior to implementation.

Table 2.1 - Plant & Equipment

Item	Number	Function
Fork lift truck	1	Movement of waste/containers

2.10 Mobile and fixed plant maintenance

2.10.1 All mobile and fixed plant on site including vehicles in the fleet will be subject to annual manufacturer maintenance to ensure proper working order in the form of service contracts.

2.10.2 Site management will undertake or delegate additional preventative maintenance checks on a more frequent basis i.e. daily, before, during and 1 hour at the end of each working day using a checklist similar to that in Appendix II to ensure the following:

- Machinery is mechanically sound for use and no presence of black fumes or trailing liquids visible prior to use or following shutoff of plant/equipment.
- All plant will be powered-down and completely shut off prior to cessation of operations on any given day.
- Plant which is not in use for any extended period is stored at least 6 metres from combustible waste.
- All vehicles will be fitted with fire extinguishers in the cab. Rubber strips are not considered appropriate as they are usually removed via uneven and bumpy ground.

2.10.3 A 'no-idling' policy will be in place which ensures that engines are switched off when vehicles or plant are not in use. This policy will ensure that tail pipe emissions are significantly reduced.

3 Site Operations

3.1 Preliminary procedures - general

3.1.1 Guidance will be given by the site management to all employees, sub-contractors, other waste carriers and customers regarding the waste types and operations which are acceptable at the site i.e. a copy of Appendix III of this document. The site will be used for the acceptance, storage and processing of waste using Kaug Refinery Services Limited's own vehicles/contracts and also for third-party users/hauliers whose details would be checked prior to the delivery/collection of waste.

3.1.2 The procedures below would be followed prior to the receipt of waste on site.

3.1.3 When a driver employed by the permit holder arrives at the waste producers premises he/she will inspect the load for conformity with relevant regulations and safety procedures.

- a) If the load is satisfactory the driver will sign the relevant paperwork (Duty of Care transfer note/delivery ticket) and remove the load from the premises.
- b) If the waste does not meet the description stated on the controlled waste transfer note the customer is advised to check the note and give a more detailed description of the waste.
- c) If the more detailed description of the waste reveals that the waste is not/permited at the recycling centre then the customer is advised that the waste must be taken to another site which is appropriately permitted to accept the waste(s).
- d) If further instructions are needed the driver may also report back to the site manager.
- e) Where it is suspected that the details given on the transfer note are incorrect the EA may be contacted for advice.

3.2 Preliminary procedures - hazardous wastes

3.2.1 The following procedures will be implemented on site to ensure hazardous waste is accepted, handled, stored and removed safely and without risk:

- a) In conjunction with a Duty of Care Waste Transfer Note, all incoming hazardous waste loads will be accompanied by a Hazardous Waste Consignment Note (HWCN) in accordance with the Hazardous Waste (England and Wales) Regulations 2005.
- b) Staff involved with the acceptance of incoming loads of hazardous waste will ensure the appropriate sections of the HWCN have been completed correctly.
- c) The site will store a maximum of 50 tonnes of hazardous waste at any one time.

3.3 Checking in & inspection of loads

- 3.3.1 All incoming vehicles are required to report to the site office. The details of the load will be recorded, and the transfer note and company documentation will be further checked by the operator to ensure that the load is acceptable at the site. The weight of all loads will be recorded using a weighbridge or agreed WRAP conversion weights for loads where the weight is not known upon receipt at the site. Any deviation from these procedures or problems with any loads will be reported to the site manager.
- 3.3.2 All vehicle drivers must report to the site office upon arrival at the site. All waste accepted on site will be directed to the appropriate reception area.
- 3.3.3 Once a load has been accepted, a visual inspection of the contents will be carried out to ensure that the material complies with the EP. If non-compliant waste is discovered before deposit, the load will not be accepted and disposed of at an approved facility. In cases where the presence of unauthorised waste is likely to lead to a breach of permit conditions, the EA will be contacted immediately to agree a course of action.
- 3.3.4 Loads are also examined at the point of unloading. If they are found to be unacceptable at this point the load will be reloaded and returned to source.

3.4 Hazardous waste storage procedure

- 3.4.1 The following measures will be in place on site to reduce the risk associated with storing hazardous waste:

- a) At any one time, the maximum amount of hazardous stored on site will not exceed 50 tonnes.
- b) Hazardous wastes will be stored within enclosed IBCs or bins.
- c) Hazardous wastes will not be stored on site for longer than 12 months.
- d) Hazardous wastes will not be kept in unsecured locations, such as bays or open containers.

3.5 Waste acceptance procedure

- 3.5.1 All incoming vehicles upon arrival are required to report to the person in charge of waste acceptance at the site. The details of the load will be recorded and the duty of care note/company documentation will be further checked by the operator to ensure that the load is acceptable at the site, including a visual check prior to the vehicle proceeding to the unloading area.

3.6 Waste deposit & handling

- 3.6.1 Once a load has been accepted by the operator, this will be transferred into the appropriate reception, storage and treatment area as shown on Drawing No. 2765-010-03.

3.7 Waste/product removal and export

- 3.7.1 When a collection vehicle arrives at the site the driver will be instructed to report to the site office on arrival. All relevant documentation will be completed, and the vehicle will be passed to pick up the load and take it to the designated customer, recycler/disposal site. The product or waste material will be loaded onto the vehicle and quantified prior to egress from the site.

3.8 Record keeping

- 3.8.1 Kaug Refinery Services Limited use detailed waste transfer and product notes in paper and electronic form to ensure compliance with the Waste Duty of Care Code of Practice - March 2016 (Section 34(9) of the Environmental Protection Act 1990). The following points detail

the correct information required in order to comply with the Waste Duty of Care Code of Practice which the operator will provide on all documentation:

- a written description of the waste which has been agreed and signed by the operator and the next holder. The description is part of the waste information the operator will provide.
- a statement confirming that the operator has fulfilled the duty to apply the waste hierarchy as required by regulation 12 of the Waste (England and Wales) Regulations 2011 (see Waste Hierarchy Guidance for England and Wales)
- the description of the waste is accurate and contains all the information required to ensure the lawful and safe handling, transport, treatment, recovery or disposal by subsequent holders, including classification of the waste by using the appropriate codes (referred to as the List of Wastes (LoW) or European Waste Catalogue (EWC)) - Appendix A of the Waste Classification Technical Guidance provides a list of the codes as well as advice on how to assess and classify waste.
- the quantity and nature and whether it is loose or in a container, if in a container, the type of container
- the time and place of transfer
- the SIC code of the transferor (current holder of the waste)
- the name and address of the transferor and transferee (person receiving the waste) and their signatures (the signature can be electronic as long as an enforcement officer can view it)
- the capacity in which the transferor and transferee are acting (e.g. as a producer, importer or registered waste carrier, broker or dealer) and their relevant authorisation to act in that capacity (e.g. their permit number or registration number)

3.8.2 For non-hazardous waste this will be done by using a paper WTN and form to fill in or alternative documentation e.g. an invoice, as long as it contains all the required information.

3.8.3 A waste information note will not be required for non-hazardous waste if the waste holder does not change on the transfer of waste e.g. the waste is moved to other premises belonging to the same business. However, it is best practice that the business understands

who has responsibility for that waste and a record is kept of internal transfers for audit purposes.

3.8.4 **Hazardous waste:** Hazardous waste acceptance will be done using a fully completed HWCN and sent to a suitably permitted site, the records of which will be kept for 5 years.

3.8.5 A summary of waste types and quantities deposited at and removed from the site and origin and destination details are then forwarded to the EA using the standard Generic Operator Returns electronic spreadsheet(s), with submission due within one month of the end of each quarter as below:

- a) Quarter 1: January to March (due on or before 30th April)
- b) Quarter 2: April to June (due on or before 31st July)
- c) Quarter 3: July - September (due on or before 31st October)
- d) Quarter 4: October - December (due on or before 31st January of the following year)

3.8.6 Outcomes of inspections of waste types, hardstanding areas, transfer/treatment areas, storage areas, drainage channels, etc. are recorded using the site inspection form or similar document and detailed comments are entered into the site's diary (including action taken or proposed).

3.8.7 Visitors to the site are made to sign the visitor's book upon arrival and exit stating the purpose of their visit and whom they represent.

3.9 Management techniques

3.9.1 All measures necessary to achieve a high level of protection of the environment and to ensure that the site is operated in accordance with the various management systems and permit conditions will be strictly adhered to.

3.9.2 The manner in which the facility is managed is a critical element in ensuring emissions from the site operations are minimised. Therefore, management of this facility ensures:

- a) Staff are competent to manage and operate the facility i.e. fit and proper persons;

- b) Waste acceptance procedures are in place;
- c) Appropriate storage and handling procedures are in place;
- d) Waste/product dispatch procedures are in place;
- e) Procedures and control techniques in place to minimise potential emissions to air, land and water;
- f) There is an EMS, i.e. this document, in place to ensure standards are maintained, including incidents and complaints management procedures;
- g) A communication programme is in place; and,
- h) A health and safety programme is in place and is coherently conveyed to all staff and rigorously enforced throughout the whole of the organisation.

3.10 Site closure plan

3.10.1 In the event that the site ceases to operate as a waste transfer/treatment facility as set out in the site's EP, the following steps will be followed to achieve site closure:

- a) Contact the EA and WRS to advise the Environment Officer(s) that the site is planned to cease/has ceased the acceptance of wastes under the permits.
- b) The amount of residual processed & unprocessed waste on site will be assessed by the TCM to set a timetable for the final processing and timely removal of waste from site.
- c) Following removal of all waste, plant and machinery from site a Site Investigation will be undertaken to ascertain the ground conditions of the land to which the site relates. Surrender applications will then be submitted to the EA and WRS for determination.

4 Environmental Control, Monitoring and Reporting

4.1 Breakdowns and spillages

- 4.1.1 In the event of breakdown of mobile plant, an alternative machine will be brought on site until it is repaired.
- 4.1.2 All site surfaces will be inspected daily when the site is in operation.
- 4.1.3 Any spillages of fuel/oil will be cleared immediately by depositing sand or absorbents on the affected area. The sand or absorbents will be placed in a skip to be taken to a suitably permitted site for disposal. All spillages of waste and windblown litter will be cleared by the end of the working day in which they occur. Spillage clearance procedures are detailed in Section 5.4.
- 4.1.4 All wastes liable to give rise to contamination will be removed from the site if the site is not secure or if operations cease or are temporarily suspended.

4.2 Site inspections and maintenance

- 4.2.1 The type and inspection frequencies for maintenance/housekeeping are listed on record form KRS/RF/4 as an advisory. The inspection form will be completed by a person who is familiar with the requirements of the EMS and EPs for the site. All details of defects, problems and repairs carried out will be recorded on the form on the day that each event occurs. Detailed comments may also be recorded in a site diary. All repairs will be carried out as soon as practically possible.
- 4.2.2 All repairs to site security will take place as soon as practically possible and the site will be made secure until the repair has been carried out. Any major defects found during the daily site inspection will be repaired as soon as practically possible.

4.3 Control of dust

4.3.1 The operator is aware that the containment of dust on site and the prevention of its escape is paramount to operational compatibility with local businesses and residents.

4.3.2 Given the nature of the operations, scale of facility and location of all processing operations inside a building, dust is not expected to be a significant issue.

4.4 Odour control

4.4.1 Odour is not expected to present an issue, given the small quantities of wastes to be handled, the types of wastes to be treated and enclosure of all operations within a building.

4.4.2 The complaints procedure in record form KRS/RF/7 will be rigorously enforced should a third-party complaint be received from a public or private source.

4.5 Litter control

4.5.1 Given the storage procedures and nature of wastes to be accepted at the site, the risk of litter escaping the site boundary is deemed very low/negligible.

4.6 Control of pests, birds and other scavengers

4.6.1 Given the types of wastes to be accepted, pests are not anticipated to pose an issue. If any occurrences are noted, a pest controller will be called to site to eradicate the problem.

4.7 Control and monitoring of noise & vibration

4.7.1 The location and surrounding land uses means noise associated with the operations will not greatly increase the existing noise level in the surrounding area. The waste operations will be carried out using the best practicable means at all times.

4.7.2 Reference should be made to the operator’s Noise and Vibration Management Plan (NVMP) for details of measures that will be implemented to control noise to an acceptable level.

4.8 Point Source Emissions Monitoring

4.8.1 In accordance with the Part B EP, periodic emissions monitoring is required on the exhaust serving the thermal appliances used on site, including metal decontamination unit and melting furnaces. Residual emissions from these processes will be released via emission point A4, location shown on the layout plan in Appendix I. The emission limits which apply and monitoring requirements are outlined in the tables below

Table 4.1 – Emission Limits and Monitoring Requirements – Metal Decontamination Unit

Pollutant	Emission Limits (mg.Nm⁻³) Expressed at Reference Conditions of 11% O₂, 273.15K, 101.3kPa, dry gas	Monitoring Frequency	Monitoring Method
Total particulate matter	20	Continuous indicative	Dust opacity meter
		Annual extractive test	EN 13284-1
Organic compounds excluding particulate matter	20	Annual extractive test	EN 12619:2013
Chloride compounds excluding particulate matter	10	Annual extractive test	EN 1911

Table 4.2 – Emission Limits and Monitoring Requirements – Electric and gas Fired Melting Furnaces

Pollutant	Emission Limits (mg.m⁻³) Expressed at Reference Conditions of 273.1K, 101.3kPa, no correction for oxygen and moisture content	Monitoring Frequency	Monitoring Method
Total particulate matter	20	Annual extractive test	EN 13284-1

4.8.2 All monitoring results and subsequent actions will be recorded in the site log book and kept on-site and made available for WRS to examine for a minimum period of two years. Any records of monitoring kept off-site should be made available for inspection by WRS within one working week of request by WRS.

4.8.3 In the event of adverse results (non-compliance) for both continuous and non-continuous emissions monitoring, investigation will be immediately undertaken by the site operator, who will:

- Identify the cause and take corrective action;
- Clearly record as much detail as possible regarding the cause and extent of the problem, and the remedial action taken; and,
- Re-test to demonstrate compliance as soon as possible and inform the regulator of the steps taken and the re-test results.

4.9 Complaints procedure

4.9.1 Any third-party complaints received will be recorded on form KRS/RF/7 and will include a record of the complaint, particulars of the complainant and details of any action taken to alleviate the problem to ensure the likelihood of a future third party complaint is minimised.

5 Emergency Procedures

5.1 General

5.1.1 In addition to obligations imposed by RIDDOR '13 (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013) the permit holder will notify the EA of any serious injuries to employees of Kaug Refinery Services Limited, other site users or members of the public arising as a result of operations on site. Minor injuries such as cuts and grazes etc. will be recorded in the accident book on site. Separate procedures will be used for different types of emergency. An emergency at the site is defined by the site management as follows:

“Any incident which is likely to result in harm to human health or pollution of the environment or serious breach of permit conditions and serious detriment to the amenities of the locality.”

5.1.2 For all emergency situations, the deposit of any further waste will be suspended where necessary to allow action to be taken safely. If necessary, staff and other users of the site will be evacuated to an area which is a safe distance away from the hazards. Staff handling the emergency will be provided with and trained to use the necessary PPE (personal protective equipment) unless the manager instructs them that the hazard is too severe and outside help is needed from the emergency services or specialist waste contractors. A visitor's book will be kept to check who is on site at all times.

5.2 Fire

5.2.1 Other than permitted combustion/thermal treatment activities, no waste will be burnt, and no fires will be allowed on site. In the event of a fire occurring on site, the operator/site supervisor will exercise his judgement and extinguish the fire with the water hose or suitable fire extinguisher and/or call the fire service for assistance. Any fires will be reported to the EA on the working day that they occur. All staff will be evacuated from the site if necessary. Smoking is not permitted on site. Firefighting residues will be disposed of to a permitted waste management facility.

5.2.2 The site has a fire prevention plan (FPP) in place which has been prepared to in accordance with EA guidance to meet the following objectives:

- To minimise the likelihood of a fire happening;
- To aim for a fire to be extinguished within 4 hours;
- To minimise the spread of a fire within the site and to surrounding neighbouring sites; and,
- To minimise impact of fire on people, environment and businesses.

5.2.3 The FPP is referenced as 2765-010-B.

5.2.4 For quick reference, the following actions will be taken when fire is detected or suspected (Site operatives):

- a) DON'T PANIC
- b) RAISE THE ALARM (IF NOT DONE SO ALREADY)
- c) NOTIFY THE SITE MANAGER (IF SAFE TO DO SO)
- d) **DO NOT TRY TO TACKLE THE FIRE YOURSELF UNLESS YOU ARE TRAINED IN DOING SO AND YOU ARE SURE OF THE NATURE OF THE FIRE**
- e) LEAVE USING THE MAIN ACCESS GATES AS QUICKLY AND AS ORDERLY AS POSSIBLE
- f) ASSEMBLE AT THE SPECIFIED FIRE ASSEMBLY POINT WHICH IS LOCATED BY THE SITE ACCESS GATES.
- g) THE SITE MANAGER OR DELEGATED OPERATIVE WILL BE IN CHARGE OF CALLING THE EMERGENCY SERVICES ON A999" AND ENSURING THAT ALL PERSONS WHO WERE WORKING ON THE SITE OR WHO SIGNED IN TO THE VISITOR'S BOOK ARE ASSEMBLED SAFELY
- h) INFORM ALL NEIGHBOURING PREMISES WHO ARE LIKELY TO BE AFFECTED
- i) INFORM THE ENVIRONMENT AGENCY
- j) DO NOT RETURN TO THE SITE UNTIL YOU HAVE BEEN GIVEN THE ALL CLEAR BY THE EMERGENCY SERVICES AND THE SITE MANAGER

5.3 Breakdowns

- 5.3.1 In the event of plant breakdowns, alternative plant will be sourced until the existing plant is repaired.
- 5.3.2 Essential spares for plant maintenance will be kept on site to ensure a repair can be carried out efficiently.

5.4 Spillages

- 5.4.1 If any oil and vehicle maintenance chemicals are kept on site, they will be stored securely. All chemicals required for use in the process will be stored securely.
- 5.4.2 Any wastes which would be classified as having the potential to cause polluting runoff will be stored on impermeable surfaces
- 5.4.3 All site surfaces will be inspected daily for the presence of spillages when the site is in operation.
- 5.4.4 All wastes liable to give rise to contamination will be removed from the site within an EA agreed timescale.

5.5 Adverse reactions

- 5.5.1 The site will use a variety of acid and alkaline chemicals as part of the metal recovery process. Acid and alkaline chemicals will be stored in separate designated areas in appropriately sealed containers. COSHH Risk Assessments will be undertaken for storage of chemicals. Waste acid alkaline effluents will be stored in separate designated bunded areas.

5.6 Staff shortages

- 5.6.1 In the event of unforeseen staff shortages arising from illness, suspension or no shows, the operator will make a judgement whether to reduce the number of incoming loads and divert

material to an alternative site. The operator will then seek further employment within a timely manner to ensure the site can continue to operate at its required capacity.

5.7 Operational failure

- 5.7.1 The manager will be contacted by staff in the event of any operational failure such as the breakdown of plant, systems or equipment and will decide whether operations are to continue or be suspended prior to corrective action being taken. Serious operational failures, which result in the closure of the site, will be recorded in the site diary.

6 Training for Site Staff

6.1 Training needs assessment

6.1.1 All new and existing site staff are subject to a specific training regime based on their responsibilities at the site to ensure all operations are carried out without harm to the environment or amenity of the surrounding area. Training in all aspects of the site and waste operations at the site with regard to the individual responsibilities of the site staff will help to prevent incidents occurring which may have an adverse impact on the environment and/or the employees and their co-workers.

6.1.2 An employee training record will be available at the site detailing information similar to form KRS/RF/6 in Appendix II and shall provide a comprehensive checklist for the training needs of all new site staff and also serves as a training review for existing site staff which will be carried out annually or a period set at the operator's preference.

6.2 Site rules and infrastructure training

6.2.1 This information is provided to all employees, visitors and contractors with a full understanding of the site's conditions of use, which is communicated and documented at induction for all staff with specific induction for visitors and contractors.

6.2.2 Competency should be demonstrated within this field to ensure the employee is fully aware of the site's surroundings and operations to ensure their safety and compliance with specific operating conditions at the site.

6.3 Emergency procedures training

6.3.1 All employees are required to be familiar with the Environmental Controls in Section 4.0 and the Emergency Procedures as detailed in the Section 5.0.

- 6.3.2 In addition to normal operating conditions as specified in the site rules, employees must also be trained in dealing with eventualities which may occur outside the scope of normal operating conditions, so they are aware of how to deal with these situations in advance of an occurrence.

6.4 Fire safety / firefighting training

- 6.4.1 Management must provide all employees with appropriate fire safety training with regard to their individual responsibilities.
- 6.4.2 Emergency procedures detailing what measures employees should adopt should a fire occur at the site are detailed in Section 5.2 and are covered by the 'emergency procedures' training (see Section 6.3).
- 6.4.3 Regular fire drills are undertaken by site management to ensure proper procedures are followed by employees in the unlikely event that a fire incident occurs. These will be unannounced drills and will not form part of the induction or review training as specified in Section 6.1.

6.5 Recognition of waste types training

- 6.5.1 All employees are given induction training and subsequent regular training to identify those waste types which are permitted for acceptance at the site under the site's EP and those wastes which are not. This will include specific training to identify those common wastes which may be found following deposit and are not permitted at the site and will also include more obscure wastes and how to handle these wastes safely. All employees are advised that they should refer any unrecognisable or unknown wastes to senior management, who should, in turn, follow procedures outlined in the EMS and/or contact the EA to agree a suitable method for removal.
- 6.5.2 Training is provided to all site users who handle waste on site and those in charge of administration and reporting. In-depth training will also be provided to drivers responsible

for collecting wastes from the site of production in accordance with Section 3.0. They will be trained to identify any wastes not covered by the EP for the site and inform the producer that an alternative facility must be sought for any non-compliant wastes.

6.6 Storage areas / limits training

6.6.1 Those employees who carry out their responsibilities at the site and those in senior posts must be trained to identify appropriate waste storage areas to ensure that waste storage operations comply with the requirements of the EPs for the site.

6.6.2 Employees in these roles must also be trained to recognise storage limits to ensure that they are in accordance with those specified in the EP.

6.7 Vehicle / plant preventative maintenance training

6.7.1 This training is provided specifically for the vehicle and plant operators in order to ensure that all plant and machinery is checked regularly to prevent any occurrences which may lead to any adverse impacts on the environment or human health.

6.7.2 Training will be in accordance with this document and will be based on the preventative maintenance schedule supplied by the plant/equipment manufacturer.

6.7.3 The same training will be provided to senior management enabling a dual-level maintenance programme.

6.8 Duty of care training

6.8.1 All employees dealing with consignments of waste are trained in the completion of Duty of Care Waste Transfer Notes and the appropriate auditing of destination sites and/or contractors to ensure compliance.

6.9 Plant operation training

6.9.1 Any employees who are required to operate loading or treatment plant for the movement or processing of waste will be required to undertake the necessary qualifications for the operation of the specific item of plant in question. This will be required prior to operating the plant and will be obtained through necessary external certification programmes.

6.9.2 Regardless of general plant operation certification, all operatives will be fully inducted in the operation of the specific make and/or model of plant used on site.

6.10 Permit / management System

6.10.1 All employees will be inducted into the operating conditions as prescribed in the EPs for the site. Whilst much of the above training will provide specific guidance on many aspects of these documents, all employees will be made aware of the location of the EPs and EMS in the site office. All managerial positions will be made fully aware of the site's operating conditions.

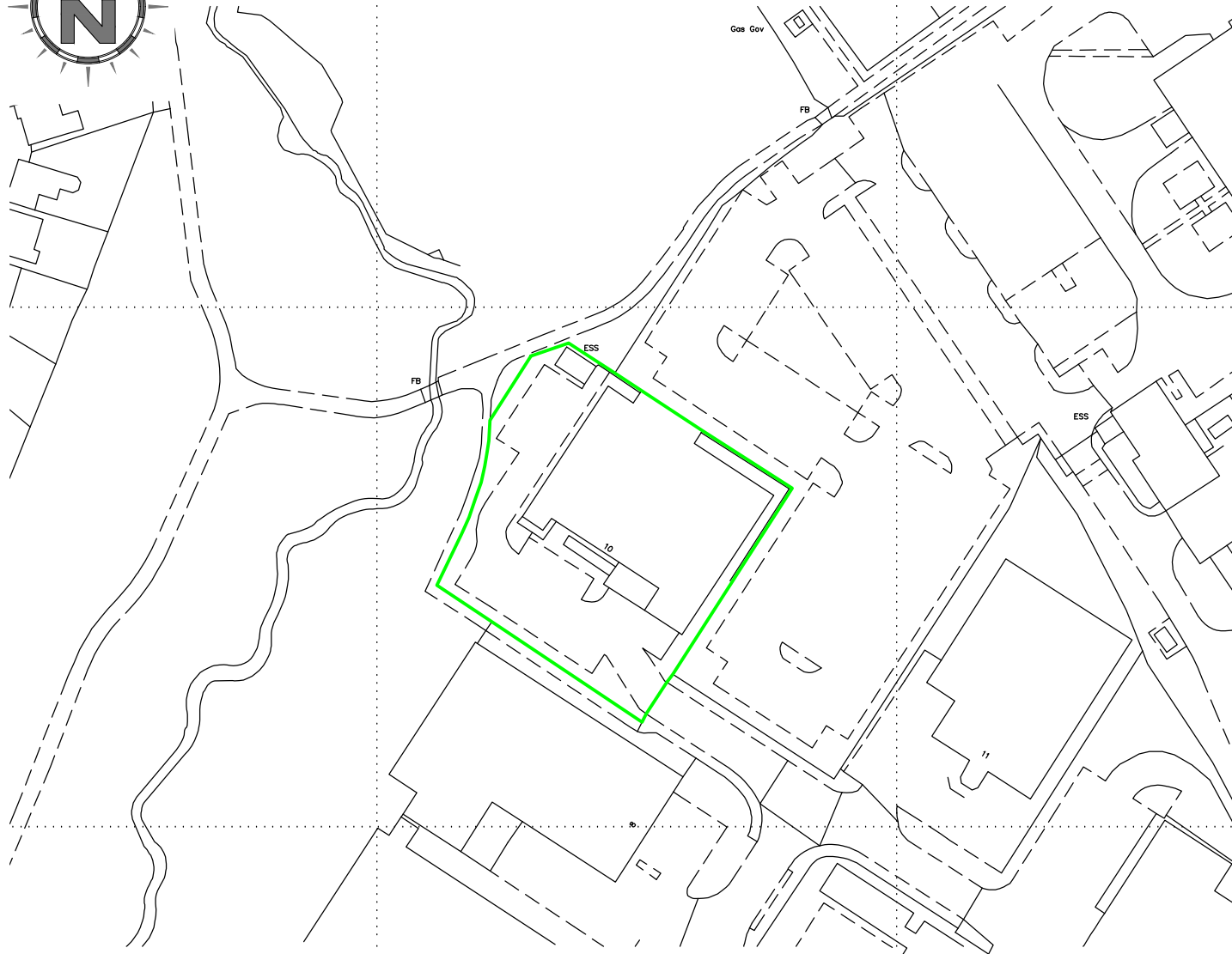
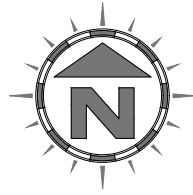
6.11 Training for contractors

6.11.1 General site training will be provided to any contractors who are working on the site on a temporary basis as described in Sections 6.2, 6.3 and 6.4 above.

6.11.2 Additional training will be provided to contractors in their area of expertise. If they are dealing with specific items of plant/machinery, site operating conditions and a general understanding of the EP conditions will be provided to prevent any adverse impacts on the environment.

Appendix I

Drawings



NOTES

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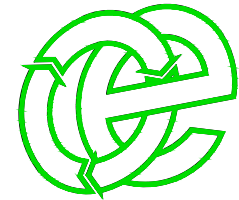
REVISION HISTORY

Rev:	Date:	Init:	Description:
-	05.12.22	JH	Initial drawing
A	05.01.23	IA	Address update
B	17.04.23	IA	Drawing title change

KEY:

 Waste EP Permit boundary

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants



DRAWING TITLE
WASTE EP PERMIT BOUNDARY PLAN

CLIENT
Kaug Refinery Services Ltd

PROJECT/SITE
10 Merse Road, North Moons Moat, Redditch, B98 9HL

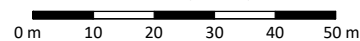
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1:1,250	2765	010

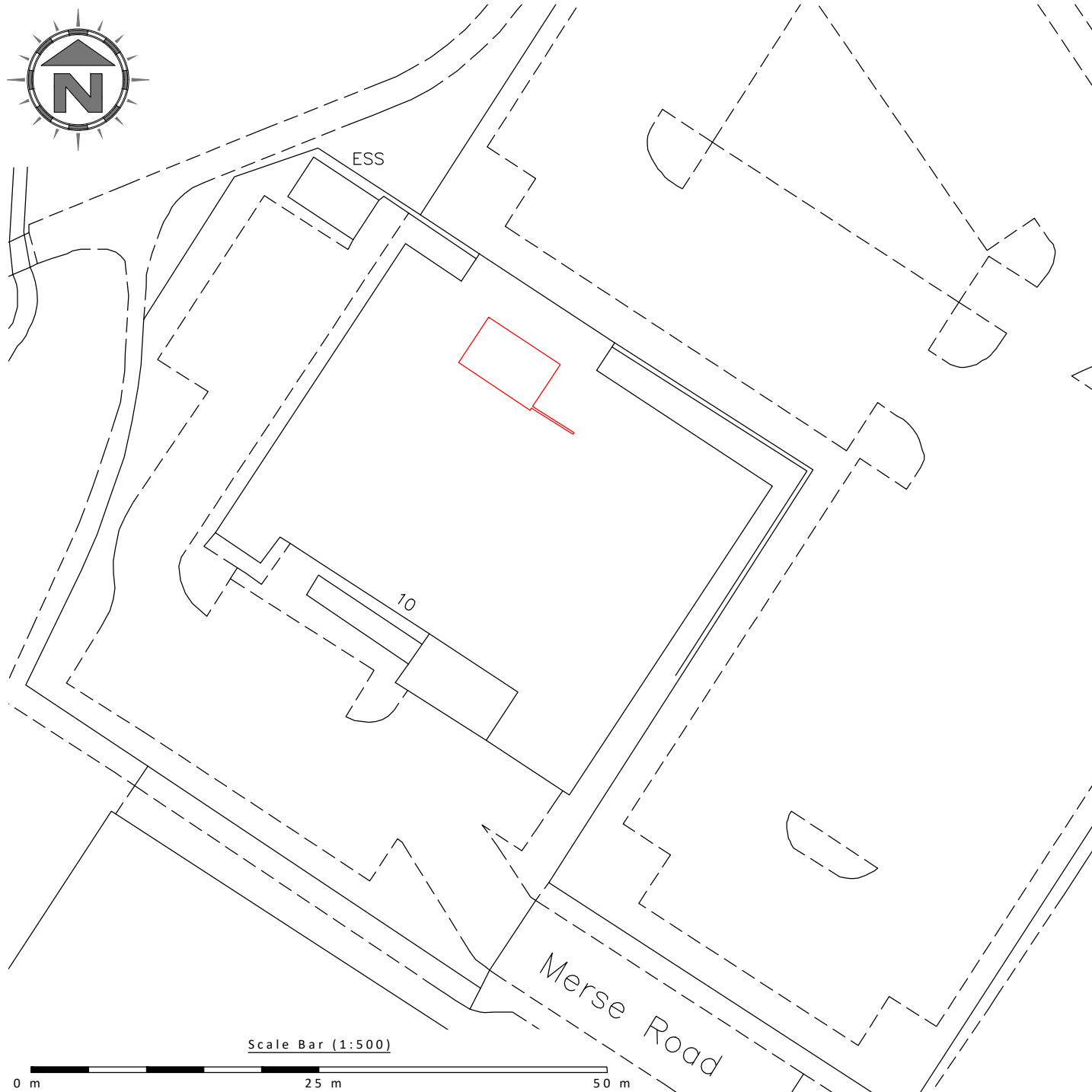
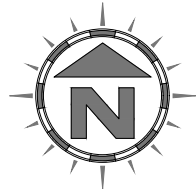
DRAWING NUMBER	REV	STATUS
2765-010-02	B	Issued

DRAWN BY	CHECKED	DATE
JH/IA	RS	05.01.23

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Scale Bar (1:1,250)






NOTES

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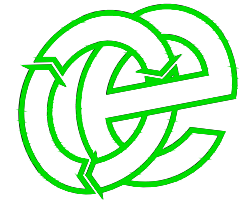
REVISION HISTORY

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-	22.03.23	IA	Initial drawing
A	17.04.23	IA	Drawing amendments

KEY:

 Part B permit boundary

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants



DRAWING TITLE

PART B PERMIT BOUNDARY PLAN

CLIENT

Kaug Refinery Services Ltd

PROJECT/SITE

10 Merse Road, North Moons Moat, Redditch, B98 9HL

SCALE @ A4

1:500

CLIENT NO

2765

JOB NO

011

DRAWING NUMBER

2765-011-02

REV

A

STATUS

Issued

DRAWN BY

JH/IA

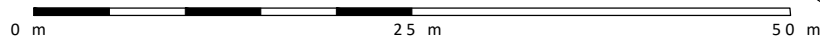
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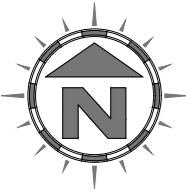
RS

DATE

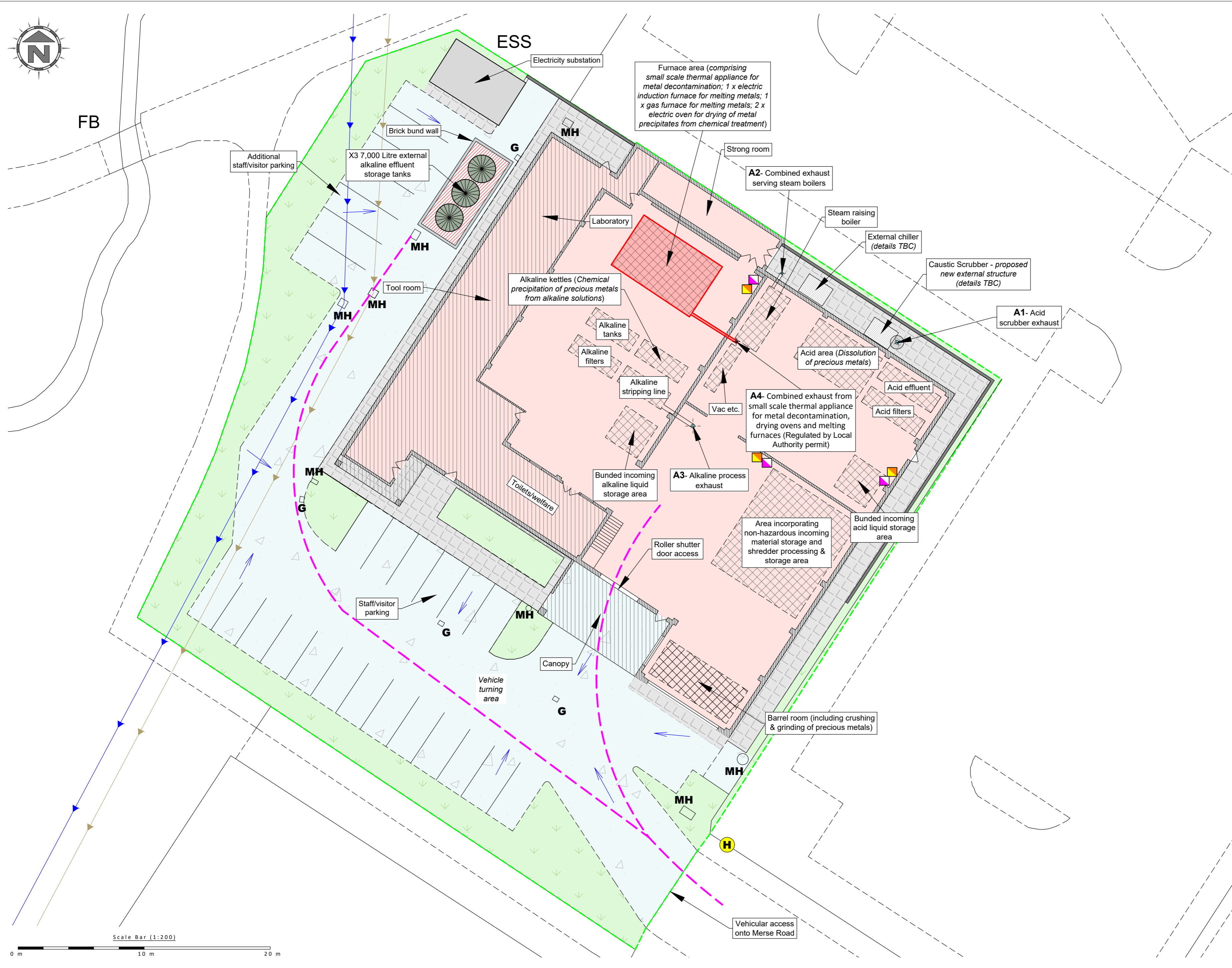
17.04.23

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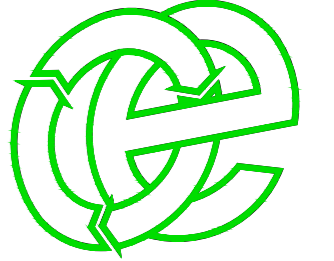


NOTES
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Rev:	Date:	Init:	Description:
-	05.12.22	JH	Initial drawing
A	15.12.22	IA/JH	Drawing amendments
B	05.01.23	IA	Address update
C	22.03.23	IA	Layout changes
D	17.04.23	IA	Drawing amendments
E	04.05.23	IA	EA comments

- KEY:**
- Waste EP Permit boundary (regulated by Environment Agency)
 - Part B Permit boundary (regulated by Local Authority)
 - Sealed buildings
 - Concreted areas
 - Spill kit
 - Firefighting equipment
 - Access routes for emergency vehicles
 - H Hydrant
 - MH** Manhole
 - G** Gully
 - Fall direction arrows
 - Paved areas
 - Un-surfaced areas

Oaktree Environmental Ltd
 Waste, Planning and Environmental Consultants



DRAWING TITLE
 SITE LAYOUT PLAN

CLIENT
 Kaug Refinery Services Ltd

PROJECT/SITE
 10 Merse Road, North Moons Moat, Redditch, B98 9HL

SCALE @ A2	CLIENT NO	JOB NO
1:200	2765	010

DRAWING NUMBER	REV	STATUS
2765-010-03	E	Issued

DRAWN BY	CHECKED	DATE
JH/IA	RS/DY	04.05.23

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Appendix II

Record Keeping Forms

**KAUG REFINERY SERVICES LIMITED
REJECTED WASTE - RECORD FORM KRS/RF/2**

DATE	
TIME	
WASTE DESCRIPTION	
QUANTITY OF WASTE	
PRODUCER/HOLDER'S NAME, ADDRESS & TELEPHONE No.	
NAME OF CARRIER	
VEHICLE REGISTRATION	
CARRIER REG. No.	
REASON FOR REJECTION OF WASTE	
ACTION TAKEN	

KAUG REFINERY SERVICES LIMITED

EMPLOYEE TRAINING NEEDS ASSESSMENT / REVIEW - KRS/RF/6

EMPLOYEE NAME					DATE					
POSITION					REVIEW DUE					
TRAINING CARRIED OUT BY										
POSITION										
TRAINING REQUIRED	GENERAL OPERATIVES		HGV DRIVER		PLANT OPERATOR		YARD MANAGER		TECHNICALLY COMPETENT MANAGER	
CARRIED OUT?	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE	Y/N	SIGNED BY EMPLOYEE
SITE RULES AND INFRASTRUCTURE										
EMERGENCY PROCEDURES										
FIRE SAFETY/ FIRE FIGHTING										
RECOGNITION OF WASTE TYPES										
STORAGE AREAS/LIMITS										
RECORD KEEPING										
VEHICLE CHECKS (Preventative Maintenance)										
PLANT CHECKS (Preventative Maintenance)										
DUTY OF CARE WASTE TRANSFER NOTES										
PLANT OPERATION - LOADING PLANT										
PLANT OPERATION - TREATMENT PLANT										
MANAGEMENT SYSTEM & PERMIT										
OTHER 1 (PLEASE SPECIFY)										
OTHER 2 (PLEASE SPECIFY)										

**KAUG REFINERY SERVICES LIMITED
COMPLAINTS REPORT FORM (KRS/RF/7)**

Date Recorded:	Reference Number:
Name and address of caller	
Telephone number of caller	
Time and Date of call	
Nature of complaint (noise, odour, dust, other) (date, time, duration)	
Weather at the time of complaint (rain, snow, fog, etc.)	
Wind (strength, direction)	
Any other complaints relating to this report	
Any other relevant information	
Potential reasons for complaint	
The operations being carried out on site at the time of the complaint	
Follow Up	
Actions taken	
Date of call back to complainant	
Summary of call back conversation	
Recommendations	
Change in procedures	
Changes to Environmental Management System (EMS)	
Date changes implemented	
Form completed by	
Signed	
Date completed	

COMPLAINT RECORDING PROCEDURE:

Any complaints received will be recorded on form KRS/RF/7. This form will normally be completed, signed and dated by the Site Manager; if they are not available the Office Manager will complete the form.

- 1) The name, address and telephone number of the caller will be requested.
- 2) Each complaint will be given a reference number.
- 3) The caller will be asked to give details of:
 - a) the nature of the complaint;
 - b) the time;
 - c) how long it lasted;
 - d) how often it occurs;
 - e) Is this the first time the problem has been noticed; and
 - f) what prompted them to complain.
- 4) The person completing the form will then, if possible, make a note of:
 - a) the weather conditions at the time of the problem (rain, snow, fog etc.);
 - b) strength and direction of the wind; and
 - c) the activity or activities taken place on the site at the time the noise was detected, particularly anything unusual.
- 5) The reason for the complaint will be investigated and a note of the findings added to the report.
- 6) The caller will then be contacted with an explanation of the source of the complaint if identified and the action taken to prevent a recurrence of the problem in future.
- 7) If the caller is unhappy about the outcome or unwilling to identify themselves the caller will be invited to contact the EA and or the Local Authority.

Note: Following any complaint the relevant management plan(s) will be reviewed to ensure appropriate actions are in place to counter any problems.

Appendix III

Environmental Permit (to be added later)

Appendix IV

Health & Safety – Conditions of Site Use

HEALTH AND SAFETY - CONDITIONS OF SITE USE

The following guidelines apply to all site personnel, contractors and visitors using the site (where applicable).

- 1) The site is covered by the Health and Safety at Work Act 1974 and its associated regulations and all users must abide by any relevant provisions. Any person found to be in contravention of the requirements of this Health and Safety Statement will be asked to leave the site.
- 2) All visitors and contractors must sign the visitor's book upon entry to and exit from the site. All vehicle drivers must report to the office and await instruction from the site manager/deputy before proceeding to deposit waste at the site.
- 3) All accidents, diseases, injuries or dangerous occurrences shall be reported to the site manager. All instructions issued by the site manager in respect of health and safety at the site must be followed by all site users.
- 4) A first aid box (including eye-wash bottles) is kept in the site office. If you are injured on site please alert a member of staff/trained first-aider for assistance.
- 5) All persons must wear the appropriate PPE on site including high visibility jackets and hard hat.
- 6) Safety boots must be worn by all persons in the waste treatment/storage areas.
- 7) Protective gloves must be worn for any operations which present a hazard of puncture to or laceration of the skin or for any manual handling work carried out on site.
- 8) Ear defenders, safety helmets (hard hats) and eye protection will be issued when deemed necessary and must be worn by all employees and contractors where required by the site manager or other site representatives.
- 9) Fire extinguishers are kept on site to deal with any fires - fires shall only be dealt with by employees of Kaug Refinery Services Limited unless alternative instructions are given by the site manager. Access to fire exits and firefighting equipment must be kept clear at all times. When the fire alarm sounds please follow instructions and leave the site in an orderly fashion.
- 10) Persons who are suspected to be under the influence of drugs or alcohol will be removed from the site.
- 11) Smoking is not permitted on the site.
- 12) Observe and follow all traffic directions and traffic/safety signs.
- 13) Drivers must comply with all safety instructions given by the site manager or appointed deputy.
- 14) All drivers are responsible for ensuring that their vehicle is safely loaded. Unsafe loads will not be accepted at the site and will not be allowed to leave the site until they have been made safe.

Declaration: To be completed by site users

I have read and understand the conditions of use for this site and agree to comply with them at all times. I accept that neither Kaug Refinery Services Limited nor their employees shall be liable for any loss or injury arising from my non-compliance with the above conditions.

Signed.....

Print name.....

Company/Organisation.....

Date.....

Note: these conditions are included in the EMS for information only and may be revised regularly as part of the site health and safety policy.

Appendix IV

Permitted Waste Codes

Permitted waste types and quantities	
Maximum Quantities	The total quantity of waste accepted for activity shall be less than 250 tonnes a year.
Waste Code	Description
06	Inorganic Chemical Processing
06 01	wastes from the manufacture, formulation, supply and use (MFSU) of acids
06 01 06*	Other acids
06 03	Manufacture – formulation – supply and use of salts and their solutions and metallic oxides
06 03 13*	Solid salts and solutions containing heavy metals
08	MFSU of Coatings/Adhesives/Inks
08 01	Manufacture – formulation – supply and use and removal of paint and varnish
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11
08 01 13*	Sludges from paint or varnish containing organic solvents or other hazardous substances
08 01 14	sludges from paint or varnish other than those mentioned in 08 01 13
08 01 99	wastes not otherwise specified
08 02	Manufacture – formulation – supply and use of other coatings (including ceramic materials)
08 02 01	Waste coating powders
08 02 99	Wastes not otherwise specified
08 03	Manufacture – formulation – supply and use of printing inks
08 03 12*	Waste ink containing hazardous substances
08 03 13	Waste ink other than those mentioned in 08 03 12
09	Photographic Industry
09 01	Photographic industry
09 01 07	Photographic film and paper containing silver or silver compounds
10	Thermal Processes
10 07	Silver – gold and platinum thermal metallurgy
10 07 01	slags from primary and secondary production
10 07 02	dross and skimmings from primary and secondary production
10 07 04	other particulates and dust
10 07 99	Wastes not otherwise specified
10 08	Other non-ferrous thermal metallurgy
10 08 11	dross and skimmings other than those mentioned in 10 08 10
10 08 14	anode scrap
10 12	

Permitted waste types and quantities	
Maximum Quantities	The total quantity of waste accepted for activity shall be less than 250 tonnes a year.
Waste Code	Description
10 12 08	Waste ceramics, bricks, tiles and construction products (after thermal processing)
10 12 99	Wastes not otherwise specified
11	Chemical Surface Treatment of Metals/Plastic
11 01	Chemical surface treatment and coating of metals and other materials
11 01 06*	acids not otherwise specified
11 01 09*	sludges and filter cakes containing hazardous substances
11 01 10	sludges and filter cakes other than those mentioned in 11 01 09
11 01 11*	aqueous rinsing liquids containing hazardous substances
11 01 12	aqueous rinsing liquids other than those mentioned in 11 01 11
11 01 98*	other wastes containing hazardous substances
11 01 99	wastes not otherwise specified
12	Shaping/Physical Treatment of Metals/Plastic
12 01	Wastes from shaping and physical and mechanical surface treatment of metals and plastics
12 01 04	non-ferrous metal dust and particles
12 01 17	Waste blasting material other than those mentioned in 12 01 16
12 01 99	Wastes not otherwise specified
15	Packaging, Absorbents, Wiping Cloths and Filters
15 02	Absorbants – filter materials – wiping cloths and protective clothing
15 02 02*	Absorbants, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances
15 02 03	Absorbants, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
16	Other wastes from Industrial Processes
16 01	end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)
16 01 18	non-ferrous metal
16 02	Electrical and electronic equipment
16 02 15*	hazardous components removed from discarded equipment
16 02 16	Components removed from discarded equipment other than those mentioned in 16 02 15
16 08	Spent catalysts
16 08 01	spent catalysts containing gold, silver, rhenium, rhodium, palladium, iridium or platinum (except 16 08 07)

Permitted waste types and quantities	
Maximum Quantities	The total quantity of waste accepted for activity shall be less than 250 tonnes a year.
Waste Code	Description
16 08 07*	spent catalysts contaminated with hazardous substances
17	Construction and Demolition Waste
17 04	Metals (including their alloys)
17 04 11	Cables other than those mentioned in 17 04 10
19	Materials from Waste and Water Treatment
19 09	municipal wastes including separately collected fractions
19 09 05	Saturated or spent ion exchange resins
20	Municipal Waste and Similar Materials from Commerce and Industry
20 01	
20 01 40	metals

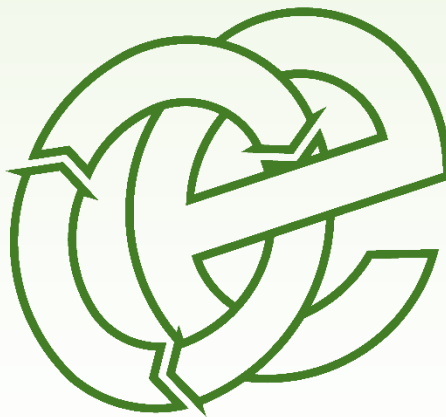
Appendix III

Emissions Modelling Assessment

EMISSIONS MODELLING ASSESSMENT - PRECIOUS METALS RECOVERY FACILITY, MERSE ROAD, REDDITCH

Kaug Refinery Services Limited

Version:	1.5	Date:	03/05/2023		
Doc. Ref:	2765-009-C	Author(s):	DY	Checked:	
Client No:	2765	Job No:	009		



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REGISTERED IN THE UK | COMPANY NO. 4850754

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1.1	29/03/2023	DY		Amended following client comment
1.2	12/04/2023	DY		Application copy
1.3	18/04/2023	DY		Tables updated within Section 2
1.4	02/05/2023	DY		Amendments to Sections 2, 3, 4 and 5
1.5	03/05/2023	DY		Minor amendments to Section 4

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1 Introduction

1.1 Background and Context of Assessment

1.1.1 Kaug Refinery Services Limited are applying for planning permission and Environmental Permits for the operation of a facility for the recovery of precious metals from wastes at a site on Merse Road, Redditch. This assessment has been undertaken to predict the potential air quality impacts at sensitive receptor locations as a result of residual emissions associated with the proposed process.

1.2 Site Location

1.2.1 The site is located at 10 Merse Road, Redditch. The site location is industrial and therefore highly suited to this type of development. Reference should be made to the site location plan within Appendix I for details of the site location.

1.3 Proposed Activities and Environmental Context

1.3.1 Reference should be made to Appendix I for a site layout plan. Kaug Refinery Services Ltd are proposing to operate a facility for recovery of precious metals from wastes. The plant will be very small scale in nature, with a maximum throughput of 250 tonnes/annum. Various specialist thermal, acid and alkaline treatment processes will be undertaken to extract precious metals from the following types of typical wastes/materials:

- Printed circuit scrap and edge connectors;
- Connectors, switches and pins;
- Reel to reel;
- Webbing & stamping scrap;
- Gold rags, wipes, bottles etc;
- Screen printing waste;
- Lithographic waste;
- China;
- Gold colour;

- Gold plating solutions and dragouts;
- Gold stripping solutions;
- Silver solutions;
- Platinum, Palladium and Rhodium solutions;
- Ion exchange resins;
- Filters;
- Carbon packs;
- Anodes;
- Polishings and sweeps;
- Lemels and cuttings;
- Bombing (stripping) solutions;
- De-burring;
- Fan dust;
- Polishing grain;
- Casting scrap;
- Crucibles; and,
- Clean scrap.

1.3.2 There will be four principal point source emissions from the process as follows, as identified on the layout plan within Appendix I:

- Emission Point A1 – Flue serving acid scrubber (abatement of fumes from acid dissolution process);
- Emission Point A2 – Combined exhaust flue from steam boilers, used to generate steam for chemical treatment processes;
- Emission Point A3 - Flue serving alkaline based metal extraction process; and,
- Emission Point A4 – Combined flue serving thermal treatment processes, including small scale metal decontamination combustion appliance, small scale melting furnaces and drying ovens.

1.3.3 The operation of the process will have the potential to create airborne emissions and subsequent impacts upon the surrounding environment. Potential air quality impacts have

been quantified within this report through prediction of resulting ground level pollutant concentrations which have been compared to the relevant Air Quality Limit Values (AQLVs), Environmental Assessment Levels (EALs), critical levels and loads.

1.4 Environmental Regulation

- 1.4.1 The site will be regulated in accordance with a waste Environmental Permit (EP), regulated by the EA and a Part B EP, regulated by Worcestershire Regulatory Services (WRS). The waste EP will cover the chemical and physical processing operations and the Part B permit will cover the operation of small scale thermal treatment appliances.

2 Air Quality Standards

2.1 Air Quality Limit Values and Objectives

2.1.1 The tables below contain the AQLVs and Air Quality Objectives which are relevant to this assessment. These have been obtained from the government permitting risk assessment website.

Table 2.1 - Air Quality Limit Values

Pollutant	Measured As	Purpose	AQLVs
Particulate matter less than 10µm in aerodynamic diameter (PM ₁₀)	24-hour mean	Protection of human health	50µg.m ⁻³ (not to be exceeded more than 35 times per calendar year)
	Annual mean	Protection of human health	40µg.m ⁻³
Particulate matter less than 2.5µm in aerodynamic diameter (PM _{2.5})	Annual mean	Protection of human health	20µg.m ⁻³
Nitrogen dioxide (NO ₂)	Annual mean	Protection of human health	40µg.m ⁻³
	Hourly Mean	Protection of human health	200µg.m ⁻³ (not to be exceeded more than 18 times per calendar year)
Sulphur dioxide (SO ₂)	1-hour mean	Protection of human health	350µg.m ⁻³ (not to be exceeded more than 24 times per calendar year)
	24-hour mean	Protection of human health	125µg.m ⁻³ (not to be exceeded more than 3 times per calendar year)
Benzene	Annual Mean	Protection of human health	5µg.m ⁻³
Carbon monoxide (CO)	Maximum daily running 8-hour mean	Protection of human health	10mg.m ⁻³

Table 2.2 - UK Air Quality Strategy Objectives

Pollutant	Measured As	Purpose	Ambient Air Directive Target Values and UK Air Quality Strategy Objectives
SO ₂	15-minute mean	Protection of human health	266µg.m ⁻³ (not to be exceeded more than 35 times per calendar year)

2.2 Environmental Assessment Levels

2.2.1 A list of short and long-term EALs relevant to this assessment are presented in the table below. These have been obtained from the permitting risk assessment guidance on the government website¹.

Table 2.3 - Environmental Assessment Levels

Substance	EALs		
	Annual Mean Limit ($\mu\text{g}\cdot\text{m}^{-3}$)	24-Hour Mean Limit ($\mu\text{g}\cdot\text{m}^{-3}$)	Hourly Mean Limit ($\mu\text{g}\cdot\text{m}^{-3}$)
CO	-	-	30,000
Benzene	-	30	-
Hydrogen Chloride (HCL)	-	-	750
Chlorine	-	-	290

2.3 Critical Levels for Protection of Vegetation and Ecosystems

2.3.1 The table below contains critical levels for the protection of vegetation at nature conservation sites, obtained from permitting risk assessment guidance on the government permitting risk assessment website.

Table 2.4 – Critical Levels

Pollutant	Critical Levels	
	Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	Measured As
Nitrogen oxide (NO _x , expressed as NO ₂)	30	Annual mean
	75	Daily mean
SO ₂	20 (10 $\mu\text{g}\cdot\text{m}^{-3}$ where lichens or bryophytes are present)	Annual mean

¹ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>

2.4 Critical Loads for Protection of Vegetation and Ecosystems

2.4.1 Critical loads are assigned for nitrogen and acid deposition at sensitive ecological sites, above which it is suggested harmful effects on vegetation may occur. The relevant guidance requires assessment of potential impacts at Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Ramsar sites within 10km of a process and Sites of Special Scientific Interest and local nature sites (Local Wildlife Sites (LWS), ancient woodland areas and Local Nature Reserves (LNR)) within 2km of a process. The table below identifies relevant ecological sites which have required assessment. Reference has been made to the APIS website to determine site specific critical loads for SSSIs. No site specific information is available on critical loads for local nature sites. Therefore, the tables below contain worst case critical loads for local nature sites to ensure a precautionary assessment.

Table 2.5 – Worst Case Critical Load for Nitrogen Deposition

Site	Worst Case Critical Load for Nitrogen Deposition (Kg N.ha ⁻¹ .Year ⁻¹)
Ipsley Alders Marsh SSSI	15
All local nature sites within 2km	3

Table 2.6 – Worst Case Critical Loads for Acid Deposition

Site	Worst Case Critical Load for Acid Deposition (keq.ha ⁻¹ .Year ⁻¹)	
	MinCLMinN	MinCLMaxN
Ipsley Alders Marsh SSSI	0.223	1.083
All local nature sites within 2km	0.1	0.1

3 Baseline Position

3.1 Air Quality Across Redditch Borough

3.1.1 Redditch Borough Council (RBC) are required to undertake a review and assessment of air quality within their area of jurisdiction under Section 82 part IV of the Environment Act (1995). Local Authorities (LAs) are obligated to prepare an Annual Status Report (ASR) each year. For areas where AQLVs are not expected to be achieved, the LA will undertake further assessment. Subsequently, if AQLVs are not predicted to be met following detailed assessment, the LA must declare an Air Quality Management Area (AQMA).

3.1.2 The latest available air quality report for RBC is the 2022 ASR². Monitoring data demonstrated no exceedances of the annual mean AQLV for NO₂ during 2021 and no discernible upward or downward trends in concentrations over the 5 year period between 2017 and 2021.

3.1.3 Monitoring is not undertaken for any other pollutant by RBC at present.

3.1.4 There are no AQMAs declared within the RBC area at present.

3.2 Air Quality Monitoring Data

3.2.1 Continuous Monitoring

3.2.1.1 The Automatic Urban and Rural Network (AURN) is a network of air pollution monitoring stations across the UK, managed by Bureau Veritas on behalf of DEFRA. The main purpose of the network is to enable the government to assess air quality at different locations to aid with the implementation of suitable policy measures for protection of human health.

² 2022 ASR, RBC, 2022.

3.2.1.2 The closest AURN urban background monitoring stations to the proposed site are Birmingham Acocks Green, situated approximately 14km North-North-East of the site, Birmingham Ladywood, situated approximately 18km to the North of the site, Leamington Spa, situated approximately 25km to the East of the site and West Bromwich Kenrick Park, situated approximately 22 km the North-North-West of the site. The West Bromwich Kenrick Park monitoring site is located within a major urban area and in relatively close proximity to the M5 motorway, whilst the Birmingham Ladywood is also located within the heart of a major urban conurbation. As such, it was not considered that these sites would provide a suitably representative source of background data for use in this assessment. The Birmingham Acocks Green and Leamington Spa sites are located in suburban locations and it was therefore considered that they could potentially provide a suitable source of background data for use in this assessment. Data from five years of recent verified data for these sites is presented in the tables below.

3.2.1.3 Data for 2020 and 2021 has not been included since national lockdown restrictions for Covid were in place for periods during these years and therefore pollution data from these years is considered unlikely to be representative of the true baseline position. Data for 2022 has not yet been fully ratified yet. Data from years between 2015 and 2019 is contained in the table below for NO_x, NO₂, PM₁₀ and PM_{2.5}. Annual mean concentrations have been calculated from available AURN data.

Table 3.1 – Annual Mean NO_x Concentrations at Birmingham Acocks Green and Leamington Spa

Site	Site Type	Site NGR	Annual Mean NO _x Concentrations (µg.m ⁻³)				
			2015	2016	2017	2018	2019
Birmingham Acocks Green	Urban Background	411654, 282146	26.32	32.65	26.96	24.11	26.14
Leamington Spa	Urban Background	431943, 265733	26.49	33.12	32.3	24.5	25.14

Table 3.2 – Annual Mean NO₂ Concentrations at Birmingham Acocks Green and Leamington Spa

Site	Site Type	Site NGR	Annual Mean NO ₂ Concentrations (µg.m ⁻³)				
			2015	2016	2017	2018	2019
Birmingham Acocks Green	Urban Background	411654, 282146	18.77	21.31	19.44	17.7	18.14
Leamington Spa	Urban Background	431943, 265733	19.3	21.39	23.46	17.5	17.84

Table 3.3 – Annual Mean PM₁₀ Concentrations at Leamington Spa

Site	Site Type	Site NGR	Annual Mean PM ₁₀ Concentrations (µg.m ⁻³)				
			2015	2016	2017	2018	2019
Leamington Spa	Urban Background	431943, 265733	15.29	15.39	13.98	14.03	14.4

Table 3.4 – Annual Mean PM_{2.5} Concentrations at Birmingham Acocks Green and Leamington Spa

Site	Site Type	Site NGR	Reported Annual Mean PM _{2.5} Concentrations (µg.m ⁻³)				
			2015	2016	2017	2018	2019
Birmingham Acocks Green	Urban Background	411654, 282146	9	10.23	10.74	9.29	8.65
Leamington Spa	Urban Background	431943, 265733	12.26	10.49	10.67	9.8	9.83

3.2.1.4 RBC do not maintain any continuous monitoring stations within their area of jurisdiction for pollutants considered within this assessment.

3.2.2 Non-Automatic Hydrocarbon Network

3.2.2.1 The Non-Automatic Hydrocarbon Network measures ambient benzene concentrations at various sites around the United Kingdom. The closest monitoring location to the proposed site is Leamington Spa, which is an urban background monitoring location, situated approximately 25km to the East. Given the nature of this monitoring location, it was considered that it may potentially provide a suitable source of background benzene data for use within this assessment, in lieu of any monitoring data in the vicinity of the site.

3.2.2.2 Annual average benzene concentrations were calculated for the most recent five years of suitable data. Data for 2020 and 2021 has not been included since national lockdown restrictions were in place for periods during these years and therefore pollution data from these years is considered unlikely to be representative of the true baseline position. Data for 2022 has not yet been fully ratified yet. The data was calculated from data downloaded from the DEFRA website. It should be noted that monitoring periods are periodic (approximately two weekly collection) and in each case, include collection periods which span the tail end of one year and the first part of the following year. Therefore, it was not possible to calculate annual means as an absolute value for each calendar year. However, the annual mean concentrations are based on data collection rate considerably in excess of

75% for each year and is therefore considered to be valid for determining annual mean background pollution data for benzene.

Table 3.5 – Annual Mean Benzene Concentrations at Leamington Spa

Site	Site Type	Site NGR	Annual Mean Benzene Concentration ($\mu\text{g.m}^{-3}$)				
			2015	2016	2017	2018	2019
Leamington Spa	Urban Industrial, Part of Non-Automatic Hydrocarbon Network	431943, 265733	0.598	0.529	0.521	0.512	0.469

3.2.3 Acid Gas Monitoring

3.2.3.1 The UK Acid Gases and Aerosols Monitoring Network is maintained in the UK by DEFRA and has been in operation since 1999. The network includes several sites around the UK in rural monitoring locations and includes monitoring of HCL. There are no monitoring stations in close proximity to the proposed plant, the closest monitoring station being Rosemaund, which is a rural monitoring site located approximately 55km to the West-South-West of the plant. Furthermore, no HCL data is available since 2016 for any site within this monitoring network. The tables below confirm the maximum monitored annual mean HCL concentrations across all sites between 2011 and 2015, which has been calculated from available data on the DEFRA website. Similarly to the benzene data, some data collection periods span the tail end of one year and the first part of the following year. However, the annual mean concentrations are based on data collection rate considerably in excess of 75% for each year for the majority of the data presented and is therefore considered to be valid for use as annual mean background pollution data for HCL.

Table 3.6 – Maximum Monitored Annual Mean HCL Concentration Between 2011 and 2015

Site	Maximum Monitored Annual Mean HCL Concentration ($\mu\text{g.m}^{-3}$)				
	2011	2012	2013	2014	2015
All Sites within UK Acid Gases and Aerosols Monitoring Network	0.636	0.432	0.515	0.471	0.756

3.2.3.2 In lieu of any suitably representative recent data, the maximum monitored annual mean concentration across all UK sites between 2011 and 2015 has been used as a source of background data, which provides a conservative assessment.

3.3 Chlorine

3.3.1 No routine background ambient monitoring is currently undertaken for chlorine within the UK.

3.4 Background Pollutant Mapping

3.4.1 The DEFRA website contains background pollutant mapping data for NO_x, NO₂, PM_{2.5} and PM₁₀ on a 1km by 1km grid square basis across the UK. This data is routinely used for assessing background pollutant concentrations where no suitably representative air pollution monitoring data exists. NO_x, NO₂, PM₁₀ and PM_{2.5} data is available for each grid square for the years 2018 to 2030. Data for CO, benzene and SO₂ is only available up until 2001. Data for CO and benzene has been adjusted from 2001 background mapping to 2023 base year, in accordance with the relevant guidance. The annual mean SO₂ concentration has been assumed to be 75% of the mapped background concentration for 2001, in accordance with the relevant guidance. Table 3.7 contains mapped background pollutant concentrations for the grid square containing the site.

Table 3.7 - Background Pollutant Mapping Data for Grid Square 407500, 268500

Pollutant	2023 Annual Mean Pollutant Concentrations (µg.m ⁻³) within Grid Square Containing Site
NO _x	22.31
NO ₂	15.92
PM ₁₀	13.13
PM _{2.5}	8.50
Benzene	0.3

Pollutant	2023 Annual Mean Pollutant Concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) within Grid Square Containing Site
CO	143.42
SO ₂	3.03

3.5 Summary of Background Data Used in Assessment

3.5.1 The table below summarises the background data used within this assessment. Short term background concentrations have been calculated using the following factors, based on government guidance and is an approach which has been accepted by the EA previously:

- 24-hour mean – factor of 0.59 applied to hourly mean background concentration;
- 8-hour mean - factor of 0.7 applied to hourly mean background concentration;
- 1-hour mean – assumed to be twice annual mean background concentration; and,
- 15-minute mean - factor of 1.34 applied to hourly mean background concentration

Table 3.8 - Summary of Background Data Used in Assessment

Pollutant	Annual Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	24-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	8-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	1-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	15-Minute Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	Source of Background Data
NO _x	33.12	39.08	N/A	N/A	N/A	Highest monitored concentration from five years of available data at Leamington Spa and Birmingham Acocks Green AURN sites

Pollutant	Annual Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	24-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	8-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	1-Hour Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	15-Minute Mean Background Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)	Source of Background Data
NO ₂	23.46	N/A	N/A	46.92	N/A	Highest monitored concentration from five years of available data at Leamington Spa and Birmingham Acocks Green AURN sites
PM ₁₀	15.39	18.16	N/A	N/A	N/A	Highest monitored concentration from five years of available data at Leamington Spa AURN site
PM _{2.5}	12.26	N/A	N/A	N/A	N/A	Highest monitored concentration from five years of available data at Leamington Spa and Birmingham Acocks Green AURN sites
SO ₂	3.03	3.58	N/A	6.06	8.12	DEFRA Mapped Background Concentration
CO	N/A	N/A	200.79	286.84	N/A	DEFRA Mapped Background Concentration
Benzene	0.6	0.71	N/A	N/A	N/A	Highest monitored concentration from five years of available data at Leamington Spa AURN site

Pollutant	Annual Mean Background Concentration ($\mu\text{g.m}^{-3}$)	24-Hour Mean Background Concentration ($\mu\text{g.m}^{-3}$)	8-Hour Mean Background Concentration ($\mu\text{g.m}^{-3}$)	1-Hour Mean Background Concentration ($\mu\text{g.m}^{-3}$)	15-Minute Mean Background Concentration ($\mu\text{g.m}^{-3}$)	Source of Background Data
HCL	N/A	N/A	N/A	1.512	N/A	Highest calculated concentration from five years of data at all sites within UK Acid Gas and Aerosol Monitoring Network

3.6 Discrete Sensitive Receptors

3.6.1 The table below outlines the nearest receptors to the proposed plant which are representative of relevant long term exposure locations. Reference should be made to Appendix II for a graphical representation of receptor locations. In order to provide a highly conservative assessment of worst case potential short term impacts, the maximum point of impact surrounding the plant has been used.

Table 3.9 – Sensitive Receptors

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R1	Residential property on Fairford Close	407227.9	269099
R2	Residential property on Hillmorton Close	407250.5	268991.3
R3	Residential property on Hillmorton Close	407238.5	268953.1
R4	Residential property on Hillmorton Close	407241.8	268944.4
R5	Residential property on Hillmorton Close	407244.1	268934.4
R6	Residential property on Hillmorton Close	407241.9	268922.4
R7	Residential property on Hillmorton Close	407235.4	268912.5
R8	Residential property on Hillmorton Close	407231.2	268903.6

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R9	Residential property on Hillmorton Close	407231.1	268891.6
R10	Residential property on Latchford Close	407225.1	268883.7
R11	Residential property on Latchford Close	407184.3	268838.3
R12	Residential property on Latchford Close	407155.6	268813.9
R13	Residential property on Latchford Close	407154.8	268802.2
R14	Residential property on Latchford Close	407141.7	268781.2
R15	Residential property on Latchford Close	407111.1	268751.9
R16	Residential property on Moorgate Close	407098.6	268723.2
R17	Residential property on Beoley Lane	407380	269468.8
R18	Holt End Farm	407414.7	269464.8
R19	Residential property on The Glebe	407533.1	269443.9
R20	Residential property on Holt Hill/Moss Lane	407750.9	269526.2
R21	Lower Greenhills Farm	408413.8	269048
R22	Carpenters Hill Wood AW/LWS	407927	270224.6
R23	Clifford's Wood LWS	408091	269765.2
R24	Pink Green Wood AW/LWS	408362.3	269725.7
R25	Grove Wood ARW	409252.5	268509.9
R26	Grove Wood AW	409049.8	268128.7
R27	Ipsley Alders Marsh SSSI	407839.98	267938.2
R28	Proctors Barn Meadow LNR	405959.38	267886.3
R29	Ravens Bank Drive Bride Track LWS	407514.9	268993.9
R30	Ravens Bank Drive Bride Track LWS	407535.2	268958.7
R31	Ravens Bank Drive Bride Track LWS	407587.9	268882.6
R32	Ravens Bank Drive Bride Track LWS	407623.6	268842.8
R33	Ravens Bank Drive Bride Track LWS	407695	268736.2
R34	Holt End Meadows LWS	407446.28	269530.6

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R35	Ipsley Alders Marsh LWS	407863.9	268078.8
R36	Arrow Valley Park LWS	406502	267598.8
R37	River Arrow LWS	405732.7	267988.3
R38	River Arrow LWS	405697.5	268053.4
R39	River Arrow LWS	405464.1	268476.2
R40	River Arrow LWS	405424.6	268649
R41	Dagnell Brook LWS	405346	269144
R42	Dagnell Brook LWS	405454	269280

4 Modelling Methodology

4.1 Model Description

4.1.1 The potential air quality impacts associated with residual emissions arising from the process have been quantified using AERMOD, which is a steady state, next generation, dispersion model. AERMOD was developed jointly by the American Meteorological Society (AMS) and the United States (US) Environmental Protection Agency (EPA) Regulatory Model Improvement Committee. AERMOD is a development from the Industrial Source Complex (ISC) 3 dispersion model and incorporates improved dispersion algorithms and pre-processors to integrate the impact of meteorology and topography within the modelling output, and is approved for use in the UK. The version of AERMOD that has been used for this current assessment is Lakes Environmental ISC-AERMOD View Version 11.2.0. The model has been run using version 22112 of the AERMOD executable file. In order to improve model run times, Lakes Environmental have produced an equivalent source code to 22112, known as AERMOD parallel which enables the model to be run over multiple processors. The model was run using Lakes Environmental AERMOD MPI 22112.

4.2 Model Inputs

4.2.1 Emission Source Process Parameters

4.2.1.1 The process will include the following point source emissions to air, as denoted on the layout plan within Appendix I:

- Emission point A1 – Exhaust from scrubber which abates emissions from acid metal extraction process;
- Emission point A2 - Exhaust from steam boiler(s);
- Emission point A3 – Alkaline based metal extraction area exhaust; and,
- Emission point A4 – Combined exhaust from abatement plant serving thermal appliances, including small scale metal decontamination combustion appliance, melting furnaces and drying ovens.

4.2.1.2 Exhaust process parameters for the above emission sources are outlined in the tables below, based on information provided by the applicant.

Table 4.1 - Expected Emission Source Process Parameters – Emission Point A1 (Acid Scrubber Exhaust)

Process Parameter	Value
Stack NGR (m)	407371.73, 268868.35
Stack internal diameter (m)	0.3
Stack height (m)	10.44
Expected actual stack volumetric flowrate (Am ³ .s ⁻¹)	1.11
Expected stack efflux temperature (K)	288 (ambient release)

Table 4.2 - Expected Emission Source Process Parameters – Emission Point A2 (Steam Boilers)

Process Parameter	Value
Stack NGR (m)	407362.66, 268873.88
Stack internal diameter (m)	0.203
Stack height (m)	9.44
Expected actual stack volumetric flowrate (Am ³ .s ⁻¹)	0.15
Expected stack efflux temperature (K)	478

Table 4.3 - Expected Emission Source Process Parameters – Emission Point A3 (Alkaline Processing Area Exhaust)

Process Parameter	Value
Stack NGR (m)	407355.60, 268861.76
Stack internal diameter (m)	0.3
Stack height (m)	9.44
Expected actual stack volumetric flowrate (Am ³ .s ⁻¹)	1.11
Expected stack efflux temperature (K)	288 (ambient release)

Table 4.4 - Expected Emission Source Process Parameters – Emission Point A4 (Abatement Plant Serving Thermal Appliances)

Process Parameter	Value
Stack NGR (m)	407359.03, 268868.45
Stack internal diameter (m)	0.17
Stack height (m)	9.44
Expected actual stack volumetric flowrate (Am ³ .s ⁻¹)	0.208
Normalised flow rate expressed at 273.15K, 101.3kPa, dry basis, 11% oxygen (Nm ³ .s ⁻¹)	0.0857
Expected exhaust gas oxygen content (dry basis, vol/vol, %)	13.66
Expected exhaust gas moisture content (vol/vol, %)	6.92
Expected stack efflux temperature (K)	478
Expected stack absolute pressure (kPa)	101.3

4.2.2 Pollutant Emissions

4.2.2.1 Emissions from the drying ovens, melting furnaces and small scale metal decontamination appliance will be extracted via the abatement plant serving the metal decontamination appliance via emission point A4. The metal decontamination appliance will be subject to Emission Limit Values (ELVs) contained with Process Guidance (PG) Note 2/09(13)³, whilst it has been agreed with the regulator that the melting furnaces will be subject to ELVs contained within PG Note 2/03(13)⁴, both processes to be regulated by WRS in accordance with a Part B permit. Therefore, emission rates for these processes have been based on ELVs within the PG Notes to provide a conservative assessment. Emission limits for these processes are outlined within the table below. It should be noted that there are no emission limits within PG Note 2/09(13) for SO₂ and NO_x. Emission concentrations for these pollutants

³ PG 2/09(13) – Statutory Guidance for Metal Decontamination Processes and Installations, DEFRA, July 2013.

⁴ PG 2/03(13) – Statutory Guidance for Electrical Furnaces, DEFRA, July 2013.

have been based on information provided by the technology provider from a mass balance for the process and design emission values.

Table 4.5 – Emission Limits/Concentrations (Small Scale Metal Decontamination Appliance and Melting Furnaces)

Pollutant	ELV/Emission Concentration for Small Scale Metal Decontamination Appliance, Expressed at 273.15K, 101.3KPa, dry gas, 11% oxygen (mg.Nm ⁻³)	ELV for Melting Furnaces, Expressed at 273.1K, 101.3KPa, no correction for oxygen or water vapour (mg.Nm ⁻³)
Total particulate matter	20	20
SO ₂	No limit (43.28mg.Nm ⁻³ provided by technology provider as abated emission level)	-
NO _x	No limit (500mg.Nm ⁻³ assumed as conservative value based on technical information provided)	-
Chloride	10	-
Organic Compounds	20	-

4.2.2.2 There are no statutory emission limits for the steam boilers, acid scrubber exhaust and alkaline process exhaust. It should be noted that these processes have been operated in accordance with an EP/licence for over 40 years at the operator’s existing site in Birmingham with no restrictions on emission or limits having been imposed by the EA.

4.2.2.3 For the steam boilers (emission point A2), emission rates were assigned based on the upper end of values stated within the boiler technical data sheet. There will be two steam boilers which will share an exhaust flue. It should be noted that only one will be operational at any one time with the second boiler provided as a backup.

4.2.2.4 The process is very small scale in nature and it is anticipated that the acid processing area will recover 142kg of precious metals each year. The acid and alkaline chemical based extraction processes do not involve the use of highly elevated temperatures, with solutions heated to allow the necessary process chemistry to occur for extraction of metals. Given these factors and the absence of any emissions controls that are applied by the regulator at the operator’s current site, it is not anticipated that emissions will be significant from the acid and alkaline chemical processing areas. However, the operator will be installing an acid

scrubber abatement unit within the acid processing area to abate any fumes that may arise from the process.

4.2.2.5 Despite the above, a precautionary assessment has been undertaken. In order to determine potential emissions, reference has been made to the European Commission (EC) Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries (EC BREF)⁵, associated EC BAT conclusions document⁶ and EA Sector guidance for the non-ferrous metals sector⁷.

4.2.2.6 The alkaline chemical processing operation will predominantly include the precipitation of precious metals from cyanide based solutions. These are not anticipated to include high concentrations of cyanide. Hydrogen Cyanide (HCN) is identified as a potential emission from hydrometallurgical processes within the EC BREF. The EC BREF states the following:

“Gold is also removed from solid and liquid cyanide solutions such as plating baths. Solutions of sodium or potassium cyanide can be used to remove gold from surface-coated material such as electronic contacts or plated materials. Gold is recovered from the cyanide solutions by electrolysis. Cyanides react with acids to form hydrogen cyanide (HCN) and therefore careful segregation of these materials is practised”

4.2.2.7 Typical formation mechanisms for HCN would be through reaction of ammonia with methane, such as during fertiliser production, as a by-product in the manufacture of acrylonitrile or from combustion of nitrogen and carbon containing substances. HCN can also be formed by reaction of cyanide with other acid gases. No ammonia or methane will be used in the alkaline chemical processing area, nor will combustion processes be used within this part of the site. Acid and alkaline chemical processing areas will also be kept

⁵ Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries, European Commission, 2017
⁶ Commission Implementing Decision (EU) 2016/1032 of 13 June 2016 establishing best available techniques (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council, for the non-ferrous metals industries.
⁷ How to comply with your environmental permit Additional guidance for: Non - Ferrous Metals and the Production of Carbon and Graphite (EPR 2.03), EA, March 2009.

completely separate on-site. As such, the potential for formation of HCN is anticipated to be insignificant. No other emissions are anticipated to be significant from emission point A3. Indeed, the applicant has been using the same processes at their existing site for over 40 years, regulated by the EA for approximately 27 years. There have been no requirements for emissions monitoring imposed in that time and no requirement for impact assessment. It is therefore logically concluded that the regulator is satisfied that emissions are not significant from the use of alkaline chemicals for precipitation of precious metals. Therefore no assessment of potential impacts for emissions from emission point A3 has been undertaken.

- 4.2.2.8 In terms of relevance to the acid based metal extraction process, the EC BREF outlines chlorine and VOCs to be potentially most significant from leaching and purification and distillation activities and to a lesser extent, NO_x, with SO₂ emissions outlined as least significant. Other emissions are not highlighted as highly significant. VOCs would not be expected to be significant as the chemicals used in the acid extraction process would be predominantly inorganic.
- 4.2.2.9 HCL, chlorine, SO₂ and NO_x emissions may arise as a result of use of nitric acid, hydrochloric acid and sulphuric acid for precipitation of metals. The EC BREF provides emissions data for alkaline scrubbers which treat exhaust gases in operational plants recovering precious metals. Furthermore, the associated EC BAT Conclusions document for the non-ferrous metals sector contains a specific BAT based limit level for NO_x emissions from the use of nitric acid for hydrometallurgical operations including dissolving/leaching. This data is presented in Table 4.7. The data included in Table 4.6 is the range of maximum reported emission concentrations across operational plants presented within the EU BREF document. Plants which are stated to include pyrometallurgical processes have been excluded, since such processes will not be included as part of the acid precipitation process. In lieu of operational data from the proposed plant, the upper end of the values in the tables below have been used to provide a conservative assessment of potential emission concentrations arising from the acid scrubber unit.

Table 4.6 – Maximum Reported Emission Values Within EC BREF – Plants Recovering Precious Metals

Pollutant	Range of Maximum Monitored Emission Concentrations (mg.Nm ⁻³)
HCL	1.5 - 11.8
Chlorine	2.4 - 3
SO ₂	0.9 - 2

Table 4.7 – NO_x Emission Limit Within EC BAT Conclusions Document for Non-Ferrous Metals Sector

Pollutant	BAT Based Emission Limit Value for Hydrometallurgical Processes Involving Leaching with Nitric Acid (mg.Nm ⁻³) Expressed at 273.15K, 101.3kPa, dry gas)
NO _x (as NO ₂)	150

4.2.2.10 Emission rates assigned in the assessment are outlined within the tables below, based on the data discussed above.

Table 4.8 – Emission Rates – Emission Point A1 (Acid Scrubber)

Pollutant	Pollutant Emission Rate (g.s ⁻¹)
NO _x	0.178
HCL	0.0131
Chlorine	0.00333
SO ₂	0.00222

Table 4.9 – Emission Rates – Emission Point A2 (Steam Boilers)

Pollutant	Pollutant Emission Rate (g.s ⁻¹)
NO _x	0.00694
SO ₂	0.0000556
CO	0.000722

Table 4.10 – Emission Rates – Emission Point A4 (Thermal Appliances)

Pollutant	Pollutant Emission Rate (g.s ⁻¹)
Total particulate matter	0.00673
SO ₂	0.00371
NO _x	0.0428
Chloride	0.000857
Organic Compounds	0.00171

4.2.2.11 There are no ambient Air Quality Standards for total particulate matter. In order to provide a worst case assessment of particulate matter, it was assumed that total particulate matter comprises 100% PM₁₀ and PM_{2.5}, providing a highly conservative assessment.

- 4.2.2.12 In accordance with the relevant guidance, it was assumed that organic compounds from the metal decontamination appliance comprise 100% benzene.
- 4.2.2.13 Emissions of chlorides from emission point A4 were assumed to comprise 100% HCL, since chlorine compounds from combustion processes are likely to be mostly oxidised and emitted as HCL.
- 4.2.2.14 Nitric oxide (NO) and NO₂ are normally measured as oxides of NO_x, but when comparing against health based standards, NO_x is usually expressed as it's individual components. NO is oxidised to NO₂ in the presence of ozone. In order to provide a conservative estimate of resulting NO₂ concentrations, it has been assumed that 35% of modelled NO_x concentrations are present as NO₂ for short-term concentrations, whilst it has been assumed that 70% of modelled NO_x concentrations are present as NO₂ for long term average concentrations. This provides a worst case scenario, in accordance with the relevant guidance.

4.2.3 **Building Downwash**

- 4.2.3.1 The building on-site was digitised within the model from site layout and elevation information obtained from a drone survey. As the closest building to the emission points, this would be expected to have an influence on pollutant dispersion. Table 4.11 contains information on building heights assigned within the model. Reference should be made to Appendix I for a plan showing the building location and orientation. The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations.

Table 4.11 - Building Inputs

Structure	Length and Width (m)	Max Height (m)
Building A	38.08 x 35.52	6.44

4.2.4 **Meteorological Data**

4.2.4.1 Meteorological data used in this assessment was from Pershore. Pershore meteorological station is located approximately 21km to the South-South-West of the proposed site and it is considered that it provides suitable data for use in this assessment. Previous guidance outlined met stations within 30km of a site to be potentially suitable to use in assessments.

4.2.4.2 Reference should be made to Appendix III for wind roses showing wind speed and direction frequency at Pershore between 2016 and 2020.

4.2.4.3 Five years of sequential meteorological data observed between 2016 and 2020 was used within the assessment. The AERMET processor within AERMOD was used to process the data to be site specific. US EPA guidance on processing met data for use within AERMOD states that land use up to 1km upwind from a site should be considered when determining surface roughness characteristics, whilst for Bowen ratio and albedo, land use types within a 10km by 10km area centred over the site should be considered⁸. AERMOD guidance states that albedo and Bowen ratio should be calculated as the arithmetic and geometric mean respectively of land use types over the 10km by 10km grid, not weighted by direction or distance. The Land Use Creator and AERSURFACE tool within AERMET was used to calculate the appropriate land-use characteristics, which are contained in the following table.

Table 4.12 - Parameters for Surface Roughness, Albedo and Bowen Ratio

Parameter	Directional Sector	Value
Surface Roughness	0-30°	0.164
	30-60°	0.151
	60-90°	0.21
	90-120	0.465
	120-150°	0.517
	150-180°	0.643

⁸

AERMOD Implementation Guide, USEPA, August 2015.

Parameter	Directional Sector	Value
	180-210°	0.7
	210-240°	0.869
	240-270°	0.972
	270-300°	0.89
	300-330°	0.357
	330-360°	0.276
Albedo	All	0.18
Bowen Ratio	All	0.68

4.2.5 Assessment Area

4.2.5.1 One high resolution uniform cartesian receptor grid was used to define the modelling domain, extended over a 3,000m by 3,000m area with a spacing of 15m in X and Y direction, centred over the emission source locations. In addition, a second uniform cartesian receptor grid was extended over a 20,000m by 20,000m area with a spacing of 200m in X and Y direction, centred over the emission source locations. This ensured the maximum point of impact could be captured to enable a conservative assessment of potential short term impacts. In addition, the discrete receptors identified previously were included within the model as cartesian receptors to assess short and long term impacts. Human receptor heights were set to 1.5m and ecological receptor heights set to 0.0m.

4.2.6 Terrain Data

4.2.6.1 Topographical features can have a significant impact on pollutant dispersion. Given that the gradient of the land between the site and receptors exceeds a gradient of 10% in places, terrain data was included in the model, in accordance with the relevant guidance⁹. The terrain data used was Ordnance Survey Terrain 5 data, which is 1:10,000 scale data, contoured at 5m vertical intervals. The digital terrain data was processed in AERMAP, the

⁹ LAQM.TG(16), DEFRA, 2016.

Pollutant	Modelled Scenarios
NO ₂	Annual mean, 99.98 th percentile of 1-hour mean concentrations
SO ₂	Annual mean, 99.2 nd percentile of 24-hour mean concentrations, 99.7 th percentile of 1-hour mean concentrations, 99.9 th percentile of 15-minute mean concentrations
CO	Maximum 8-hour rolling mean concentration
Organic Compounds (as benzene)	Annual mean, maximum 24-hour mean concentration
Chlorine	Maximum 1-hour mean concentration
HCL	Maximum 1-hour mean concentration

4.3 Assessment of Potential Impacts

4.3.1 Methodology for Assessment of Potential Impacts at Human Receptors and SSSIs

4.3.1.1 In order to assess potential impacts at human receptors and SSSIs, reference has been made to the permitting air emissions risk assessment guidance on the government website.¹⁰

4.3.1.2 The government guidance indicates that potential impacts from a process can be considered insignificant if the following screening criteria are met:

- The long term process contribution (PC) is <1% of the long term environmental standard; and/or,
- The short term PC is <10% of the short term environmental standard.

¹⁰

<https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

4.3.1.3 The guidance also indicates that more detailed assessment of emissions (modelling) for a process may be required if the following criteria are met:

- The long term PC + background concentration is >70% of the long term environmental standard; and/or
- The short term process contribution is >20% (Short term environmental standard minus twice annual mean background concentration).

4.3.1.4 If any of the criteria above are met for both short and long term modelled concentrations, it can be concluded that potential impacts will be acceptable and there is no requirement for further assessment, in accordance with the relevant guidance. If the above criteria are exceeded, the Predicted Environmental Concentration (PEC), inclusive of background concentrations, is then compared to the relevant environmental standard. If the modelling shows that the relevant standard will be met at receptor locations, confidence will be high that a breach of the standard will be unlikely, especially given the conservative assumptions which have been used throughout the assessment.

4.3.2 Methodology for Assessment of Potential Impacts at Local Nature Sites

4.3.2.1 In accordance with government permitting risk assessment guidance, potential impacts on local nature sites, such as Local Wildlife Sites and ancient woodland areas, can be screened out as insignificant if the PC is <100% of the critical level/load for relevant pollutants.

4.3.3 Assessment of Potential Impacts on Critical Loads for Acid Deposition at Ecological Receptors

4.3.3.1 It should be noted that a range of critical loads are assigned for each ecological receptor.

4.3.3.2 The APIS website provides specific guidance for assessing potential impacts on critical loads for acid deposition as follows, which has been used for assessing impacts on critical loads for acid deposition associated with the proposed development:

“The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less than CLminN only the acidifying effects of sulphur from the process need to be considered.”

Where PEC N Deposition < CLminN

*PC as % CL function = (PC S deposition/CLmaxS)*100*

Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.

Where PEC N Deposition > CLminN

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100”*

- 4.3.3.3 Where the PC is <1% of the critical load for acid deposition at SSSIs, the impact can be concluded to be insignificant. Where the PC is <100% of the critical load at local nature sites, the impact can be concluded to be insignificant.

4.4 Model Verification and Uncertainty

- 4.4.1 There can be a significant degree in uncertainty in predications made by any atmospheric dispersion model, which needs to be considered when assessing results. Such uncertainty can arise as a result of model limitations, uncertainty in input data, including emissions estimates, meteorological data used and background pollutant concentrations used in the assessment.
- 4.4.2 AERMOD is a commonly used model produced by the US EPA and is approved for use in the UK. The model is well validated and the US EPA present the results of the model validation exercises undertaken on their website. These verify the output of the model in comparison to observed data for a number of scenarios, to ensure predictions are as accurate as possible. The model input code is periodically updated by the US EPA to resolve bugs and

errors and to improve the output to take account of latest knowledge. The latest AERMOD model executable file has been used to run the model for the purpose of this assessment.

4.4.3 In addition to the choice of model, the following methods used in the assessment ensure that confidence can be high that potential impacts have not been underestimated:

- Worst case modelled concentrations across 5 years of meteorological data used in assessment;
- Where possible, estimation of existing background pollutant concentrations have been conservative;
- Worst case assumption made that total particulate matter comprises PM₁₀ or PM_{2.5};
- Worst case assumptions made for NO_x to NO₂ conversion;
- Worst case assumption that organic compounds comprise 100% benzene;
- Worst case emission rates used throughout assessment; and,
- Worst case assumption that melting furnaces, small scale metal decontamination appliance and acid based metal extraction process would all operate simultaneously and be continuously operational for 11 hours each day.

5 Model Results

5.1 Predicted Pollutant Concentrations

- 5.1.1 The tables below contain the maximum modelled ground level pollutant concentrations within the modelling domain and at sensitive receptors, with comparison to the relevant AQLVs, EALs and critical levels for each pollutant and scenario. Maximum modelled concentrations from the five years of sequential data have been used to undertake assessment of potential impacts. Pollutant contour profiles for NO₂ are included within Appendix IV.
- 5.1.2 In accordance with previous guidance¹¹, annual mean AQLVs/EALs are considered relevant at receptors where cumulative occupancy exceeds 6 months of the year, eg residential properties. The annual mean AQLVs/EALs are not relevant at building facades of offices and other places of work where members of the public do not have regular access. In order to ensure a conservative, worst case assessment, the maximum point of impact within the modelling domain was used to assess potential worst case impacts on short term air quality standards.

¹¹

LAQM.TG(09), DEFRA, 2009.

Table 5.1 – Modelled Annual Mean NO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean NO ₂ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.36546	0.31092	0.32665	0.35194	0.31720	0.91	23.83	59.56
R2	0.63590	0.55567	0.58070	0.62443	0.52403	1.59	24.10	60.24
R3	0.61593	0.58384	0.58695	0.66788	0.52801	1.67	24.13	60.32
R4	0.63376	0.61001	0.61830	0.71016	0.55403	1.78	24.17	60.43
R5	0.64324	0.63703	0.64643	0.75047	0.57897	1.88	24.21	60.53
R6	0.63818	0.66357	0.67138	0.79288	0.59935	1.98	24.25	60.63
R7	0.63008	0.67070	0.67767	0.80986	0.61403	2.02	24.27	60.67
R8	0.64555	0.68650	0.70214	0.83914	0.64413	2.10	24.30	60.75
R9	0.69495	0.71622	0.75103	0.89978	0.70863	2.25	24.36	60.90
R10	0.71650	0.71261	0.76936	0.90814	0.72859	2.27	24.37	60.92
R11	0.70365	0.64668	0.76718	0.85648	0.69714	2.14	24.32	60.79
R12	0.62018	0.55517	0.67448	0.73282	0.59893	1.83	24.19	60.48
R13	0.63483	0.54082	0.67405	0.72322	0.59125	1.81	24.18	60.46
R14	0.61500	0.48010	0.62259	0.65480	0.53635	1.64	24.11	60.29
R15	0.54034	0.38732	0.51764	0.54117	0.44608	1.35	24.00	60.00
R16	0.50857	0.33787	0.46037	0.47453	0.40813	1.27	23.97	59.92
R17	0.17304	0.17265	0.15655	0.17378	0.15969	0.43	23.63	59.08
R18	0.18903	0.18845	0.17064	0.18966	0.16991	0.47	23.65	59.12
R19	0.22204	0.22494	0.19555	0.23022	0.19955	0.58	23.69	59.23
R20	0.10877	0.13118	0.10932	0.11173	0.10499	0.33	23.59	58.98
R21	0.01963	0.02434	0.01672	0.02099	0.01850	0.06	23.48	58.71

Table 5.2 – Modelled 99.8th Percentile of 1-Hour Mean NO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to 99.8 th Percentile of 1-Hour Mean NO ₂ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	29.55221	24.03047	25.56153	23.81002	26.31816	14.78	76.47	38.24
R2	36.63287	32.20771	34.18354	36.96677	37.38428	18.69	84.30	42.15
R3	36.00542	34.74205	31.46340	34.84589	35.88707	18.00	82.93	41.46
R4	36.18251	33.94964	32.78099	36.03938	35.49461	18.09	83.10	41.55
R5	36.18622	33.31164	36.34514	38.05996	38.00729	19.03	84.98	42.49
R6	37.31502	37.43363	38.93975	39.67577	40.00529	20.00	86.93	43.46
R7	40.78993	43.59997	39.10707	42.99746	42.21766	21.80	90.52	45.26
R8	42.47352	43.85128	40.08871	43.83654	41.99066	21.93	90.77	45.39
R9	42.75001	43.44585	40.54634	44.05096	42.55057	22.03	90.97	45.49
R10	44.45976	42.47053	40.35729	40.81223	42.61746	22.23	91.38	45.69
R11	38.03712	39.75583	38.98274	41.14923	37.25129	20.57	88.07	44.03
R12	30.34589	35.63415	35.34412	35.27771	35.66528	17.83	82.59	41.29
R13	32.73765	32.91674	36.19679	35.44623	36.21694	18.11	83.14	41.57
R14	32.61066	28.96349	33.30580	35.18583	32.77749	17.59	82.11	41.05
R15	31.15435	26.56822	29.28428	31.29751	28.76183	15.65	78.22	39.11
R16	26.42938	24.99252	28.52452	28.91564	25.03804	14.46	75.84	37.92
R17	14.09343	15.55458	14.64960	16.49244	15.20726	8.25	63.41	31.71
R18	15.19025	15.86737	13.44588	15.55927	14.54245	7.93	62.79	31.39
R19	15.85490	13.60745	15.03652	16.37387	15.94973	8.19	63.29	31.65
R20	6.83682	6.37822	6.55451	6.43920	6.51306	3.42	53.76	26.88
R21	2.23814	1.81984	1.43992	1.97432	1.74348	1.12	49.16	24.58
Maximum Point of Impact	135.95637	135.57563	137.49080	136.91726	138.00530	69.00	184.93	92.46

Table 5.3 – Modelled Annual Mean PM₁₀ Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean PM ₁₀ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.01433	0.01214	0.01318	0.01389	0.01296	0.04	15.40	38.51
R2	0.02963	0.02567	0.02787	0.02893	0.02450	0.07	15.42	38.55
R3	0.02905	0.02735	0.02827	0.03126	0.02473	0.08	15.42	38.55
R4	0.03015	0.02884	0.03005	0.03374	0.02621	0.08	15.42	38.56
R5	0.03060	0.03024	0.03147	0.03600	0.02757	0.09	15.43	38.57
R6	0.03001	0.03139	0.03251	0.03812	0.02859	0.10	15.43	38.57
R7	0.02948	0.03182	0.03289	0.03926	0.02943	0.10	15.43	38.57
R8	0.03026	0.03273	0.03434	0.04094	0.03109	0.10	15.43	38.58
R9	0.03324	0.03456	0.03739	0.04459	0.03490	0.11	15.43	38.59
R10	0.03437	0.03411	0.03831	0.04487	0.03606	0.11	15.43	38.59
R11	0.03328	0.02982	0.03730	0.04076	0.03384	0.10	15.43	38.58
R12	0.02851	0.02476	0.03193	0.03394	0.02816	0.08	15.42	38.56
R13	0.02911	0.02387	0.03177	0.03330	0.02754	0.08	15.42	38.56
R14	0.02772	0.02053	0.02870	0.02941	0.02434	0.07	15.42	38.55
R15	0.02339	0.01574	0.02291	0.02320	0.01950	0.06	15.41	38.53
R16	0.02162	0.01329	0.01981	0.01980	0.01758	0.05	15.41	38.53
R17	0.00494	0.00529	0.00460	0.00498	0.00470	0.01	15.40	38.49
R18	0.00556	0.00588	0.00510	0.00556	0.00502	0.01	15.40	38.49
R19	0.00766	0.00811	0.00680	0.00801	0.00693	0.02	15.40	38.50
R20	0.00610	0.00654	0.00596	0.00610	0.00572	0.02	15.40	38.49
R21	0.00097	0.00117	0.00082	0.00102	0.00090	0.00	15.39	38.48

Table 5.4 – Modelled Annual Mean PM_{2.5} Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean PM _{2.5} Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.01433	0.01214	0.01318	0.01389	0.01296	0.07	12.27	61.37
R2	0.02963	0.02567	0.02787	0.02893	0.02450	0.15	12.29	61.45
R3	0.02905	0.02735	0.02827	0.03126	0.02473	0.16	12.29	61.46
R4	0.03015	0.02884	0.03005	0.03374	0.02621	0.17	12.29	61.47
R5	0.03060	0.03024	0.03147	0.03600	0.02757	0.18	12.30	61.48
R6	0.03001	0.03139	0.03251	0.03812	0.02859	0.19	12.30	61.49
R7	0.02948	0.03182	0.03289	0.03926	0.02943	0.20	12.30	61.50
R8	0.03026	0.03273	0.03434	0.04094	0.03109	0.20	12.30	61.50
R9	0.03324	0.03456	0.03739	0.04459	0.03490	0.22	12.30	61.52
R10	0.03437	0.03411	0.03831	0.04487	0.03606	0.22	12.30	61.52
R11	0.03328	0.02982	0.03730	0.04076	0.03384	0.20	12.30	61.50
R12	0.02851	0.02476	0.03193	0.03394	0.02816	0.17	12.29	61.47
R13	0.02911	0.02387	0.03177	0.03330	0.02754	0.17	12.29	61.47
R14	0.02772	0.02053	0.02870	0.02941	0.02434	0.15	12.29	61.45
R15	0.02339	0.01574	0.02291	0.02320	0.01950	0.12	12.28	61.42
R16	0.02162	0.01329	0.01981	0.01980	0.01758	0.11	12.28	61.41
R17	0.00494	0.00529	0.00460	0.00498	0.00470	0.03	12.27	61.33
R18	0.00556	0.00588	0.00510	0.00556	0.00502	0.03	12.27	61.33
R19	0.00766	0.00811	0.00680	0.00801	0.00693	0.04	12.27	61.34
R20	0.00610	0.00654	0.00596	0.00610	0.00572	0.03	12.27	61.33
R21	0.00097	0.00117	0.00082	0.00102	0.00090	0.01	12.26	61.31

Table 5.5 – Modelled 90.4th Percentile of 24-Hour Mean PM₁₀ Concentrations at Receptor Locations

Receptor	Modelled PC to 90.4 th Percentile of 24-Hour Mean PM ₁₀ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.1303	0.11535	0.13115	0.13008	0.12388	0.26	18.29	36.58
R2	0.27172	0.24558	0.27614	0.24892	0.21027	0.55	18.44	36.87
R3	0.23205	0.23811	0.27299	0.29528	0.21347	0.59	18.46	36.91
R4	0.24689	0.26717	0.27067	0.31231	0.23365	0.62	18.47	36.94
R5	0.25066	0.27481	0.28542	0.32405	0.2343	0.65	18.48	36.97
R6	0.25748	0.30897	0.31366	0.30847	0.24744	0.63	18.47	36.95
R7	0.25054	0.3184	0.28169	0.35134	0.27181	0.70	18.51	37.02
R8	0.29224	0.3194	0.29761	0.38549	0.29857	0.77	18.55	37.09
R9	0.28517	0.33156	0.33924	0.4172	0.33366	0.83	18.58	37.15
R10	0.33804	0.33021	0.32927	0.45277	0.35553	0.91	18.61	37.23
R11	0.36565	0.27796	0.36317	0.38656	0.28187	0.77	18.55	37.09
R12	0.28244	0.24035	0.30727	0.3196	0.24963	0.64	18.48	36.96
R13	0.28375	0.23412	0.29112	0.31184	0.26619	0.62	18.47	36.94
R14	0.29857	0.19773	0.2751	0.29025	0.24744	0.60	18.46	36.92
R15	0.26036	0.14589	0.22627	0.2252	0.19711	0.52	18.42	36.84
R16	0.22803	0.12397	0.18736	0.20634	0.1744	0.46	18.39	36.78
R17	0.042472	0.042741	0.03874	0.04455	0.042167	0.09	18.20	36.41
R18	0.04799	0.046133	0.039506	0.043955	0.041427	0.10	18.21	36.42
R19	0.060661	0.062224	0.052587	0.063382	0.05729	0.13	18.22	36.45
R20	0.045155	0.051504	0.04754	0.046131	0.039374	0.10	18.21	36.42
R21	0.007816	0.0099046	0.007036	0.008043	0.0081331	0.02	18.17	36.34
Maximum Point of Impact	5.48716	4.40435	5.60218	4.46301	4.91562	11.20	23.76	47.52

Table 5.6 – Modelled 99.2nd Percentile of 24-Hour Mean SO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to 99.2 nd Percentile of 24-Hour Mean SO ₂ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.28688	0.27489	0.27232	0.28522	0.30741	0.25	3.89	3.11
R2	0.60452	0.46313	0.50179	0.55273	0.59235	0.48	4.18	3.35
R3	0.62541	0.48056	0.58592	0.67525	0.49322	0.54	4.26	3.40
R4	0.62202	0.50789	0.59188	0.66402	0.49879	0.53	4.24	3.40
R5	0.63247	0.51034	0.59879	0.60833	0.53995	0.51	4.21	3.37
R6	0.63937	0.50826	0.80277	0.72832	0.5213	0.64	4.38	3.51
R7	0.54758	0.56559	0.81424	0.76512	0.53951	0.65	4.39	3.52
R8	0.54769	0.67167	0.8071	0.75974	0.61132	0.65	4.39	3.51
R9	0.6103	0.71095	0.79394	0.82881	0.69828	0.66	4.41	3.53
R10	0.64399	0.65068	0.66642	0.80051	0.81684	0.65	4.40	3.52
R11	0.69157	0.79486	1.02464	0.94687	0.79366	0.82	4.60	3.68
R12	0.63758	0.65512	0.76205	0.84195	0.65482	0.67	4.42	3.54
R13	0.68496	0.5983	0.76372	0.68039	0.67392	0.61	4.34	3.47
R14	0.62388	0.58242	0.67806	0.5812	0.59884	0.54	4.26	3.41
R15	0.5267	0.50369	0.49046	0.48343	0.47099	0.42	4.11	3.29
R16	0.46114	0.42294	0.36022	0.39609	0.3642	0.37	4.04	3.23
R17	0.11133	0.11326	0.10157	0.11087	0.10664	0.09	3.69	2.95
R18	0.11821	0.13488	0.13031	0.098378	0.10355	0.11	3.71	2.97
R19	0.1356	0.13335	0.13909	0.13137	0.11064	0.11	3.72	2.98
R20	0.093709	0.08009	0.083698	0.085443	0.1197	0.10	3.70	2.96
R21	0.018999	0.023582	0.021	0.022145	0.016543	0.02	3.60	2.88
Maximum Point of Impact	6.87222	6.44064	6.85053	6.8153	6.95894	5.57	10.54	8.43

Table 5.7 – Modelled 99.7th Percentile of 1-Hour Mean SO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to 99.7 th Percentile of 1-Hour Mean SO ₂ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	2.0611	1.69808	1.78439	1.75727	1.92877	0.59	8.12	2.32
R2	2.75134	2.45863	2.68291	2.77806	2.7768	0.79	8.84	2.53
R3	2.67356	2.65608	2.33618	2.77144	2.74513	0.79	8.83	2.52
R4	2.72679	2.62786	2.53638	2.82771	2.81353	0.81	8.89	2.54
R5	2.70228	2.60228	2.6224	2.92685	2.8504	0.84	8.99	2.57
R6	2.82416	2.96255	2.75033	3.12628	2.97568	0.89	9.19	2.62
R7	3.16791	3.4806	3.08546	3.36127	3.10668	0.99	9.54	2.73
R8	3.2761	3.542	3.21213	3.33901	3.39067	1.01	9.60	2.74
R9	3.42576	3.41193	3.26103	3.44761	3.34099	0.99	9.51	2.72
R10	3.37889	3.30223	3.11303	3.26692	3.33348	0.97	9.44	2.70
R11	2.80232	2.90845	2.92717	3.01182	2.89615	0.86	9.07	2.59
R12	2.46947	2.60371	2.7917	2.7002	2.70265	0.80	8.85	2.53
R13	2.49922	2.58456	2.79385	2.82117	2.60858	0.81	8.88	2.54
R14	2.47173	2.3859	2.59506	2.83538	2.46084	0.81	8.90	2.54
R15	2.29204	2.10815	2.30985	2.47705	2.18457	0.71	8.54	2.44
R16	2.13027	1.93611	2.13199	2.13435	2.03589	0.61	8.19	2.34
R17	0.80147	0.8646	0.80095	0.92546	0.91646	0.26	6.99	2.00
R18	0.91607	0.94332	0.83705	0.94053	0.8932	0.27	7.00	2.00
R19	0.93368	0.90652	0.92345	1.06647	0.9478	0.30	7.13	2.04
R20	0.60814	0.48733	0.57292	0.55773	0.57049	0.17	6.67	1.91
R21	0.13776	0.12981	0.096313	0.11224	0.10812	0.04	6.20	1.77
Maximum Point of Impact	12.31549	11.95087	12.17828	12.20111	12.12742	3.52	18.38	5.25

Table 5.8 – Modelled 99.9th Percentile of 15-Minute Mean SO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to 99.9 th Percentile of 15-Minute Mean SO ₂ Concentrations (µg.m ⁻³)					Maximum PC to AQLV (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to AQLV (%)
	2017	2018	2019	2020	2021			
R1	3.46379	3.27405	3.40619	3.13938	3.33791	1.30	11.58	4.35
R2	4.72589	4.67967	4.68838	4.76714	4.62627	1.79	12.89	4.84
R3	4.15341	4.55223	3.80017	4.26417	4.55703	1.71	12.68	4.77
R4	4.32643	4.38452	3.82396	4.32387	4.44999	1.67	12.57	4.73
R5	4.51892	4.55415	4.11698	4.59183	4.78245	1.80	12.90	4.85
R6	4.75590	5.12691	4.72617	4.69369	5.14393	1.93	13.26	4.99
R7	5.02745	5.45010	4.84331	5.28789	5.54626	2.09	13.67	5.14
R8	5.17249	5.75795	5.21240	5.64049	5.68602	2.16	13.88	5.22
R9	5.66577	5.76547	5.57930	5.50774	5.86458	2.20	13.98	5.26
R10	5.60392	5.38222	5.56167	5.55486	5.52666	2.11	13.72	5.16
R11	4.61909	4.81333	4.83657	4.88134	4.60424	1.84	13.00	4.89
R12	3.95419	4.25419	4.34010	4.20751	4.37408	1.64	12.49	4.70
R13	4.01972	4.07233	4.29230	4.28035	4.31480	1.62	12.43	4.67
R14	3.83913	3.73013	4.11857	4.18410	4.03258	1.57	12.30	4.63
R15	3.67400	3.39623	3.59732	3.71443	3.57139	1.40	11.83	4.45
R16	3.37121	3.15207	3.49000	3.45629	3.28429	1.31	11.61	4.36
R17	1.45066	1.45027	1.39951	1.60094	1.61623	0.61	9.74	3.66
R18	1.42647	1.47096	1.37063	1.45465	1.40656	0.55	9.59	3.61
R19	1.52807	1.49800	1.49665	1.57084	1.52961	0.59	9.69	3.64
R20	1.23543	1.09872	1.17754	1.17744	1.15830	0.46	9.36	3.52
R21	0.26586	0.23808	0.20053	0.22528	0.23987	0.10	8.39	3.15
Maximum Point of Impact	16.99376	17.14982	16.99995	16.88531	16.91881	6.45	25.27	9.50

Table 5.9 – Modelled Annual Mean Benzene Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean Benzene Concentrations ($\mu\text{g}\cdot\text{m}^{-3}$)					Maximum PC to AQLV (%)	Maximum PEC ($\mu\text{g}\cdot\text{m}^{-3}$)	Contribution of PEC to AQLV (%)
	2016	2017	2018	2019	2020			
R1	0.00364	0.00308	0.00335	0.00353	0.00329	0.07	0.60	12.07
R2	0.00753	0.00652	0.00708	0.00735	0.00623	0.15	0.61	12.15
R3	0.00738	0.00695	0.00719	0.00794	0.00629	0.16	0.61	12.16
R4	0.00766	0.00733	0.00764	0.00857	0.00666	0.17	0.61	12.17
R5	0.00777	0.00768	0.00800	0.00915	0.00701	0.18	0.61	12.18
R6	0.00762	0.00798	0.00826	0.00969	0.00726	0.19	0.61	12.19
R7	0.00749	0.00808	0.00836	0.00997	0.00748	0.20	0.61	12.20
R8	0.00769	0.00832	0.00872	0.01040	0.00790	0.21	0.61	12.21
R9	0.00845	0.00878	0.00950	0.01133	0.00887	0.23	0.61	12.23
R10	0.00873	0.00867	0.00974	0.01140	0.00916	0.23	0.61	12.23
R11	0.00846	0.00757	0.00948	0.01036	0.00860	0.21	0.61	12.21
R12	0.00724	0.00629	0.00811	0.00862	0.00715	0.17	0.61	12.17
R13	0.00740	0.00606	0.00807	0.00846	0.00700	0.17	0.61	12.17
R14	0.00704	0.00522	0.00729	0.00747	0.00618	0.15	0.61	12.15
R15	0.00594	0.00400	0.00582	0.00590	0.00496	0.12	0.61	12.12
R16	0.00549	0.00338	0.00503	0.00503	0.00447	0.11	0.61	12.11
R17	0.00125	0.00134	0.00117	0.00127	0.00119	0.03	0.60	12.03
R18	0.00141	0.00150	0.00130	0.00141	0.00128	0.03	0.60	12.03
R19	0.00195	0.00206	0.00173	0.00203	0.00176	0.04	0.60	12.04
R20	0.00155	0.00166	0.00151	0.00155	0.00145	0.03	0.60	12.03
R21	0.00024	0.00030	0.00021	0.00026	0.00023	0.01	0.60	12.01

Table 5.10 – Maximum Modelled 24-Hour Mean Benzene Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 24-Hour Mean Benzene Concentrations ($\mu\text{g}\cdot\text{m}^{-3}$)	Maximum PC to EAL (%)	Maximum PEC ($\mu\text{g}\cdot\text{m}^{-3}$)	Contribution of PEC to EAL (%)
R1	0.14921	0.50	0.86	2.86
R2	0.2706	0.90	0.98	3.27
R3	0.2574	0.86	0.97	3.22
R4	0.28218	0.94	0.99	3.31
R5	0.31048	1.03	1.02	3.40
R6	0.32957	1.10	1.04	3.47
R7	0.30767	1.03	1.02	3.39
R8	0.28373	0.95	0.99	3.31
R9	0.28179	0.94	0.99	3.31
R10	0.28454	0.95	0.99	3.32
R11	0.42255	1.41	1.13	3.78
R12	0.37962	1.27	1.09	3.63
R13	0.3417	1.14	1.05	3.51
R14	0.28363	0.95	0.99	3.31
R15	0.20132	0.67	0.91	3.04
R16	0.18442	0.61	0.89	2.98
R17	0.05425	0.18	0.76	2.55
R18	0.05589	0.19	0.77	2.55
R19	0.06237	0.21	0.77	2.57
R20	0.10085	0.34	0.81	2.70
R21	0.00821	0.03	0.72	2.39
Maximum Point of Impact	2.69331	8.98	3.40	11.34

Table 5.11 – Maximum Rolling 8-Hour Mean CO Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 8-Hour Rolling Mean CO Concentrations ($\mu\text{g}\cdot\text{m}^{-3}$)	Maximum PC to AQLV (%)	Maximum PEC ($\mu\text{g}\cdot\text{m}^{-3}$)	Contribution of PEC to AQLV (%)
R1	0.19548	0.0020	200.99	2.01
R2	0.30707	0.0031	201.10	2.01
R3	0.2542	0.0025	201.04	2.01
R4	0.26285	0.0026	201.05	2.01
R5	0.26398	0.0026	201.05	2.01
R6	0.32627	0.0033	201.12	2.01
R7	0.30798	0.0031	201.10	2.01
R8	0.34969	0.0035	201.14	2.01
R9	0.37707	0.0038	201.17	2.01
R10	0.3585	0.0036	201.15	2.01
R11	0.32531	0.0033	201.12	2.01
R12	0.28104	0.0028	201.07	2.01
R13	0.25923	0.0026	201.05	2.01
R14	0.2606	0.0026	201.05	2.01
R15	0.20407	0.0020	200.99	2.01
R16	0.21791	0.0022	201.01	2.01
R17	0.053992	0.0005	200.84	2.01
R18	0.052485	0.0005	200.84	2.01
R19	0.069667	0.0007	200.86	2.01
R20	0.081593	0.0008	200.87	2.01
R21	0.0096951	0.0001	200.80	2.01
Maximum Point of Impact	1.6865	0.0169	202.48	2.02

Table 5.12 – Maximum Modelled 1-Hour Mean CO Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 1-Hour Mean CO Concentrations ($\mu\text{g.m}^{-3}$)	Maximum PC to EAL (%)	Maximum PEC ($\mu\text{g.m}^{-3}$)	Contribution of PEC to EAL (%)
R1	0.34571	0.0012	287.19	0.96
R2	0.50139	0.0017	287.34	0.96
R3	0.56246	0.0019	287.40	0.96
R4	0.57793	0.0019	287.42	0.96
R5	0.60693	0.0020	287.45	0.96
R6	0.62549	0.0021	287.47	0.96
R7	0.63045	0.0021	287.47	0.96
R8	0.64785	0.0022	287.49	0.96
R9	0.64391	0.0021	287.48	0.96
R10	0.6775	0.0023	287.52	0.96
R11	0.53829	0.0018	287.38	0.96
R12	0.4878	0.0016	287.33	0.96
R13	0.47154	0.0016	287.31	0.96
R14	0.45445	0.0015	287.29	0.96
R15	0.42716	0.0014	287.27	0.96
R16	0.40673	0.0014	287.25	0.96
R17	0.12082	0.0004	286.96	0.96
R18	0.12252	0.0004	286.96	0.96
R19	0.13052	0.0004	286.97	0.96
R20	0.13525	0.0005	286.98	0.96
R21	0.04509	0.0002	286.89	0.96
Maximum Point of Impact	2.12137	0.0071	288.96	0.96

Table 5.13 – Maximum Modelled 1-Hour Mean HCL Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 1-Hour Mean HCL Concentrations ($\mu\text{g}\cdot\text{m}^{-3}$)	Maximum PC to EAL (%)	Maximum PEC ($\mu\text{g}\cdot\text{m}^{-3}$)	Contribution of PEC to EAL (%)
R1	6.70166	0.89	8.21	1.10
R2	8.81678	1.18	10.33	1.38
R3	8.04051	1.07	9.55	1.27
R4	8.26707	1.10	9.78	1.30
R5	9.10499	1.21	10.62	1.42
R6	9.51744	1.27	11.03	1.47
R7	9.93281	1.32	11.44	1.53
R8	10.45696	1.39	11.97	1.60
R9	10.40569	1.39	11.92	1.59
R10	10.51787	1.40	12.03	1.60
R11	9.24655	1.23	10.76	1.43
R12	8.2186	1.10	9.73	1.30
R13	8.06541	1.08	9.58	1.28
R14	7.61543	1.02	9.13	1.22
R15	6.87264	0.92	8.38	1.12
R16	6.34972	0.85	7.86	1.05
R17	3.84496	0.51	5.36	0.71
R18	3.88775	0.52	5.40	0.72
R19	3.92781	0.52	5.44	0.73
R20	1.66168	0.22	3.17	0.42
R21	1.0788	0.14	2.59	0.35
Maximum Point of Impact	29.58972	3.95	31.10	4.15

Table 5.14 – Maximum Modelled 1-Hour Mean Chlorine Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 1-Hour Mean Chlorine Concentrations ($\mu\text{g.m}^{-3}$)	Maximum PC to EAL (%)
R1	1.60643	0.55
R2	2.10719	0.73
R3	1.92794	0.66
R4	1.95279	0.67
R5	2.20732	0.76
R6	2.29104	0.79
R7	2.36659	0.82
R8	2.48544	0.86
R9	2.47234	0.85
R10	2.49283	0.86
R11	2.21757	0.76
R12	1.96774	0.68
R13	1.93162	0.67
R14	1.8248	0.63
R15	1.65073	0.57
R16	1.52274	0.53
R17	0.94187	0.32
R18	0.95163	0.33
R19	0.96668	0.33
R20	0.40248	0.14
R21	0.26148	0.09
Maximum Point of Impact	7.3497	2.53

Table 5.15 – Modelled Annual Mean NO_x Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean NO _x Concentrations (µg.m ⁻³)					Maximum PC to Critical Level (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to Critical Level (%)
	2016	2017	2018	2019	2020			
R22	0.03763	0.04229	0.03309	0.03803	0.03405	0.14	33.16	110.54
R23	0.04038	0.05676	0.04309	0.04830	0.04521	0.19	33.18	110.59
R24	0.01763	0.02556	0.01892	0.02219	0.02046	0.09	33.15	110.49
R25	0.00525	0.00638	0.00423	0.00530	0.00474	0.02	33.13	110.42
R26	0.00730	0.00856	0.00537	0.00659	0.00640	0.03	33.13	110.43
R27	0.15814	0.12415	0.16917	0.16343	0.15066	0.56	33.29	110.96
R28	0.09056	0.05712	0.07177	0.08089	0.07059	0.30	33.21	110.70
R29	1.21469	1.53537	1.20399	1.35770	1.22887	5.12	34.66	115.52
R30	0.99574	1.28014	0.95138	1.15941	1.02830	4.27	34.40	114.67
R31	0.65672	0.77385	0.61692	0.69410	0.61875	2.58	33.89	112.98
R32	0.51208	0.57453	0.46616	0.52651	0.45789	1.92	33.69	112.32
R33	0.31438	0.34949	0.27059	0.30321	0.27922	1.16	33.47	111.56
R34	0.24672	0.24701	0.22242	0.24843	0.21972	0.83	33.37	111.23
R35	0.20140	0.15806	0.19162	0.20436	0.18909	0.68	33.32	111.08
R36	0.08571	0.05264	0.07988	0.06179	0.07634	0.29	33.21	110.69
R37	0.08184	0.05418	0.06846	0.07761	0.06470	0.27	33.20	110.67
R38	0.08010	0.05444	0.06983	0.07969	0.06452	0.27	33.20	110.67
R39	0.06103	0.05552	0.06347	0.07561	0.06586	0.25	33.20	110.65
R40	0.05734	0.05064	0.05778	0.06950	0.05817	0.23	33.19	110.63
R41	0.04230	0.03619	0.03931	0.04489	0.03961	0.15	33.16	110.55
R42	0.04363	0.04061	0.04107	0.04875	0.04063	0.16	33.17	110.56

Table 5.16 – Modelled Annual Mean SO₂ Concentrations at Receptor Locations

Receptor	Modelled PC to Annual Mean SO ₂ Concentrations (µg.m ⁻³)					Maximum PC to Critical Level (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to Critical Level (%)
	2016	2017	2018	2019	2020			
R22	0.00105	0.00119	0.00093	0.00106	0.00097	0.012	3.03	30.31
R23	0.00108	0.00154	0.00117	0.00131	0.00123	0.015	3.03	30.32
R24	0.00050	0.00072	0.00053	0.00062	0.00058	0.007	3.03	30.31
R25	0.00015	0.00018	0.00012	0.00015	0.00013	0.002	3.03	30.30
R26	0.00020	0.00024	0.00015	0.00018	0.00018	0.002	3.03	30.30
R27	0.00318	0.00258	0.00359	0.00346	0.00317	0.036	3.03	30.34
R28	0.00192	0.00119	0.00154	0.00167	0.00151	0.019	3.03	30.32
R29	0.03410	0.04361	0.03378	0.03840	0.03455	0.436	3.07	30.74
R30	0.02779	0.03622	0.02673	0.03265	0.02894	0.362	3.07	30.66
R31	0.01811	0.02158	0.01716	0.01923	0.01717	0.216	3.05	30.52
R32	0.01369	0.01550	0.01258	0.01420	0.01231	0.155	3.05	30.45
R33	0.00764	0.00865	0.00664	0.00741	0.00678	0.087	3.04	30.39
R34	0.00573	0.00585	0.00518	0.00572	0.00506	0.059	3.04	30.36
R35	0.00415	0.00332	0.00405	0.00432	0.00401	0.043	3.03	30.34
R36	0.00174	0.00104	0.00169	0.00118	0.00155	0.017	3.03	30.32
R37	0.00178	0.00115	0.00149	0.00164	0.00140	0.018	3.03	30.32
R38	0.00174	0.00116	0.00152	0.00169	0.00139	0.017	3.03	30.32
R39	0.00129	0.00119	0.00139	0.00165	0.00145	0.016	3.03	30.32
R40	0.00119	0.00107	0.00126	0.00150	0.00127	0.015	3.03	30.31
R41	0.00081	0.00073	0.00082	0.00090	0.00079	0.009	3.03	30.31
R42	0.00082	0.00083	0.00085	0.00099	0.00079	0.010	3.03	30.31

Table 5.17 – Maximum Modelled 24-Hour Mean NO_x Concentrations at Receptor Locations

Receptor	Maximum Modelled PC to 24-Hour Mean NO _x Concentrations (µg.m ⁻³)	Maximum PC to Critical Level (%)	Maximum PEC (µg.m ⁻³)	Contribution of PEC to Critical Level (%)
R1	1.03111	1.37	40.11	53.48
R2	2.28527	3.05	41.37	55.15
R3	0.91134	1.22	39.99	53.32
R4	0.27285	0.36	39.35	52.47
R5	0.55145	0.74	39.63	52.84
R6	8.5101	11.35	47.59	63.45
R7	5.00703	6.68	44.09	58.78
R8	35.48737	47.32	74.57	99.42
R9	34.67153	46.23	73.75	98.34
R10	19.89485	26.53	58.97	78.63
R11	19.22443	25.63	58.30	77.74
R12	12.8592	17.15	51.94	69.25
R13	9.47697	12.64	48.56	64.74
R14	9.2095	12.28	48.29	64.39
R15	3.3095	4.41	42.39	56.52
R16	3.20476	4.27	42.28	56.38
R17	3.39657	4.53	42.48	56.64
R18	3.92429	5.23	43.00	57.34
R19	2.97897	3.97	42.06	56.08
R20	1.78948	2.39	40.87	54.49
R21	2.58759	3.45	41.67	55.56

5.2 Assessment of Potential Impacts at Human Receptors

5.2.1 Nitrogen Dioxide

5.2.1.1 The modelled PEC for annual mean NO₂ concentrations is <70% of the AQLV at all relevant receptor locations. As such, impacts are concluded to be insignificant, in accordance with the relevant guidance. Furthermore, no exceedence of the annual mean AQLV is predicted at any relevant receptor location. Although the maximum modelled PC to 99.8th percentile of 1-hour mean concentrations is >10% of the AQLV at several receptor locations, the PEC is significantly below the AQLV at all discrete receptor locations (R1 to R21) surrounding the plant. Furthermore, no exceedence of the short term AQLV is predicted at the maximum point of impact, the PEC being 92.46% of the AQLV at maximum point of impact surrounding the plant. Therefore, potential impacts are not predicted to be significant. Confidence in this prediction is high given the highly conservative assumptions used in this assessment for NO_x emissions. The pollutant contour profiles within Appendix IV demonstrate that peak short term NO₂ concentrations occur in very close proximity to the plant and reduce rapidly with increasing distance from the plant.

5.2.2 Particulate Matter

5.2.2.1 The modelled PC to annual mean PM₁₀ and PM_{2.5} concentrations is <1% of the AQLVs at all relevant receptor locations. As such, impacts are predicted to be insignificant. Furthermore, no exceedence of the annual mean AQLV is predicted at any relevant receptor location. The modelled PC to 90.4th percentile of 24-hour mean PM₁₀ concentrations is <10% of the AQLV at all discrete receptor locations. Although this criteria is exceeded at the maximum point of impact, the PEC is significantly below the AQLV (47.52% of the AQLV). As such, no significant impacts are predicted. Confidence in this prediction is high given the highly conservative assumptions used in this assessment for particulate matter.

5.2.3 Sulphur Dioxide

5.2.3.1 The modelled PC to 99.2nd percentile of 24-hour mean concentrations, 99.7th percentile of 1-hour mean concentrations and 99.9th percentile of 15-minute mean concentrations is <10% of the AQLV at all locations surrounding the plant. As such, impacts on short term SO₂ AQLVs are predicted to be insignificant.

5.2.4 Benzene

5.2.4.1 The modelled PC is less than 1% of the annual mean AQLV for benzene at all relevant receptors surrounding the plant. Furthermore, the modelled PC is less than 10% of the short term EAL at all locations surrounding the plant. As such, potential impacts are not predicted to be significant. Furthermore, no exceedence of the AQLV/EAL is predicted at any relevant receptor location.

5.2.5 Carbon Monoxide

5.2.5.1 The maximum modelled PC to rolling 8-hour maximum mean and 1-hour mean CO concentration is <10% of the AQLV and EAL respectively at all locations surrounding the plant. As such, impacts are concluded to be insignificant. Furthermore, no exceedence of the AQLV/EAL is predicted at any relevant receptor location.

5.2.6 Hydrogen Chloride

5.2.6.1 The maximum modelled PC to 1-hour mean HCL concentration is <10% of the EAL at all locations surrounding the plant. As such, impacts are concluded to be insignificant. Furthermore, no exceedence of the EAL is predicted at any relevant receptor location.

5.2.7 Chlorine

5.2.7.1 The maximum modelled PC to 1-hour mean chlorine concentrations is <10% of the EAL at all locations surrounding the plant. As such, impacts are concluded to be insignificant.

5.3 Assessment of Potential Impacts at Sensitive Ecological Receptors

5.3.1 Critical Levels

5.3.1.1 The modelled PC is less than 100% of the critical level for annual mean and 24-hour mean NO_x concentrations and annual mean SO₂ concentrations at all local nature sites (receptors R22 to R26 and R28 to R42). As such, potential impacts on local nature sites are predicted to be insignificant, in accordance with the relevant guidance.

5.3.1.2 The modelled PC is less than 1% and 10% of critical level for annual mean and 24-hour mean NO_x concentrations respectively at receptor R27. Furthermore, the modelled PC to annual mean critical level for SO₂ is <1% at receptor R27. As such, potential impacts at Ipsley Alders Marsh SSSI are predicted to be insignificant, in accordance with the relevant guidance.

5.3.2 Nitrogen Deposition

5.3.2.1 The maximum PC to nitrogen deposition has been calculated from the predicted annual mean NO_x concentration, in accordance with the relevant guidance. Nitrogen deposition arising as a result of resulting annual mean NO_x concentrations has been calculated using the following formula:

$$F = \left(\frac{V_d \times C \times 10000}{1000000000} \right) \times 0.3 \times 31536000$$

Where: F = deposition flux (Kg N.ha⁻¹.Year⁻¹)

V_d = nitrogen dry deposition velocity, assumed to be 0.003m.s⁻¹ to provide conservative assessment

C = predicted annual mean NO_x concentration (µg.m⁻³)

10000 = conversion from m² to hectares (ha)

1000000000 = conversion from µg to Kg

0.30 = Factor based on proportion of NO₂ that is nitrogen

31536000 = conversion from seconds to year

5.3.2.2 Calculated annual nitrogen deposition at relevant receptors is presented in the table below. As the PC is <100% of the worst case critical load at local nature sites (R22 to R26 and R28 to R42) and <1% of the critical load at Ipsley Alders Marsh SSSI (R27), impacts are predicted to be insignificant at all relevant ecological receptors and there is no requirement for further assessment in accordance with government permitting risk assessment guidance.

Table 5.18 - Calculated Annual Nitrogen Deposition at Ecological Receptors

Receptor	Maximum Modelled Annual Mean NO _x Concentration (µg.m ⁻³)	Calculated PC to Annual Nitrogen Deposition (Kg N.ha ⁻¹ .Year ⁻¹) Based on Modelled Annual Mean NO _x Concentration	Percentage Contribution to Worst Case Critical Load for Annual Nitrogen Deposition (%)
R22	0.04229	0.01200	0.40
R23	0.05676	0.01611	0.54
R24	0.02556	0.00725	0.24
R25	0.00638	0.00181	0.06
R26	0.00856	0.00243	0.08
R27	0.16917	0.04802	0.32
R28	0.09056	0.02570	0.86
R29	1.53537	0.43578	14.53
R30	1.28014	0.36333	12.11
R31	0.77385	0.21964	7.32
R32	0.57453	0.16307	5.44
R33	0.34949	0.09919	3.31
R34	0.24843	0.07051	2.35
R35	0.20436	0.05800	1.93
R36	0.08571	0.02433	0.81
R37	0.08184	0.02323	0.77
R38	0.08010	0.02273	0.76
R39	0.07561	0.02146	0.72
R40	0.06950	0.01973	0.66
R41	0.04489	0.01274	0.42
R42	0.04875	0.01384	0.46

5.3.3 Acid Deposition

5.3.3.1 The potential PC to acid deposition across relevant ecological sites can be calculated by converting nitrogen and sulphur deposition predictions to kiloequivalents ($\text{keq} \cdot \text{ha}^{-1} \cdot \text{Year}^{-1}$) using the following assumptions, obtained from the APIS website:

- 1 $\text{keq N ha}^{-1} \cdot \text{Year}^{-1}$ is equal to $14\text{kg N ha}^{-1} \cdot \text{Year}^{-1}$; and,
- 1 $\text{keq S ha}^{-1} \cdot \text{Year}^{-1}$ is equal to $16\text{kg S ha}^{-1} \cdot \text{Year}^{-1}$

5.3.3.2 Potential sulphur deposition across ecological sites was calculated in a similar fashion to nitrogen deposition, using the following equation and assumptions:

$$F = \frac{V_d \times C \times 10000}{1000000000} \times 0.50 \times 31536000$$

Where: F = deposition flux ($\text{Kg S} \cdot \text{ha}^{-1} \cdot \text{Year}^{-1}$)

V_d = sulphur dry deposition velocity, assumed to be $0.024\text{m} \cdot \text{s}^{-1}$ to provide conservative assessment

C = predicted annual mean SO_2 concentration ($\mu\text{g} \cdot \text{m}^{-3}$)

10000 = conversion from m^2 to hectares (ha)

1000000000 = conversion from μg to Kg

0.5 = Factor based on proportion of SO_2 that is sulphur

31536000 = conversion from seconds to year

5.3.3.3 Based upon the above, the following table summarises annual nitrogen and sulphur deposition, total PC to annual acid deposition at ecological receptors due to nitrogen and sulphur and percentage contribution to critical load function for nitrogen (CL_{maxN}). As is shown, the total PC to acid deposition is predicted to be less than 100% of the relevant critical load at all local nature sites (R22 to R26 and R28 to R42) and less than 1% of the relevant critical load at Ipsley Alders Marsh SSSI (R27). As such, potential impacts are predicted to be insignificant.

Table 5.19 - Calculated Acid Deposition at Ecological Receptors

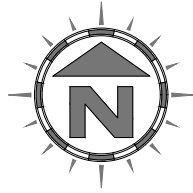
Receptor	Calculated PC to Annual Acid Deposition from Nitrogen (keq.ha ⁻¹ . Year ⁻¹) Based on Maximum Modelled Annual Mean NO _x Concentration	Calculated PC to Annual Acid Deposition from Sulphur (keq.ha ⁻¹ . Year ⁻¹) Based on Maximum Modelled Annual Mean SO ₂ Concentration	Total PC to Annual Acid Deposition Due to Nitrogen and Sulphur (keq.ha ⁻¹ . Year ⁻¹)	PC to CLMaxN (%)
R22	0.00086	0.00028	0.00114	1.14
R23	0.00115	0.00036	0.00152	1.52
R24	0.00052	0.00017	0.00069	0.69
R25	0.00013	0.00004	0.00017	0.17
R26	0.00017	0.00006	0.00023	0.23
R27	0.00343	0.00085	0.00428	0.40
R28	0.00184	0.00045	0.00229	2.29
R29	0.03113	0.01031	0.04144	41.44
R30	0.02595	0.00857	0.03452	34.52
R31	0.01569	0.00510	0.02079	20.79
R32	0.01165	0.00367	0.01531	15.31
R33	0.00709	0.00205	0.00913	9.13
R34	0.00504	0.00138	0.00642	6.42
R35	0.00414	0.00102	0.00516	5.16
R36	0.00174	0.00041	0.00215	2.15
R37	0.00166	0.00042	0.00208	2.08
R38	0.00162	0.00041	0.00203	2.03
R39	0.00153	0.00039	0.00192	1.92
R40	0.00141	0.00035	0.00176	1.76
R41	0.00091	0.00021	0.00112	1.12
R42	0.00099	0.00023	0.00122	1.22

6 Conclusions

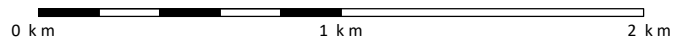
- 6.1 An assessment of potential air quality impacts has been undertaken for the proposed operation of a facility for the recovery of precious metals from wastes at 10 Merse Road, Redditch. Potential emissions from the processes have been modelled to predict resulting short and long term pollutant concentrations at relevant ecological and human receptor locations and comparison made with relevant AQLVs/EALs and critical levels and loads.
- 6.2 An assessment of potential impacts on AQLVs, EALs, critical levels and loads has been undertaken in accordance with government permitting risk assessment guidance.
- 6.3 The assessment has not predicted any significant impacts on health based short or long AQLVs and EALs at discrete human receptor locations and no exceedances of AQLVs or EALs have been predicted at any location surrounding the plant.
- 6.4 The assessment has not predicted any significant impacts on short and long term critical levels and loads at relevant ecological receptor locations.
- 6.5 A series of conservative assumptions have been used throughout this assessment and therefore confidence in the above conclusions is high.

Appendix I

Site Layout Plans



Scale Bar (1:25,000)



NOTES

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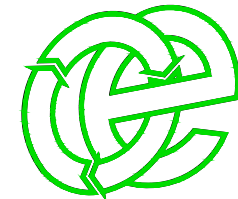
REVISION HISTORY

Rev:	Date:	Init:	Description:
-	20.05.22	RS	Initial drawing

KEY:

Planning boundary

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants



DRAWING TITLE
SITE LOCATION MAP

CLIENT
Kaug Refinery Services Ltd

PROJECT/SITE
10 Merse Road, Moons Moat North
Industrial Estate, Redditch B98 9HL

SCALE @ A4	CLIENT NO	JOB NO
1:1,250	2765	009

DRAWING NUMBER	REV	STATUS
2765-009-01	-	Issued

DRAWN BY	CHECKED	DATE
RS	RS	20.05.22

Lime House, Road Two, Winsford, Cheshire, CW7 3QZ
t: 01606 558833 | e: sales@oaktree-environmental.co.uk


NOTES

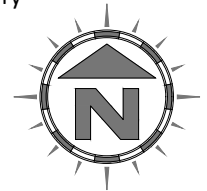
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REVISION HISTORY

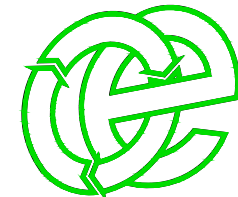
Rev:	Date:	Init:	Description:
-	20.05.22	RS	Initial drawing

KEY:

 Planning boundary



Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants



DRAWING TITLE

SITE LOCATION PLAN

CLIENT

Kaug Refinery Services Ltd

PROJECT/SITE

10 Merse Road, Moons Moat North
Industrial Estate, Redditch B98 9HL

SCALE @ A4

1:1,250

CLIENT NO

2765

JOB NO

009

DRAWING NUMBER

2765-009-02

REV

-

STATUS

Issued

DRAWN BY

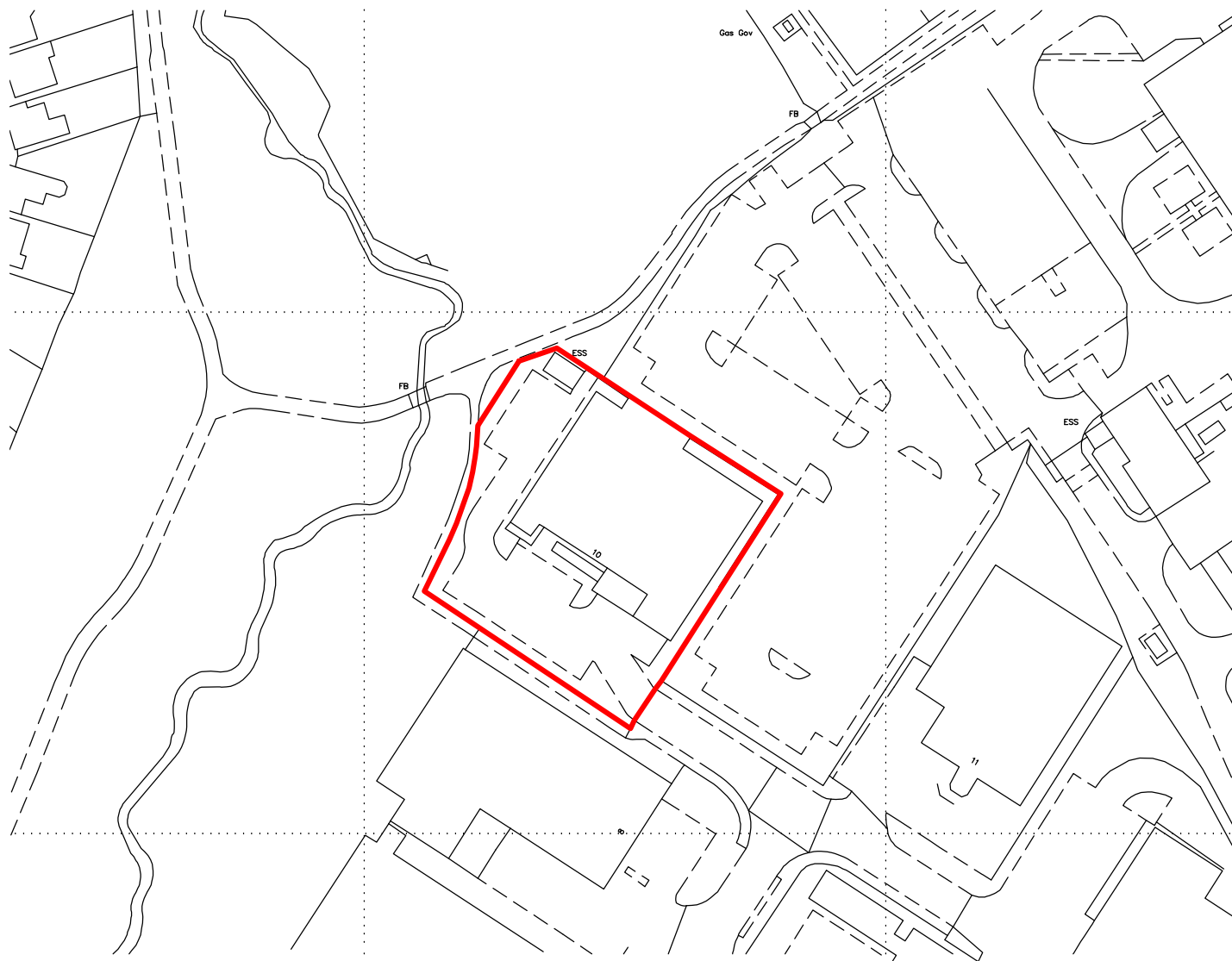
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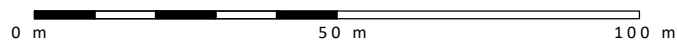
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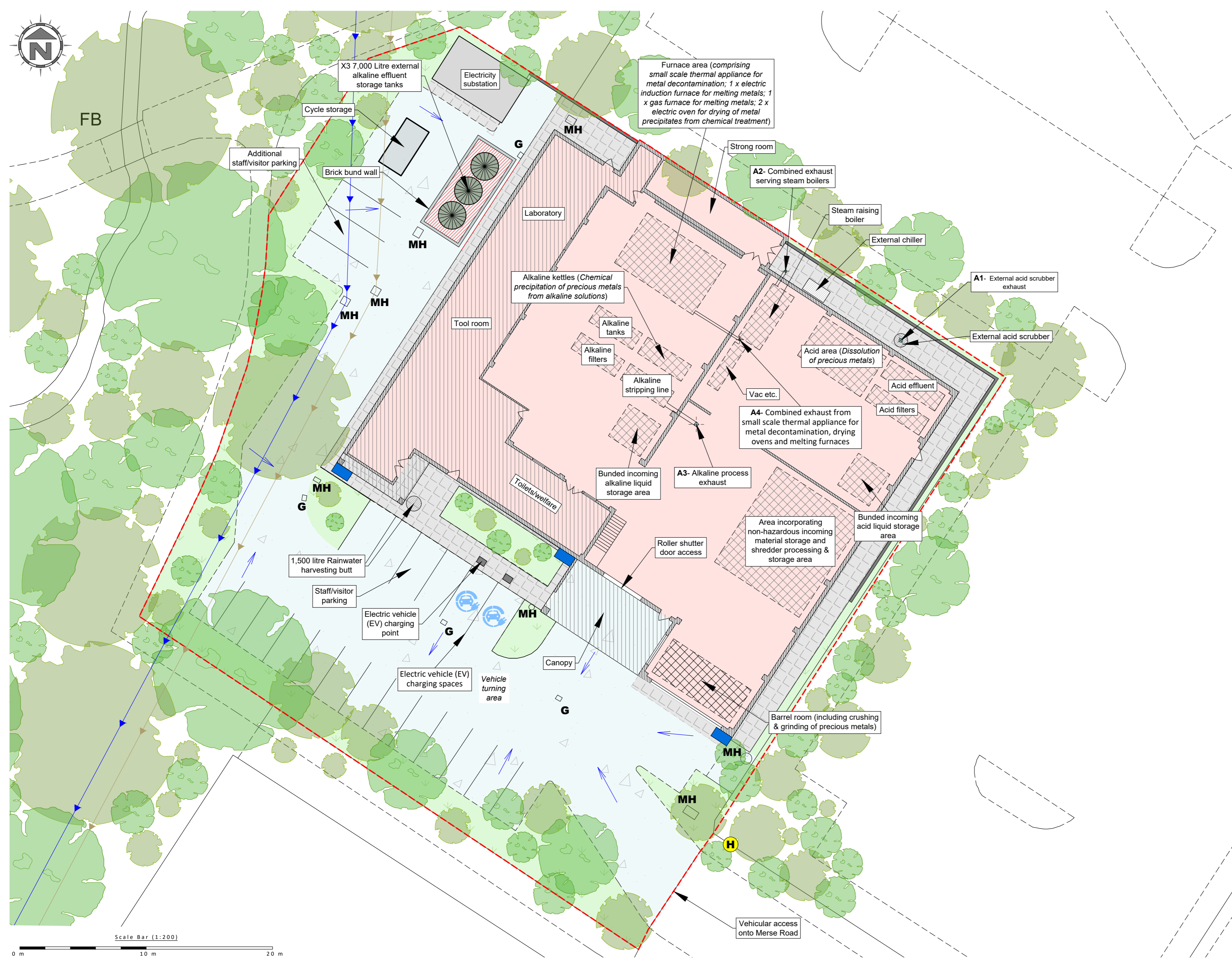
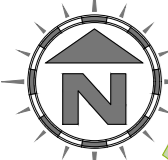
DATE

20.05.22



Scale Bar (1:1,250)



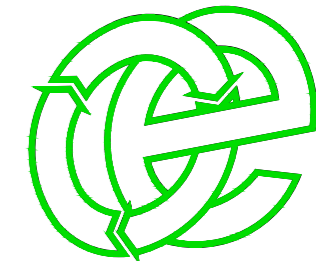


NOTES
 Site survey undertaken using Intel Falcon 8+ drone in September 2022. Ordnance Survey data reproduced with the permission of the controller of H.M.S.O. Crown copyright licence No. 100022432. This drawing is copyright and property of Oaktree Environmental Ltd.

Rev:	Date:	Init:	Description:
-	14.03.23	JH	Initial drawing
A	14.04.23	IA	Layout amendments
B	04.05.23	IA	Layout changes as required by EA

- KEY:**
- Planning boundary
 - Sealed buildings
 - Concreted areas
 - H Hydrant
 - MH Manhole
 - G Gully
 - Fall direction arrows
 - Paved areas
 - Un-surfaced areas
 - Schwegler 1SP bird/bat terrace
 - Surface water drainage
 - Foul drainage

Oaktree Environmental Ltd
 Waste, Planning and Environmental Consultants



DRAWING TITLE
 PROPOSED LAYOUT PLAN

CLIENT
 Kaug Refinery Services Ltd

PROJECT/SITE
 10 Merse Road, North Moons Moat, Redditch, B98 9HL

SCALE @ A2 **CLIENT NO** **JOB NO**
 1:200 2765 009

DRAWING NUMBER **REV** **STATUS**
 2765-009-04 B Issued

DRAWN BY **CHECKED** **DATE**
 JH/IA RS/DY 04.05.23

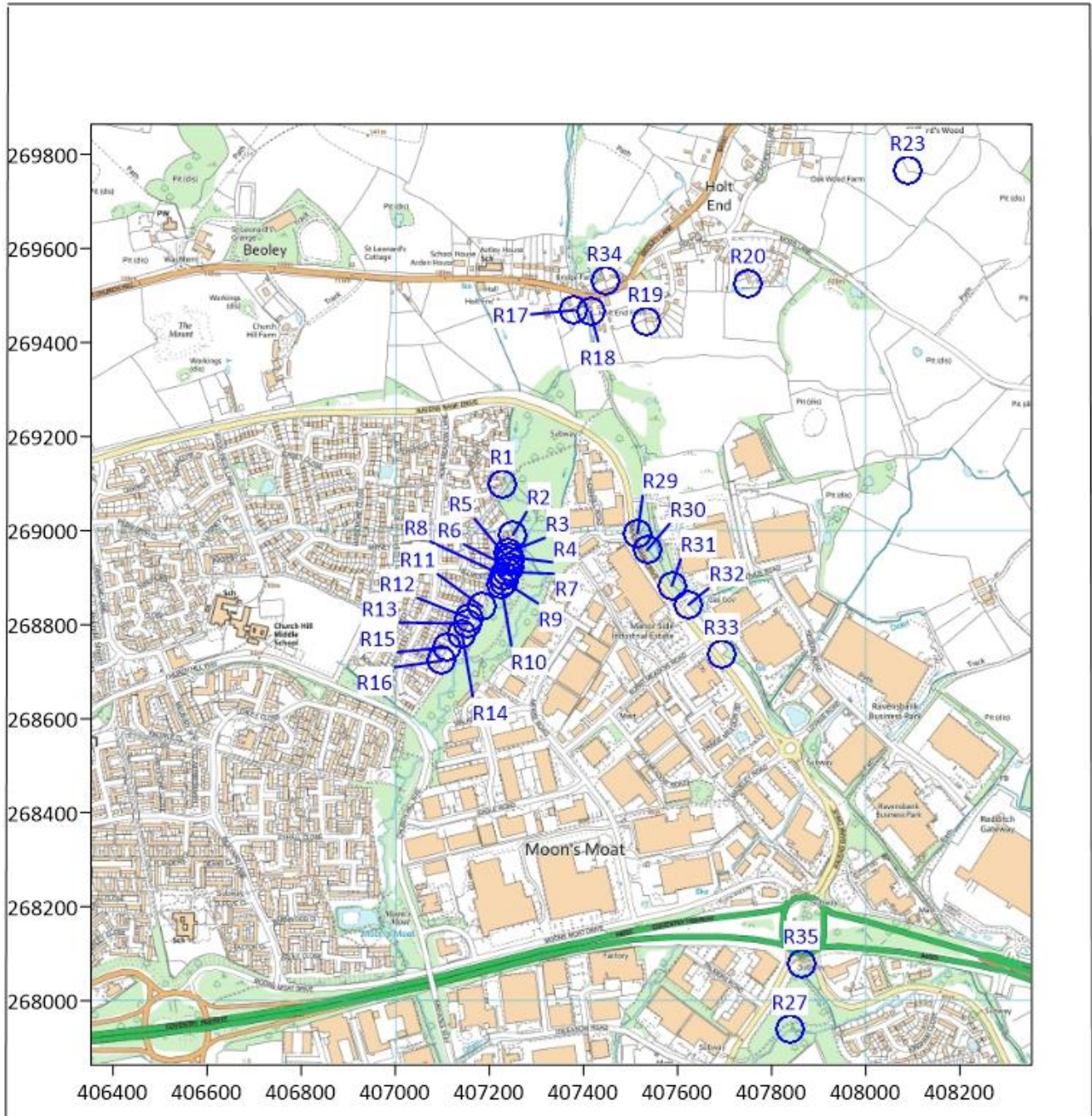
Lime House, Road Two, Winsford, Cheshire, CW7 3QZ
 t: 01606 558833 | e: sales@oaktree-environmental.co.uk

Scale Bar (1:200)


0 m 10 m 20 m

Appendix II

Sensitive Receptor Locations



Appendix II Figure 1 - Sensitive Receptors

 Receptor Location

R1 Receptor Identifier

Oaktree Environmental Ltd
 Lime House
 2 Road Two
 Winsford
 Cheshire
 CW7 3QZ



N.B - Map contains Ordnance Survey data

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Appendix III

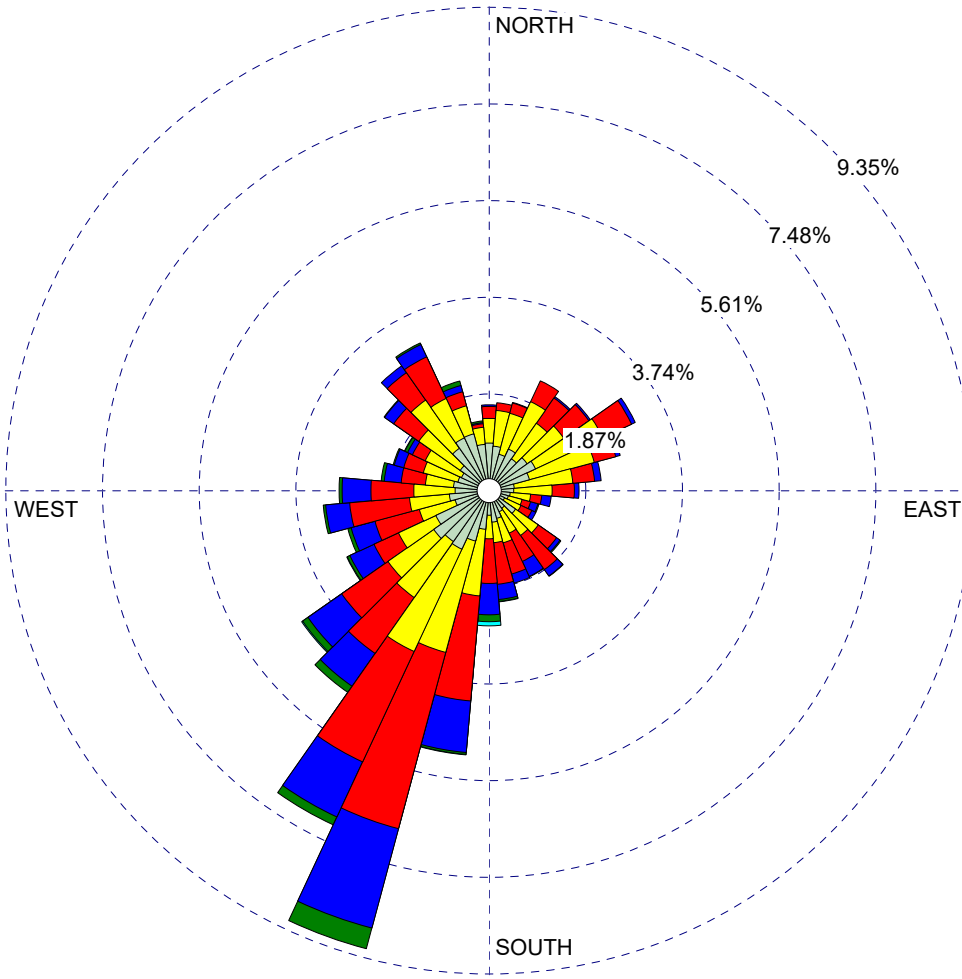
Pershore Wind Roses

WIND ROSE PLOT:

Wind Speed and Direction Frequency at Pershore - 2016

DISPLAY:

**Wind Speed
Direction (blowing from)**



**WIND SPEED
(m/s)**

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 2.21%

COMMENTS:

DATA PERIOD:

**Start Date: 01/01/2016 - 00:00
End Date: 01/01/2017 - 23:59**

COMPANY NAME:

MODELER:

CALM WINDS:

2.21%

TOTAL COUNT:

8784 hrs.

AVG. WIND SPEED:

3.12 m/s

DATE:

20/05/2021

PROJECT NO.:

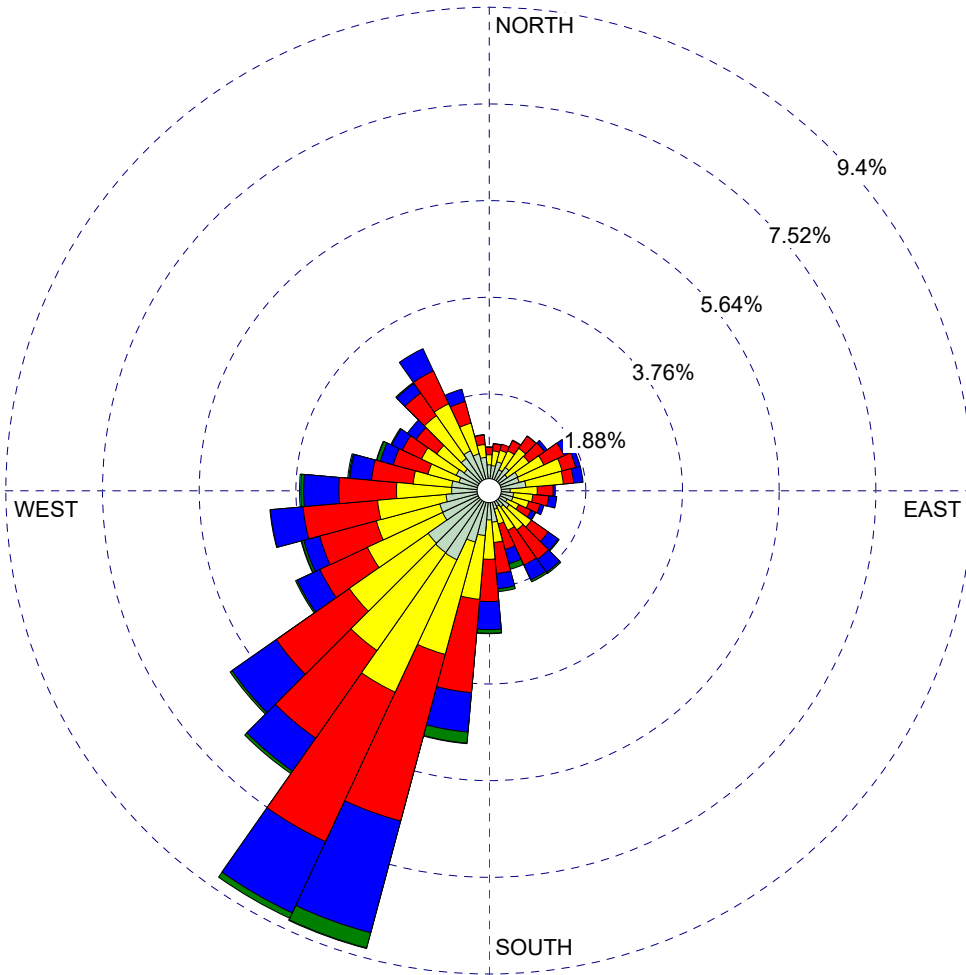
2385-004

WIND ROSE PLOT:

Wind Speed and Direction Frequency at Pershore - 2017

DISPLAY:

**Wind Speed
Direction (blowing from)**



WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 1.45%

COMMENTS:

DATA PERIOD:

**Start Date: 01/01/2017 - 00:00
End Date: 01/01/2018 - 23:59**

COMPANY NAME:

MODELER:

CALM WINDS:

1.45%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

3.27 m/s

DATE:

20/05/2021

PROJECT NO.:

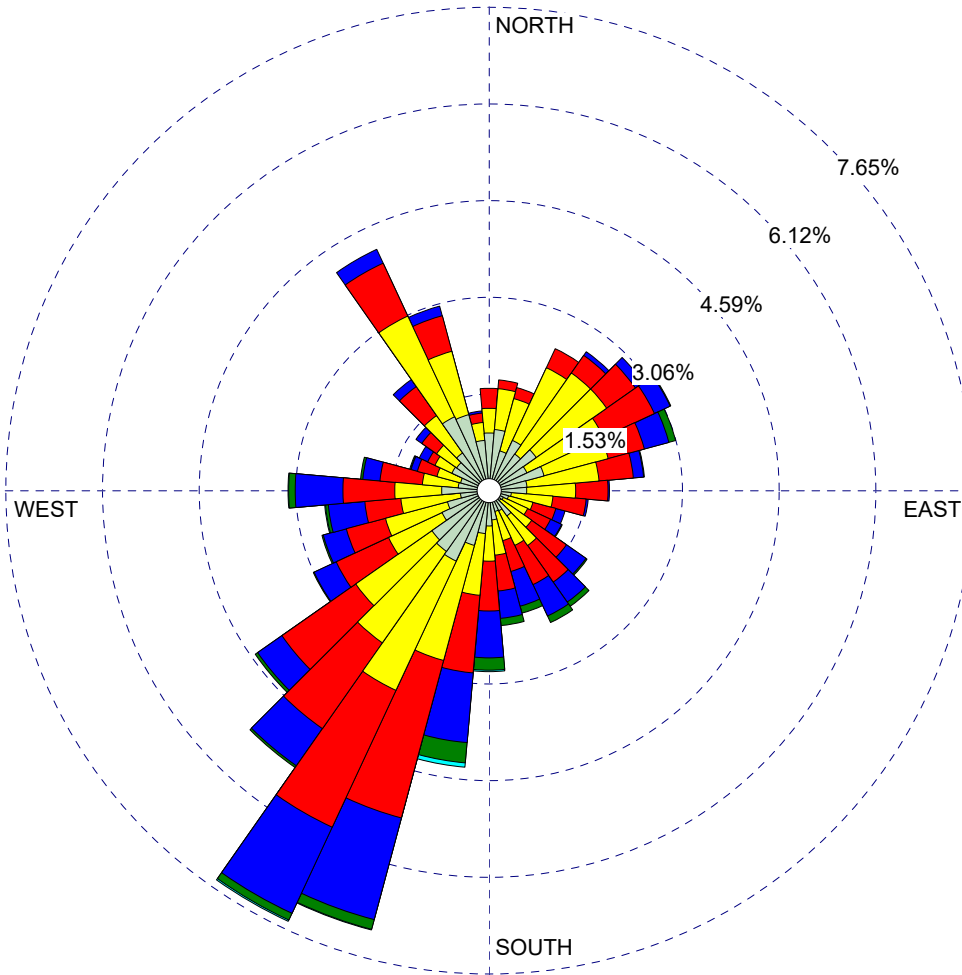
2385-004

WIND ROSE PLOT:

Wind Speed and Direction Frequency at Pershore - 2018

DISPLAY:

**Wind Speed
Direction (blowing from)**



WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 1.39%

COMMENTS:

DATA PERIOD:

**Start Date: 01/01/2018 - 00:00
End Date: 01/01/2019 - 23:59**

COMPANY NAME:

MODELER:

CALM WINDS:

1.39%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

3.24 m/s

DATE:

20/05/2021

PROJECT NO.:

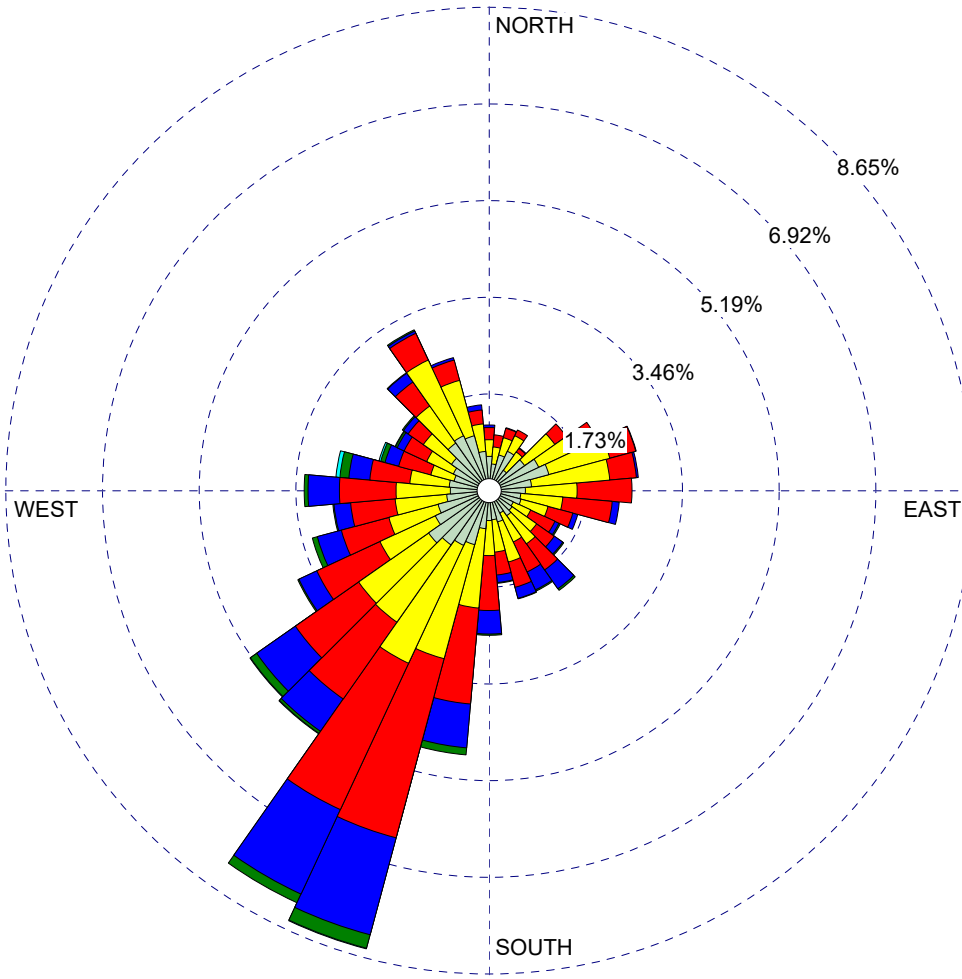
2385-004

WIND ROSE PLOT:

Wind Speed and Direction Frequency at Pershore - 2019

DISPLAY:

**Wind Speed
Direction (blowing from)**



**WIND SPEED
(m/s)**

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 1.86%

COMMENTS:

DATA PERIOD:

**Start Date: 01/01/2019 - 00:00
End Date: 01/01/2020 - 23:59**

COMPANY NAME:

MODELER:

CALM WINDS:

1.86%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

3.09 m/s

DATE:

20/05/2021

PROJECT NO.:

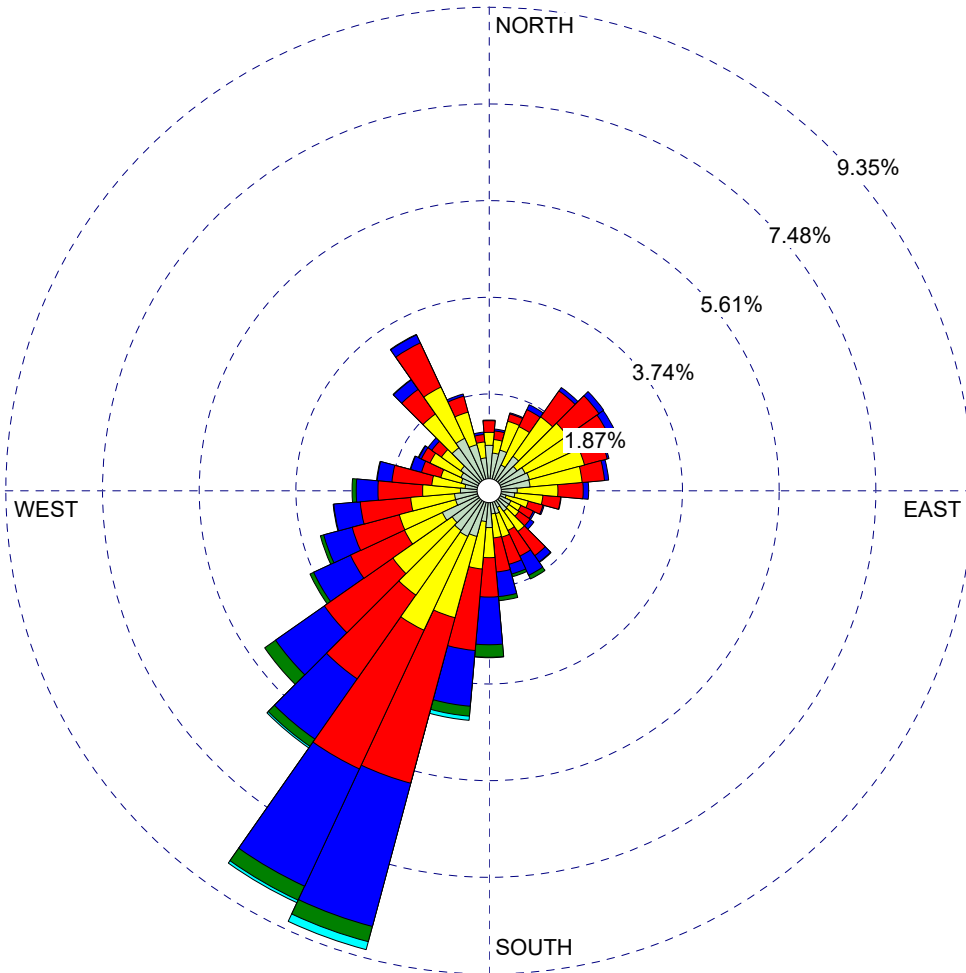
2385-004

WIND ROSE PLOT:

Wind Speed and Direction Frequency at Pershore - 2020

DISPLAY:

Wind Speed
Direction (blowing from)



WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 1.82%

COMMENTS:

DATA PERIOD:

Start Date: 01/01/2020 - 00:00
End Date: 01/01/2021 - 23:59

COMPANY NAME:

MODELER:

CALM WINDS:

1.82%

TOTAL COUNT:

8784 hrs.

AVG. WIND SPEED:

3.41 m/s

DATE:

20/05/2021

PROJECT NO.:

2385-004

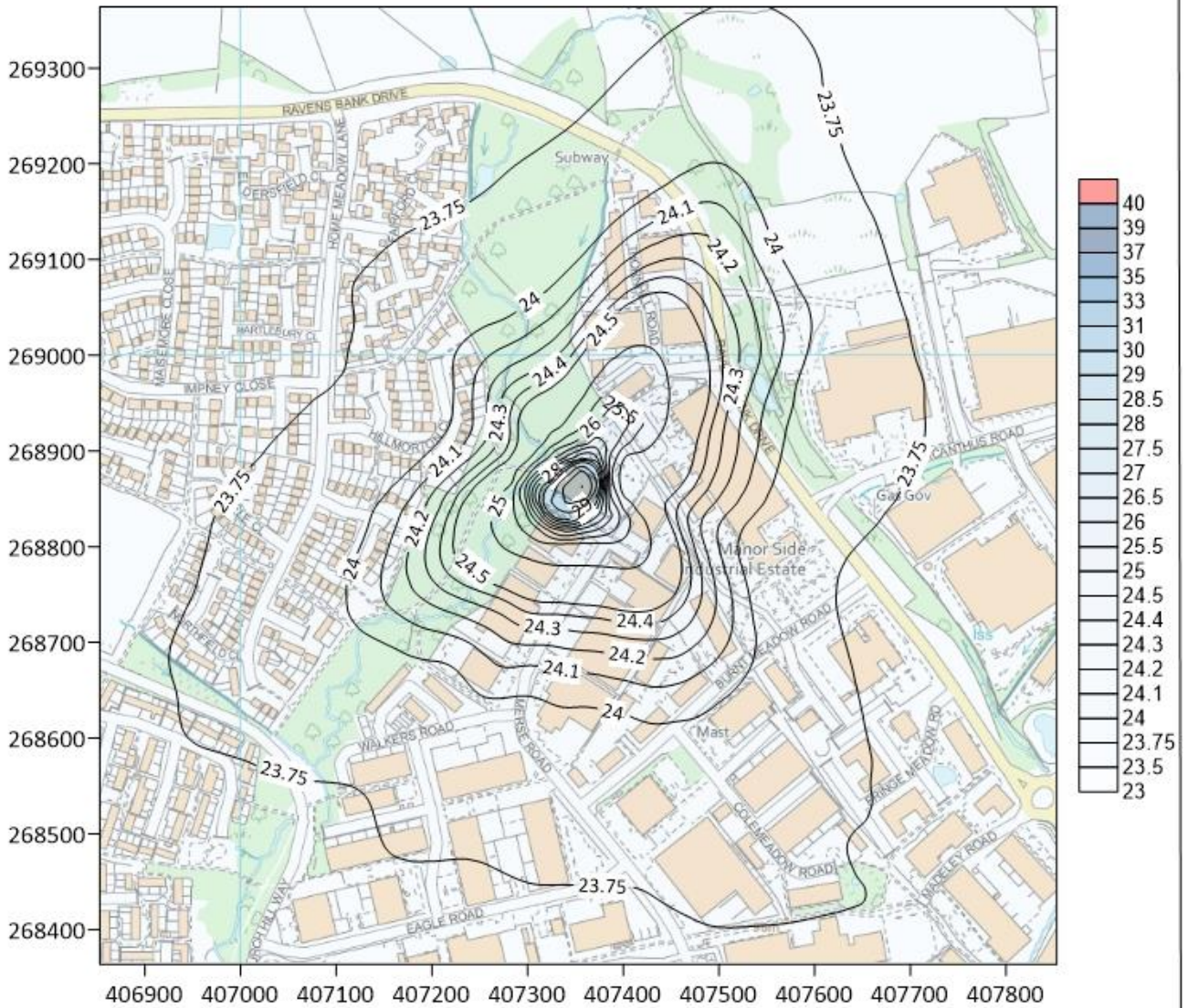


Figure IV Figure 1 - Predicted annual mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2016 meteorological data

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 Cheshire
 CW7 3QZ



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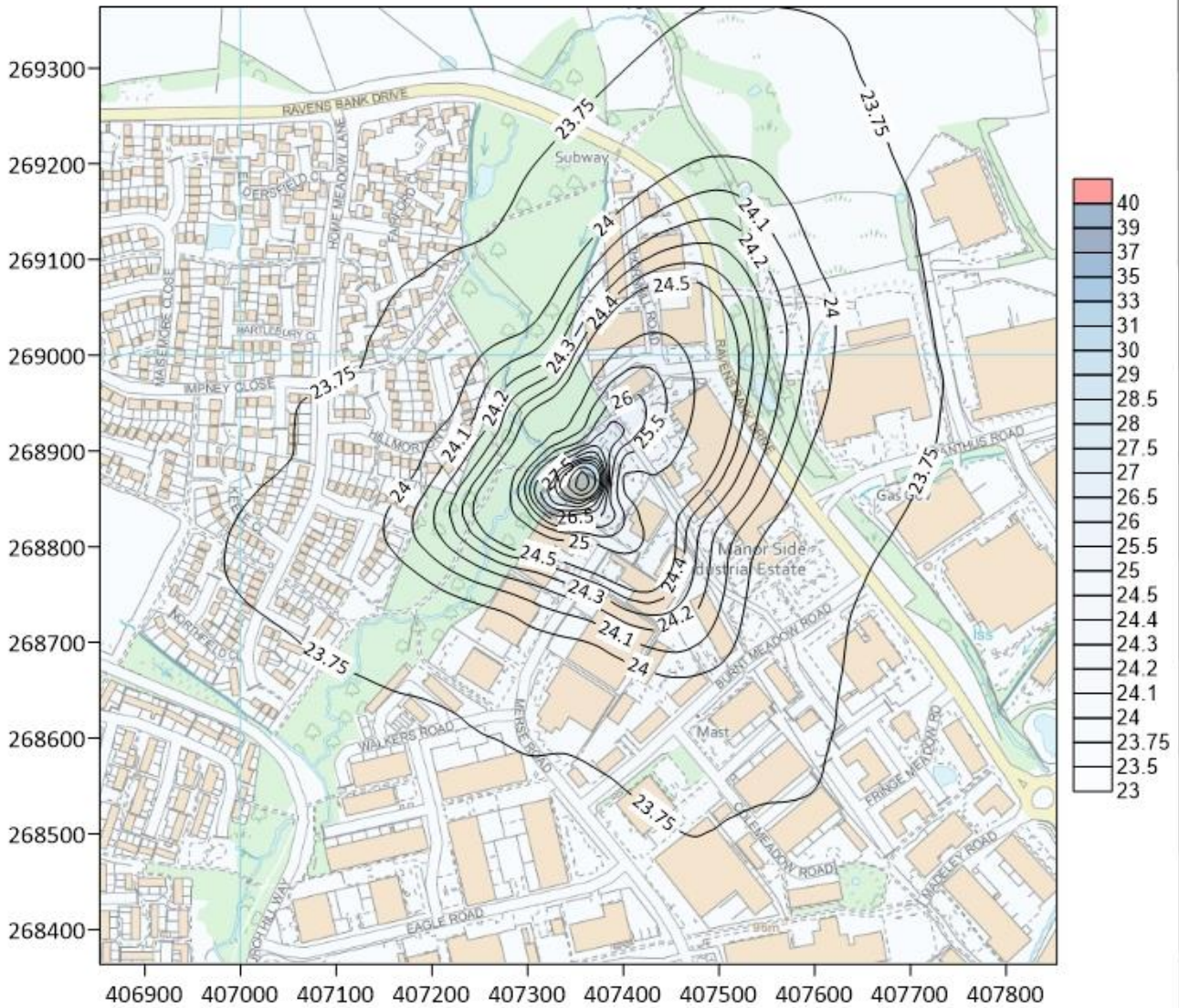


Figure IV Figure 2 - Predicted annual mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2017 meteorological data

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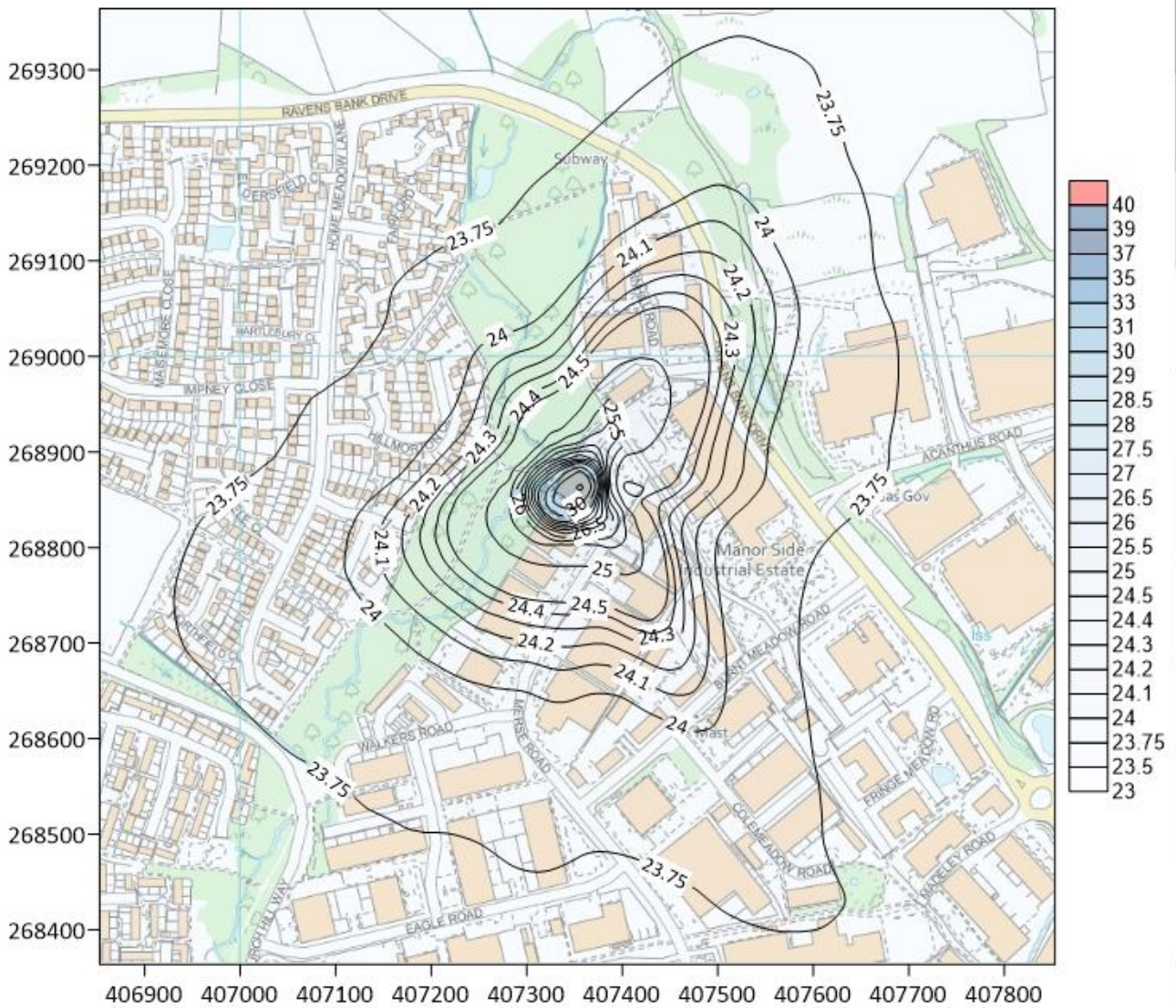


Figure IV Figure 3 - Predicted annual mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2018 meteorological data

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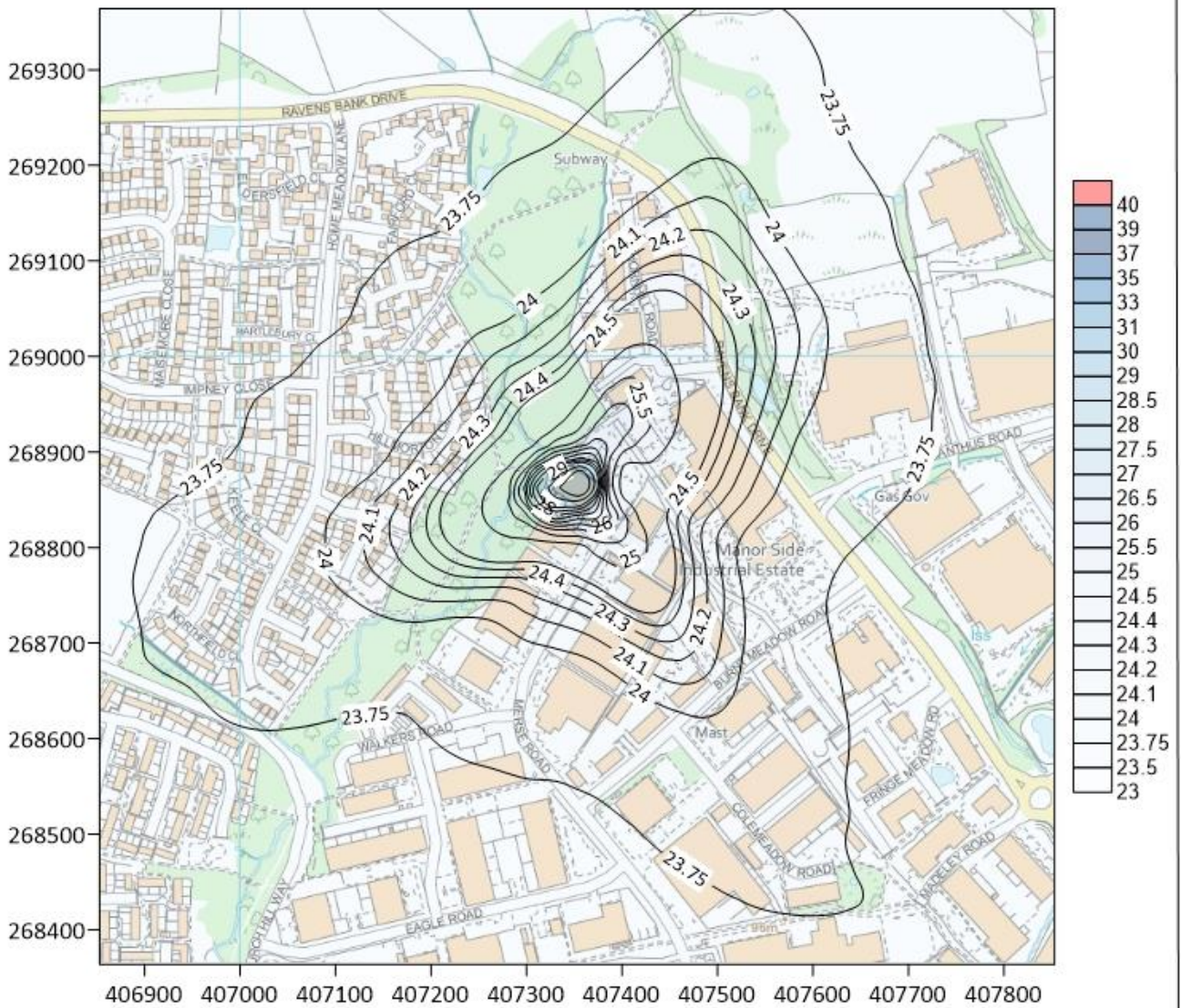


Figure IV Figure 4 - Predicted annual mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2019 meteorological data

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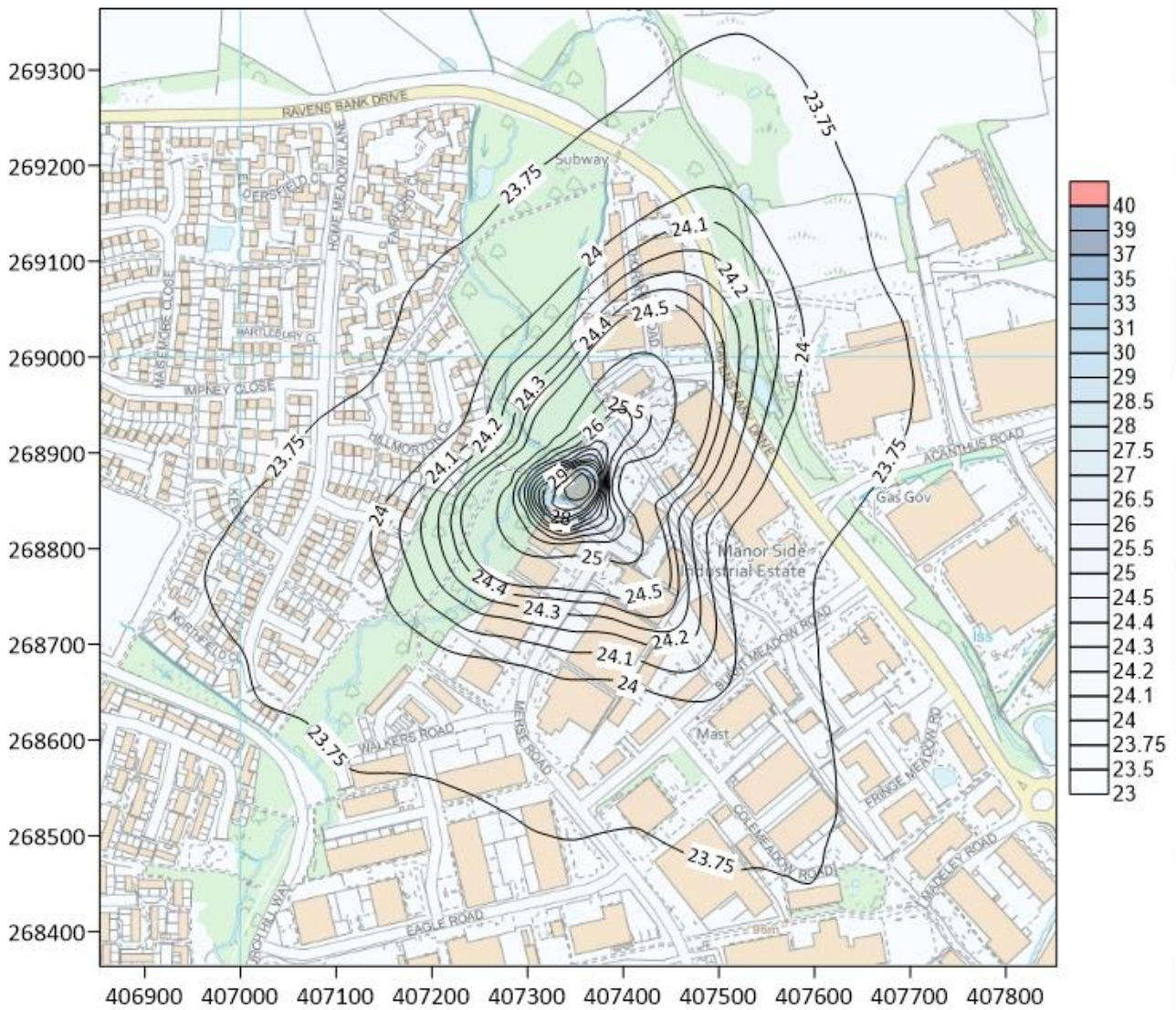


Figure IV Figure 5 - Predicted annual mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2020 meteorological data

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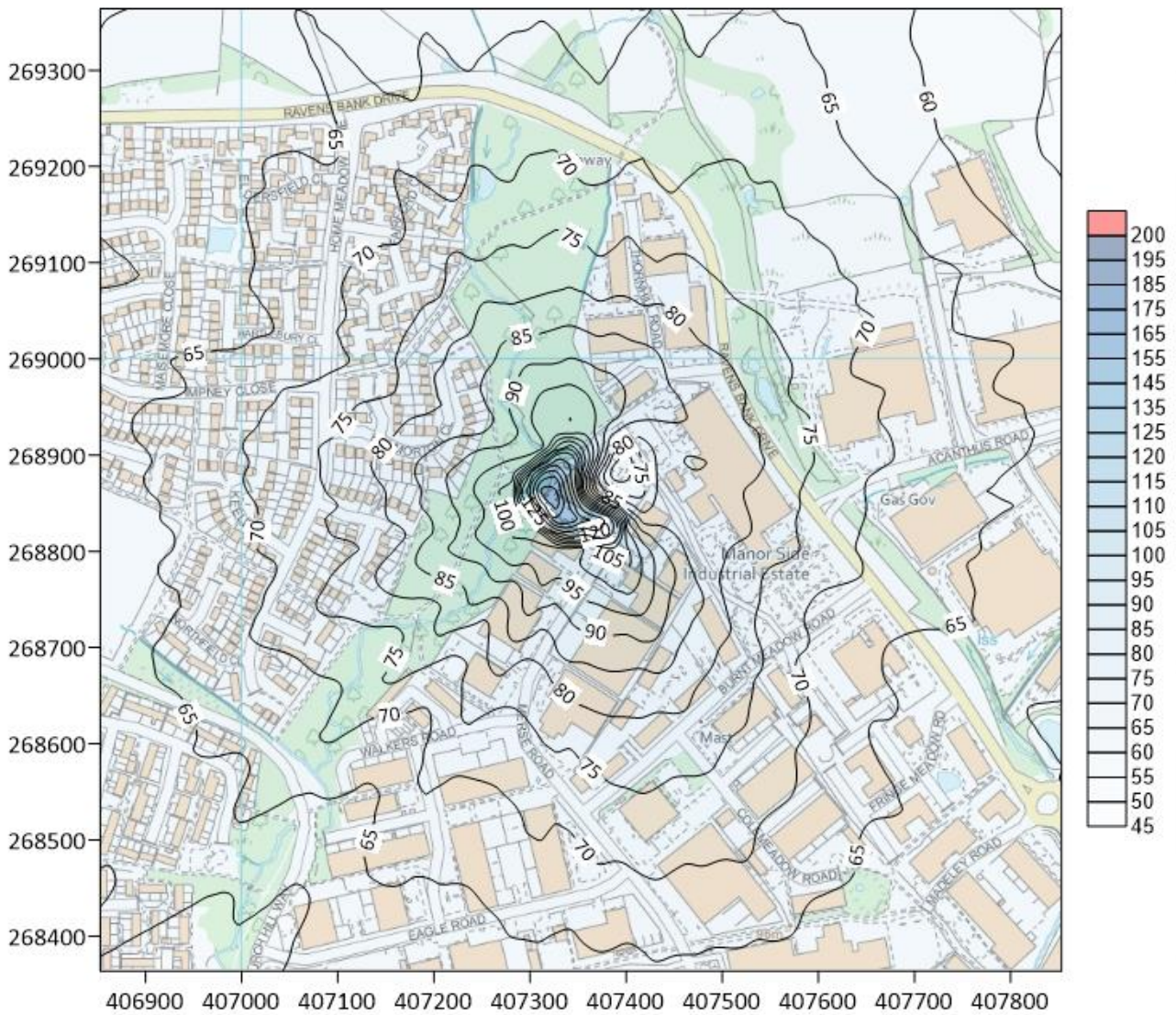


Figure IV Figure 6 - Predicted 99.8th percentile of 1-hour mean nitrogen dioxide concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) based upon 2016 meteorological data

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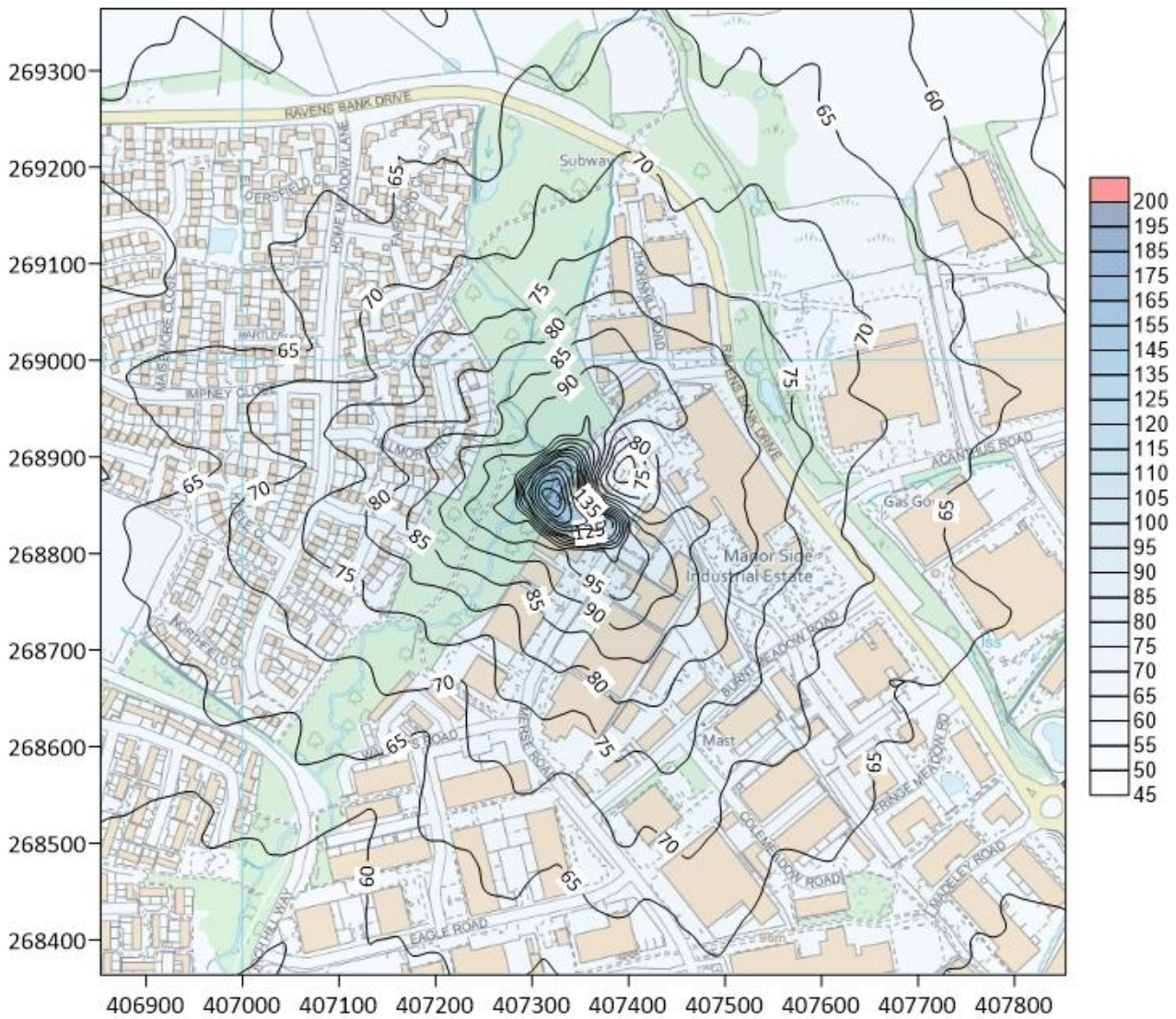


Figure IV Figure 7 - Predicted 99.8th percentile of 1-hour mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2017 meteorological data

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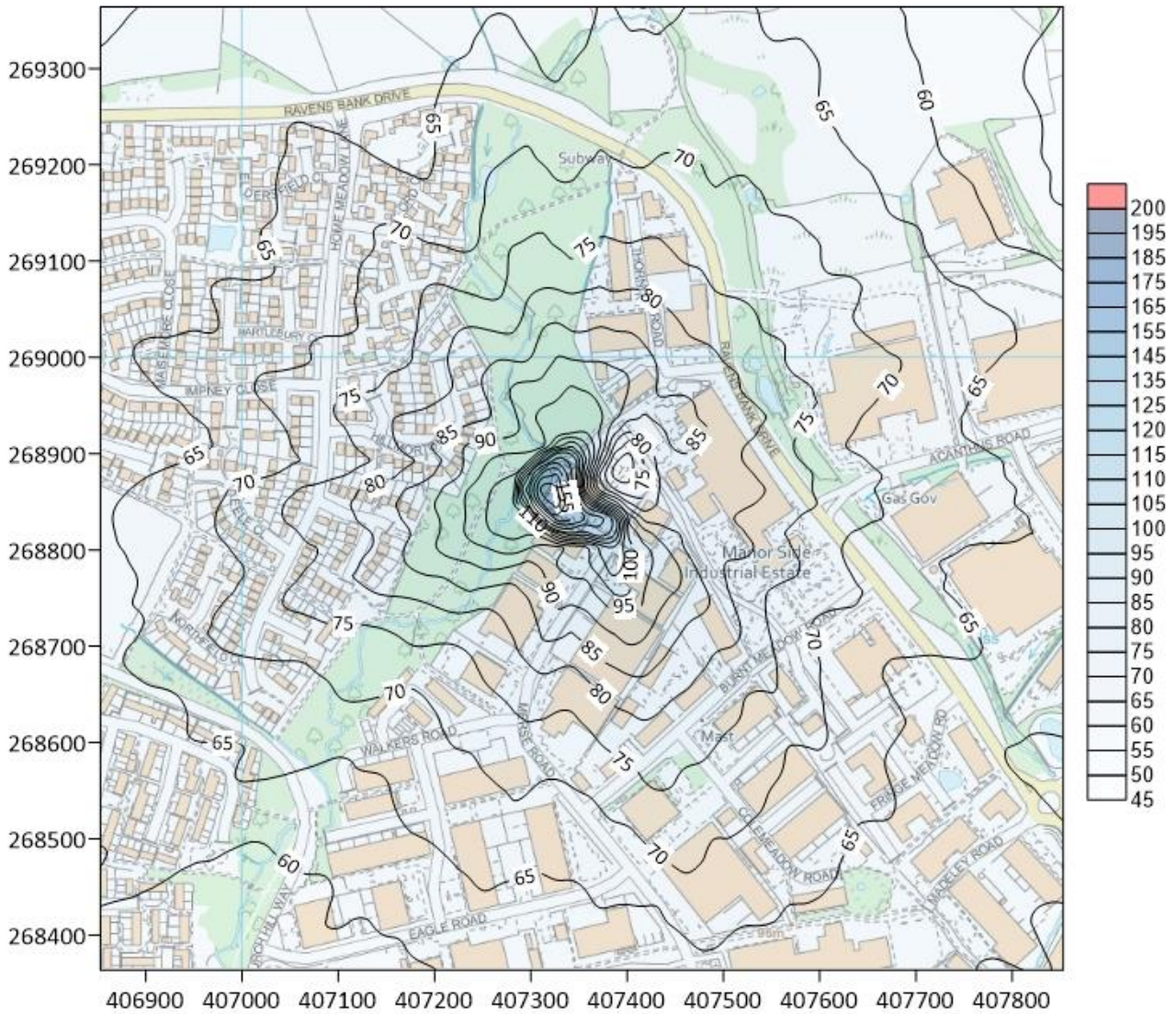


Figure IV Figure 9 - Predicted 99.8th percentile of 1-hour mean nitrogen dioxide concentrations ($\mu\text{g}\cdot\text{m}^{-3}$) based upon 2019 meteorological data

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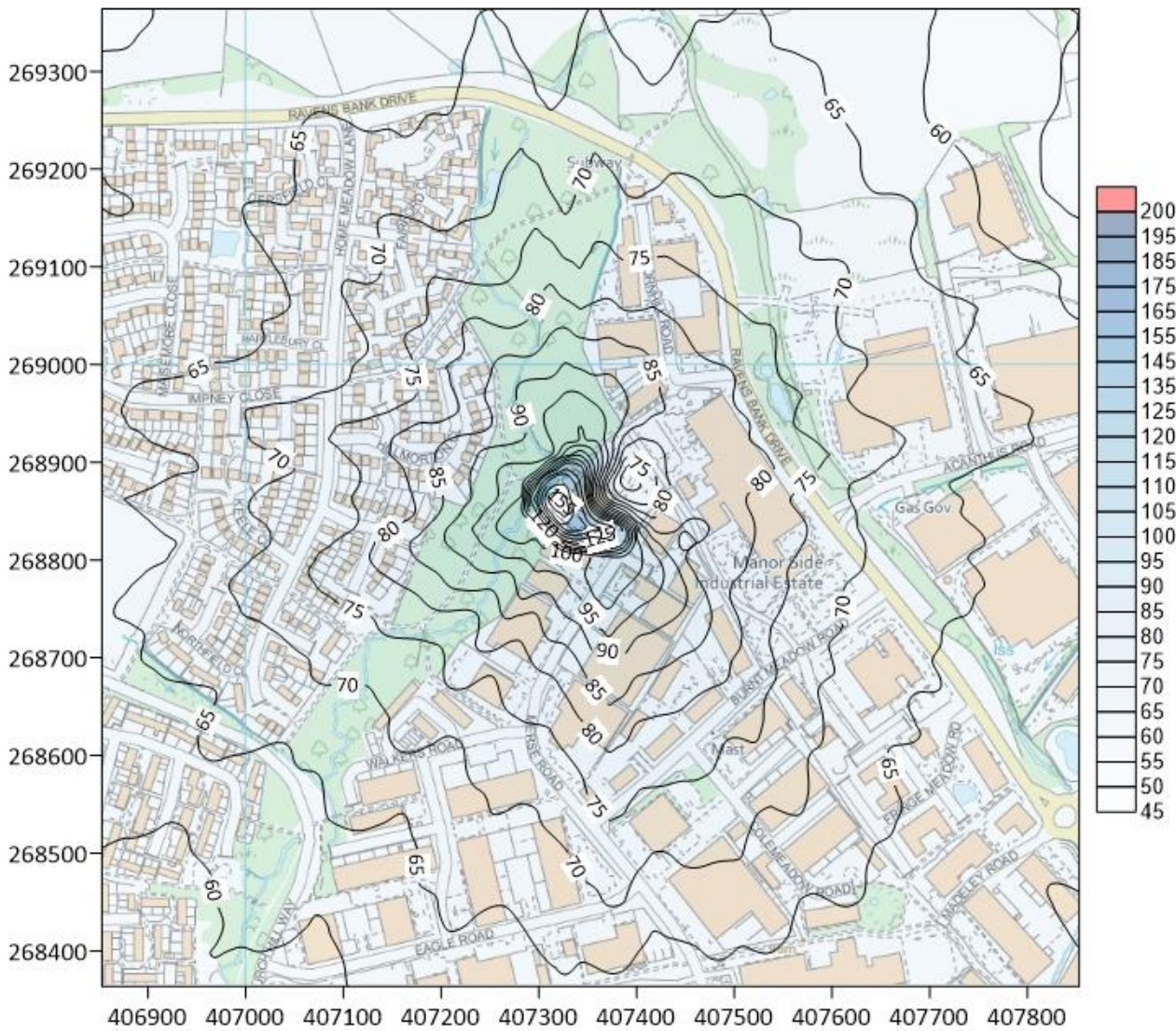


Figure IV Figure 10 - Predicted 99.8th percentile of 1-hour mean nitrogen dioxide concentrations ($\mu\text{g.m}^{-3}$) based upon 2020 meteorological data

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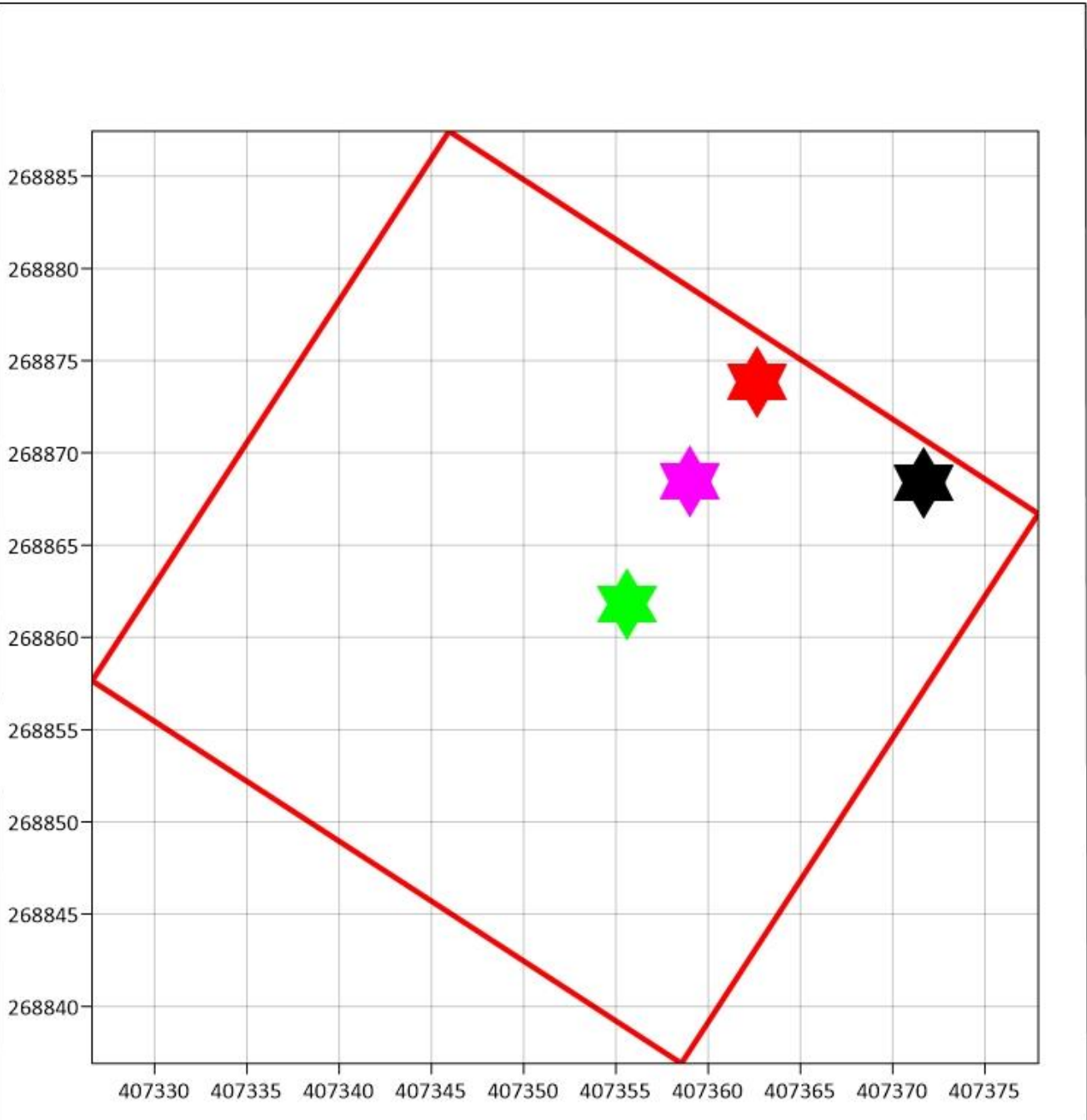
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Appendix V

Buildings and Emission Sources Digitised

Within Model



Appendix V Figure 1 - Buildings and Emission Points Digitised Within Model

-  Emission Point A1
-  Emission Point A2
-  Emission Point A3
-  Emission Point A4

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