Thorverton Road Transfer Station – Proposed WEEE Shredder Dust Abatement

Air Emissions Risk Assessment

SUEZ Recycling and Recovery UK Ltd

Prepared by:

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Basis of Report

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1.0 Introduction

SLR Consulting Limited (SLR) has been commissioned by SUEZ Recycling and Recovery UK Ltd (the 'Applicant') to undertake an Air Emissions Risk Assessment (AERA) in support of an Environmental Permit (EP) variation application for their Thorverton Road, Waste Transfer Station, Matford Business Park, Exeter, EX2 8FS (the 'Site').

1.1 Proposed Variation

The proposed EP variation incorporates a mechanical Waste Electrical and Electronic Equipment (WEEE) shredder, fitted with a dedicated dust abatement plant with fabric bag filters and discharging through a single emission point (Stack 1).

1.2 Scope and Objective

The scope of the AERA has been defined in reference to guidance published by the Environment Agency (EA). Emissions to air of Particulate Matter (PM_{10} and $PM_{2.5}$) have been assessed for the new permitted emission point.

An AERA screening assessment (Stage 1) has already been undertaken (the results of this are not provided in this report). The emissions could not be 'screened out' as 'insignificant'. Therefore, a detailed modelling assessment (Stage 2) has been undertaken to predict impacts at sensitive human receptors and facilitate comparison to relevant Air Quality Standards for the protection of human health.

This report presents this Stage 2 AERA.

2.0 Legislation and Relevant Guidance

2.1 Environmental Permitting Regulations

The Site is regulated under the Environmental Permitting (England and Wales) Regulations (EPR) 2016 (as amended).

2.1.1 Environment Agency Guidance

This assessment follows the EA guidance '*Air emissions risk assessment for your environmental permit*'[1] (the 'AERA guidance') to assist operators for all types of permitted facilities to assess risks to the environment and human health when applying for a permit under the EPR.

2.2 Air Quality Legislation and Guidance

2.2.1 Air Quality Standards Regulations

The Air Quality Standards Regulations 2010[2] (AQSR) transpose both the EU Ambient Air Quality Directive (2008/50/EC), and the Fourth Daughter Directive (2004/107/EC) within UK legislation, in order to align and mirror European obligations. The regulations set Limit Values, Target Values, and Objectives for the protection of human health and the environment. Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[3] was introduced to mirror revisions to supporting EU legislation.

2.2.2 Air Quality Strategy

The latest Air Quality Strategy (AQS) for England was published in 2023[4]. The AQS provides the delivery framework for air quality management across England for local authorities and summarises the air quality standards and objectives operable within England for the protection of public health and the environment. The AQS objectives apply at locations where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period (referred to as *relevant exposure*).

2.2.3 Local Air Quality Management

The Environment Agency's role in relation to Local Air Quality Management (LAQM) is as follows[5]:

> *"The Environment Agency is committed to ensuring that any industrial installation or waste operation we regulate will not contribute significantly to breaches of an AQS objective.*
>
> *It is a mandatory requirement of EPR legislation that we ensure that no single industrial installation or waste operation we regulate will be the sole cause of a*

[1] Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

[2] The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

[3] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

[4] Air Quality Strategy: Framework for Local Authority Delivery, Defra, (2023).

[5] Regulating to Improve Air Quality. AQPG3, version 1, Environment Agency, 14 July 2008.

breach of an EU air quality limit value. Additionally, we have committed that no installation or waste operation will contribute significantly to a breach of an EU air quality limit value."

2.2.4 Air Quality Assessment Levels

The ambient air quality standards/limit values of relevance to human receptors in this assessment (collectively termed *Air Quality Assessment Levels (AQALs)* throughout this report) are provided in Table 2-1. Defra has published Technical Guidance for use in LAQM, referred to as LAQM.TG(22)[6]. According to LAQM.TG(22), air quality standards should only apply to locations where '*members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Authorities should not consider exceedances of the objectives at any location where relevant public exposure would not be realistic*'.

Thus, short term AQAL (such as the 1-hour standards) should apply to areas which may be regularly frequented by the public, even for a short period of time. Longer term AQAL, such as annual means, should apply at houses or other locations which the public can be expected to occupy on a continuous basis. These AQAL do not apply to exposure at the workplace. Table 2-2 provides an indication of those locations.

Table 2-1: Applied AQALs

Pollutant	AQAL (µg/m^3)	Averaging Period
PM_{10}	40	Annual mean
	50	24-hour mean (not to be exceeded on more than 35 occasions per annum)
$PM_{2.5}$	20	Annual mean

Table 2-2: Human Health Relevant Exposure

Averaging Period	AQALs Should Apply At:	AQALs Should Not Apply At:
Annual mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices or other places of work Hotels Gardens of residences Kerbside sites
24-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term

.

[6] Defra, Local Air Quality Management Technical Guidance (TG22), April 2021.

3.0 Assessment Methodology

3.1 Approach

Detailed atmospheric dispersion modelling has been undertaken with due consideration to the EA's AERA guidance. The modelling approach is based upon the following stages:

- Review of emission sources, pollutant emission rates and characteristics;
- Identification of sensitive receptors;
- Compilation of the existing air quality baseline;
- Calculation of PC (Process Contribution) and PEC (Predicted Environmental Concentration); and
- Evaluation against relevant environmental standards for human receptors.

3.2 Model Setup

For this assessment the AERMOD dispersion model[7] has been utilised; this model is widely used and accepted by the EA for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

3.2.1 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum PC and PEC outside the Site boundary to be assessed.

A nested receptor grid extending ~2km from the Site was applied as follows:

- 500m x 500 at 20m grid resolution;
- 800m x 800m at 50m grid resolution;
- 1,300m x 1,300m at 100m grid resolution; and
- 2,300m x 2,300m at 200m grid resolution.

In addition, the modelling of discrete sensitive receptor locations as described in Section 4.1 was undertaken to assess the impact at relevant exposure locations for annual mean impact and facilitate the discussion of results.

3.2.2 Building Downwash

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. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

[7] Software used: Lakes AERMOD View, (Executable Aermod_24142).

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Structures input to the model are represented in Figure 3-1.



Figure 3-1: Stack Location, Modelled Buildings and Structures

3.2.3 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights (see Figure 4-3).

3.2.4 Meteorological Data

Meteorological data from the Exeter station (5 years of hourly sequential data for the period 2020-2024 inclusive) was converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor. Details specific to the Site location were used to define the surface characteristics; albedo, bowen ratio and surface roughness, applied in the conversion (Table 3-1). A 5-year windrose is presented in Figure 4-1.

Table 3-1: Applied Surface Characteristics

Zone (Start)	Zone (End)	Albedo	Bowen Ratio	Surface Roughness (m)
137	232	0.28	0.75	0.064
232	297			0.022
297	137	0.29	0.925	0.024

3.2.5 Dispersion Model Uncertainty

Model validation studies[8] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short-term high percentiles concentrations well within a factor of two. The latest evaluation study for AERMOD shows the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance) to be between 0.96 and 1.2.

3.3 Quantification of Emissions

The emission parameters applied in the modelling are provided in Table 3-2. These inputs reflect technical data supplied by the Applicant for the proposed WEEE shredder stack. The PM concentration of air released from the stacks has been defined in reference to the Best Available Technology - Associated Emission Level (BAT-AEL) channelled dust emissions to air from the mechanical treatment of waste[9] .

As a precautionary approach, emission rates have been calculated assuming that PM_{10} comprises 100% of total PM, and that $PM_{2.5}$ *also* comprises 100% of total PM.

Table 3-2: Emission Parameters

Parameter	Stack
Stack Location (BNG)	x293129, y89846
Stack Height (m)	10.75
Stack Diameter (m)	0.90
Flow (Am^3/s)	8.21
Velocity (m/s)	12.9
Emission Temperature (°C)	Ambient (A)
Flow (Nm^3/s)	8.21
'Dust' as PM_{10} Concentration (mg/Nm^3)	5.0 (B)
'Dust' as $PM_{2.5}$ Concentration (mg/Nm^3)	5.0 (B)
PM_{10} Emission Rate (g/s)	0.0409(C)
$PM_{2.5}$ Emission Rate (g/s)	0.0409(D)
Notes:	

[8] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).

[9] European Commission, Best Available Techniques (BAT) Reference Document for Waste Treatment, JRC Science for Policy Report JRC113018, (2018).

Parameter	Stack
(A) The 'ambient' option within Aermod has been selected. This equates the emission temperature with the ambient temperature within the meteorological data file. (B) At reference conditions of 273.15K, 101.3kpa, assuming dry gas (C) Modelled at 'ambient conditions' so no adjustment of reference to stack conditions, assuming PM is PM_{10} (D) Modelled at 'ambient conditions' so no adjustment of reference to stack conditions, assuming all PM is $PM_{2.5}$.	

3.4 Assessment of Impacts on Human Health

3.4.1 Operational Envelope

The WEEE shredder is unlikely to operate continuously, however the modelling assessment has considered the continuous operation (8,760 hours per year) of the emission source, reflecting a precautionary approach.

3.4.2 Treatment of Model Output

The assessment of impacts against the AQALs was undertaken using model output as described in Table 3-3.

Table 3-3: Model Outputs

Averaging Period	Model Output – PC	Predicted Environmental Concentration (PEC)
24-hour	90.41%ile of 24-hour means for PM_{10}	PC + annual mean background
Calendar year	Annual mean for PM_{10} & $PM_{2.5}$	PC + annual mean background

3.4.3 Assessment of Impact and Significance

To assess the potential impact on air quality, the predicted exposure is compared to the AQALs, and the results of the dispersion modelling have been presented in the form of:

- Tabulated concentrations at discrete receptor locations to facilitate the discussion of results; and
- Illustrations of the impact as isopleths (contours of concentration) for the criteria selected enabling determination of impact at any locations within the study area.

In accordance with the EA's AERA guidance, the impact is considered to be insignificant or negligible if:

- The long-term process contribution (PC) is <1% of the long term AQAL; and
- The short-term PC is <10% of the short term AQAL.

For PCs that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant AQAL.

4.0 Baseline Environment

4.1 Site Setting and Sensitive Receptors

The Site is located in Exeter, Devon at the approximate National Grid Reference (NGR) x293105, y89857.

4.1.1 Human Receptors

According to LAQM.TG(22), the AQALs should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant AQAL. As such, 14 worst-case locations surrounding the Site have been selected to inform the risk assessment in terms of relevant exposure (see Table 4-1 and Figure 4-2).

Further, the dispersion modelling has been completed using a receptor grid to allow potential short-term exposure to be assessed at all locations surrounding the Site.

Table 4-1: Human Receptors

ID	Description	NGR (m)		Flagpole Receptor Height (m)
		X	Y	
HR1	Residential (above pub)	293257	90015	1.5
HR2	Residential	293807	90275	1.5
HR3	Residential	293948	90187	1.5
HR4	Residential	294035	90072	1.5
HR5	Residential	294074	89979	1.5
HR6	Residential	294087	89836	1.5
HR7	Residential	293721	89007	1.5
HR8	Residential	294351	89648	1.5
HR9	Residential	293330	89049	1.5
HR10	Commercial Accommodation	292907	89162	1.5
HR11	Commercial / Educational	293026	89560	1.5
HR12	Residential	292365	89586	1.5
HR13	Residential	292149	89867	1.5
HR14	Residential	292071	90191	1.5

4.2 Baseline Air Quality for Human Receptors

4.2.1 LAQM Review and Assessment

The latest publicly available LAQM report for Exeter City Council (ECC) at the time of writing is the 2025 Air Quality Annual Status Report[10] (ASR) (inclusive of 2020-2024 monitoring datasets).

[10] Exeter City Council, 2025 Air Quality Annual Status Report, (2025).

4.2.1.1 Air Quality Management Areas

ECC currently has one active AQMA within its administrative area; the Exeter AQMA, located approximately 1.2km west of the Site at its nearest extent. This AQMA was declared due to exceedances of the annual mean nitrogen dioxide (NO_2) AQAL only, and therefore has not been considered further.

4.2.1.2 Automatic Air Quality Monitoring

Automatic pollutant monitoring of PM_{10} and $PM_{2.5}$ is currently undertaken by ECC at two locations within its administrative area, CM1 and CM2; located approximately 3.2km and 2.4km respectively north of the Site. CM1 is also registered as a Automatic Urban and Rural Network (AURN) monitoring location and is located on Queen Street at a kerbside location[11]. CM2 is located at a roadside[12] location on Alphington Street.

Given the setting of the aforementioned automatic monitors, pollutant concentrations recorded by these monitors are not anticipated to be representative of baseline conditions at the Site. Automatic monitoring data has therefore not been considered further.

4.2.2 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution. The latest datasets include annual average concentration estimates for PM_{10} and $PM_{2.5}$ using a reference year of 2021; the year in which comparisons between modelled and monitored concentrations are made.

Defra mapped background concentrations for the assessment year (2026) are presented in Table 4-2. All mapped background concentrations presented are 'well-below' the respective annual mean AQALs.

Table 4-2: Defra Mapped Background PM_{10} and $PM_{2.5}$ Concentrations

Grid Square (X, Y) (m)	Year	Annual Mean Concentration (µg/m³)	
		PM_{10}	$PM_{2.5}$
293500, 089500	2026	11.3	5.9
293500, 090500	2026	11.2	6.1
294500, 090500	2026	12.2	6.2
294500, 089500	2026	12.1	6.2
292500, 089500	2026	11.9	6.0
292500, 090500	2026	10.5	5.9
AQAL		***40***	***20***

4.2.3 Application of Baseline Data

In the absence of appropriate local monitoring data, the Defra mapped background concentrations have been applied in this assessment.

[11] Kerbside location defined by LAQM.TG(22) as 'A site sampling within one metre of the kerb of a busy road'.

[12] Roadside location defined by LAQM.TG(22) as 'A site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases)'.

4.3 Meteorological Conditions

A wind rose from the Exeter meteorological station dataset (2020-2024) is presented in Figure 4-1 below, showing the frequency of wind speed and direction used in the assessment. Prevailing winds are from south-southwest, with winds from northern and eastern sectors occurring least frequently.

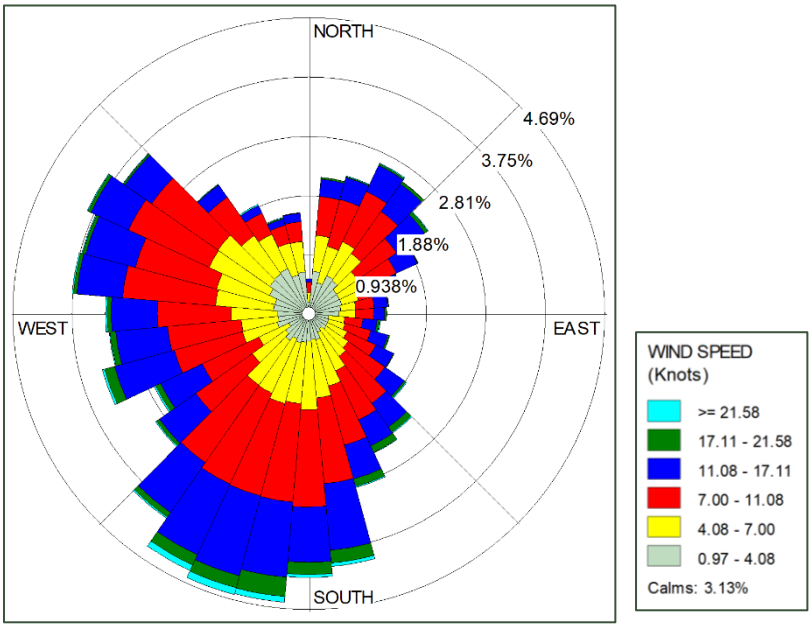


Figure 4-1: Exeter Wind Rose (2020-2024)



Figure 4-2: Modelled Human Receptor Locations

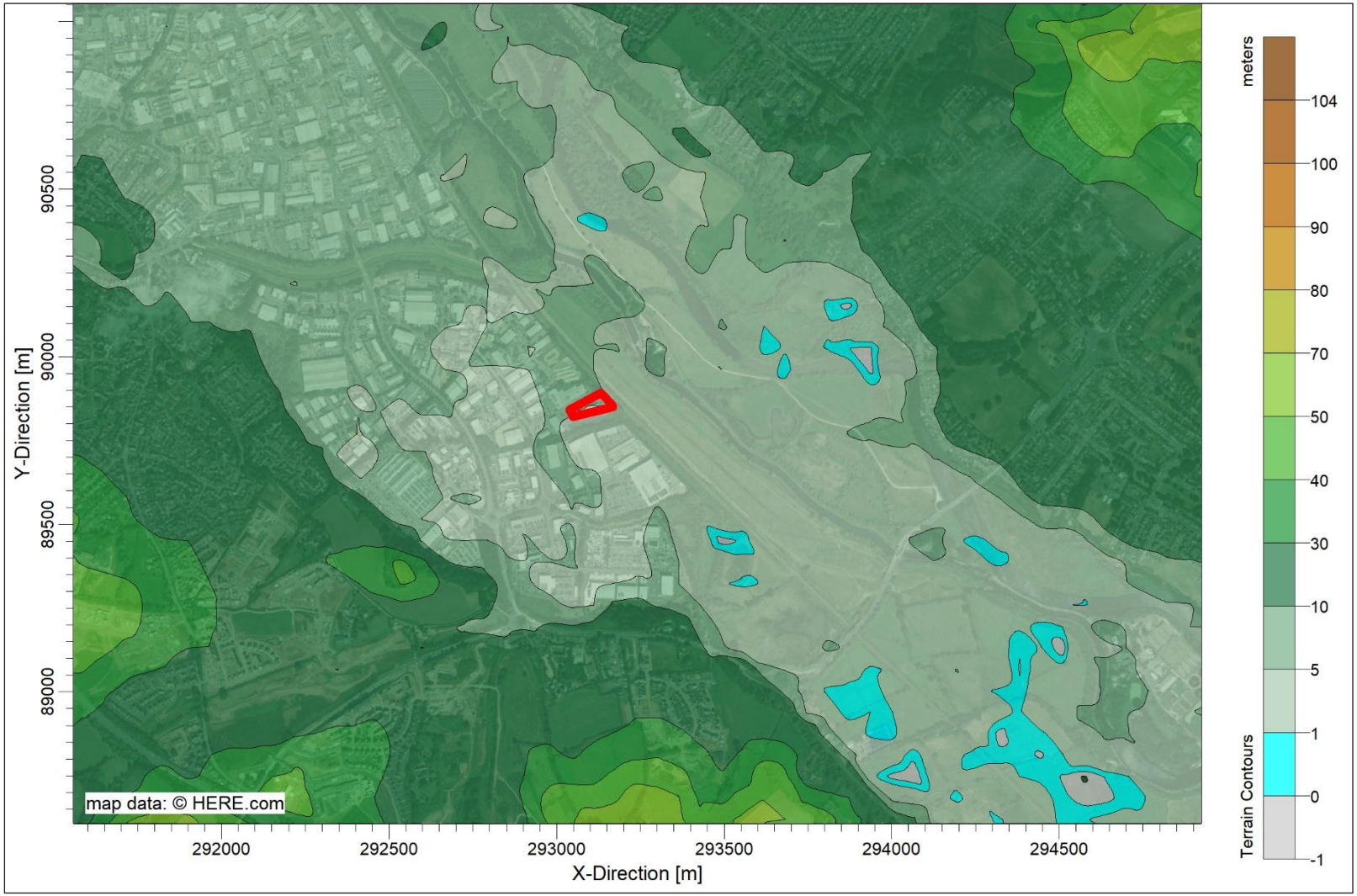


Figure 4-3: Surrounding Topography

5.0 Assessment Results

Assessment of results has been undertaken in consideration of the maximum predicted values across the 5-years of meteorological data investigated.

A single operational scenario has been investigated, representing the proposed WEEE shredder and dedicated bag filter dust abatement plant. To ensure a robust evaluation, a highly conservative approach has been adopted based on the following key parameters:

- the WEEE shredder is assumed to operate continuously (8,760 hours/year), whereas in reality, actual operational hours are expected to be lower;
- PM_{10} comprises 100% of the total PM emissions; and
- $PM_{2.5}$ *also* comprises 100% of the total PM emissions.

Potential emissions from existing Site operations are assumed to be fully accounted for within the baseline background concentrations applied (as presented in Section 4.2.2).

Predicted PM_{10} and $PM_{2.5}$ impacts are presented in Table 5-1, Table 5-2 and Table 5-3 below. Isopleth plots are presented in Appendix B.

Table 5-1: Predicted Annual Mean PM_{10} Impacts

Receptor	PC (µg/m^3)	PC as % of AQAL	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of AQAL
HR1	0.4	1.0%	11.2	11.6	29.0%
HR2	0.1	0.2%	11.2	11.3	28.2%
HR3	0.1	0.2%	11.2	11.3	28.1%
HR4	0.1	0.2%	12.2	12.3	30.7%
HR5	0.1	0.2%	12.1	12.2	30.5%
HR6	0.1	0.2%	12.1	12.2	30.5%
HR7	0.1	0.2%	12.1	12.2	30.5%
HR8	0.1	0.2%	11.3	11.4	28.4%
HR9	0.1	0.1%	11.3	11.3	28.3%
HR10	0.1	0.2%	11.9	12.0	29.9%
HR11	0.2	0.5%	11.3	11.5	28.7%
HR12	0.1	0.3%	11.9	12.0	30.0%
HR13	0.1	0.2%	11.9	11.9	29.9%
HR14	<0.1	0.1%	10.5	10.5	26.2%

Table 5-2: Predicted 24-hour Mean (90.41%ile) PM_{10} Impacts

Receptor	PC (µg/m^3)	PC as % of AQAL	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of AQAL
Maximum Offsite	3.7	7.5%	12.2	12.3	24.5%
HR1	1.1	2.1%	11.2	11.4	22.8%
HR2	0.2	0.4%	11.2	11.4	22.8%
HR3	0.2	0.4%	11.2	12.4	24.8%

Receptor	PC (µg/m^3)	PC as % of AQAL	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of AQAL
HR4	0.2	0.4%	12.2	12.3	24.7%
HR5	0.2	0.4%	12.1	12.4	24.8%
HR6	0.2	0.5%	12.1	12.4	24.7%
HR7	0.2	0.5%	12.1	11.5	23.0%
HR8	0.2	0.5%	11.3	11.5	23.0%
HR9	0.2	0.4%	11.3	12.2	24.4%
HR10	0.3	0.6%	11.9	11.9	23.8%
HR11	0.6	1.2%	11.3	12.2	24.5%
HR12	0.4	0.7%	11.9	12.1	24.2%
HR13	0.2	0.5%	11.9	10.6	21.1%
HR14	0.1	0.2%	10.5	12.3	24.5%

Table 5-3: Predicted Annual Mean $PM_{2.5}$ Impacts

Receptor	PC (µg/m^3)	PC as % of AQAL	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of AQAL
HR1	0.4	2.0%	6.1	6.5	32.4%
HR2	0.1	0.4%	6.1	6.1	30.7%
HR3	0.1	0.3%	6.1	6.1	30.6%
HR4	0.1	0.3%	6.2	6.3	31.5%
HR5	0.1	0.3%	6.2	6.2	31.1%
HR6	0.1	0.4%	6.2	6.2	31.1%
HR7	0.1	0.3%	6.2	6.2	31.1%
HR8	0.1	0.4%	5.9	6.0	30.0%
HR9	0.1	0.3%	5.9	6.0	29.9%
HR10	0.1	0.5%	6.0	6.1	30.6%
HR11	0.2	0.9%	5.9	6.1	30.6%
HR12	0.1	0.6%	6.0	6.1	30.7%
HR13	0.1	0.3%	6.0	6.1	30.5%
HR14	0.0	0.2%	5.9	6.0	29.9%

The findings are as follows:

- PM_{10} impacts:
  - The annual mean PC is insignificant (<1%) at 13 of the 14 sensitive receptors.
  - The annual mean PEC does not exceed the AQAL (40µg/m^3) at any sensitive receptor.
  - The 24-hour mean (90.41%ile) PC is insignificant (<10%) at all sensitive receptors.
  - The 24-hour mean (90.41%ile) PEC does not exceed the AQAL (50µg/m^3) at any sensitive receptor.
  - The maximum predicted short-term (24-hour mean) PEC at any location offsite is presented and does not exceed the AQAL.

- $PM_{2.5}$ impacts:
  - The annual mean PC is insignificant (<1%) at 13 of the 14 sensitive receptors.
  - The annual mean PEC does not exceed the AQAL (20µg/m^3) at any sensitive receptor.

6.0 Conclusions

This AERA has quantified and assessed the potential air quality impacts associated with the proposed WEEE shredder and dust abatement plant. The assessment has been undertaken in reference to Environment Agency guidance and published standards for the protection of human health.

The dispersion modelling predicts that potential PM_{10} and $PM_{2.5}$ emissions from the dust abatement stack does not exceed the relevant long-term or short-term standards for the protection of human health at any location of relevant exposure.

Appendix A EA Modelling Checklist

Table A-1: Modelling Checklist

Item	Yes/No	Details / Reason for Omission
Location map	Yes	Figure 4-2
Site plan	Yes	Figure 3-1
Pollutants modelled and relevant EALs	Yes	Section 2.2
Details of modelled scenarios	Yes	Section 3.3 and 5.0
Details of relevant ambient concentrations	Yes	Section 4.2
Model description and justification	Yes	Section 3.2
Special model treatment used	Yes	Section 3.4.2
Table of emission parameters used	Yes	Table 3-2
Details of modelled domain and receptors	Yes	Sections 3.2.1 and 4.1
Details of meteorological data used	Yes	Section 3.2.4 and 4.3
Details of terrain treatment	Yes	Section 3.2.3
Details of building treatment	Yes	Section 3.2.2
Details of modelling deposition	Yes	No sensitive ecological receptors.
Model uncertainty and sensitivity	Yes	Section 3.2.5
Assessment of impacts	Yes	Section 5.0
Contour plots	Yes	Appendix B
Model input files	Yes	Appendix C

Appendix B Contour Plots

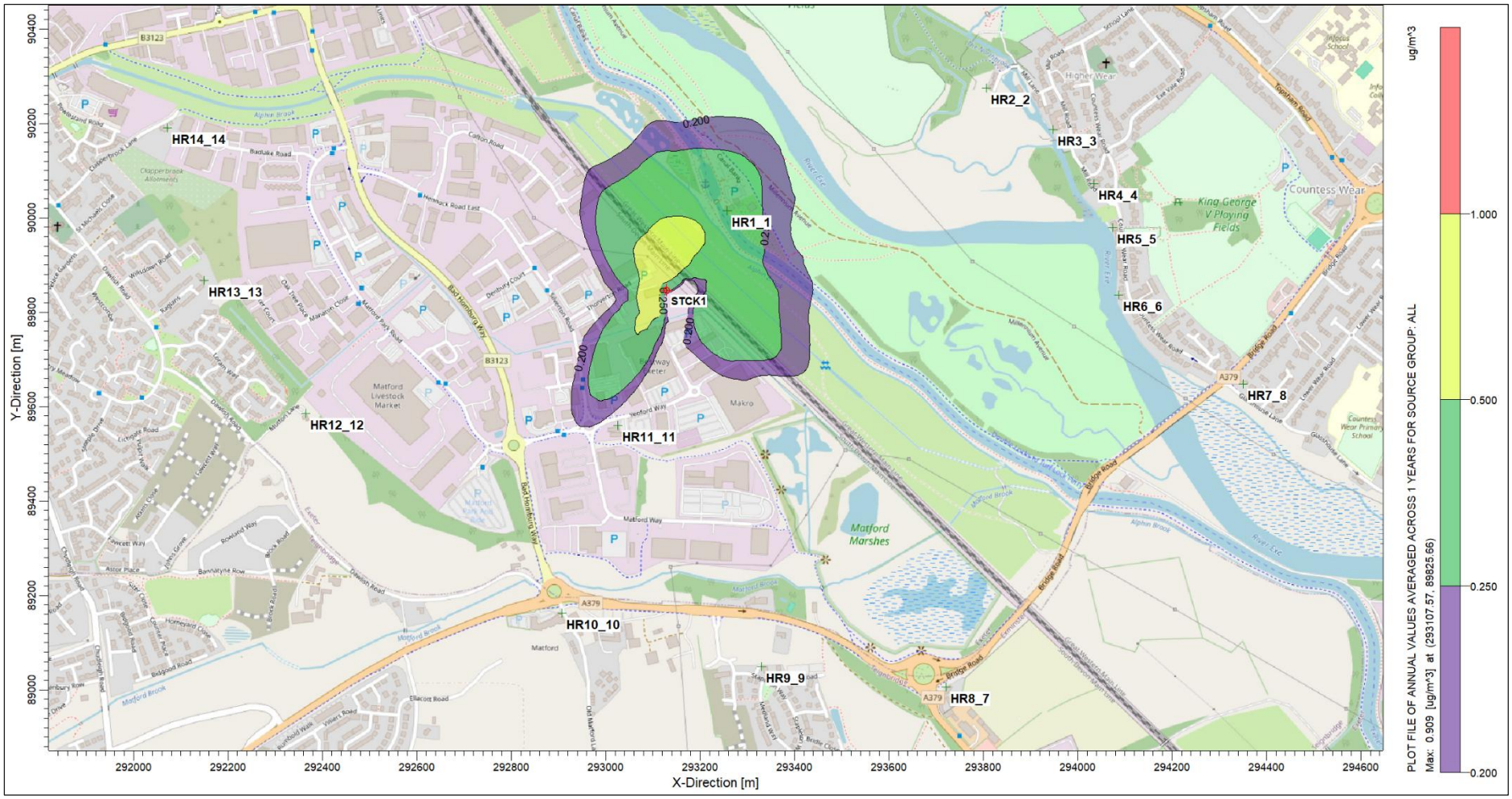


Figure B-1: Annual Mean PM_{10} & $PM_{2.5}$ Process Contribution (2020)

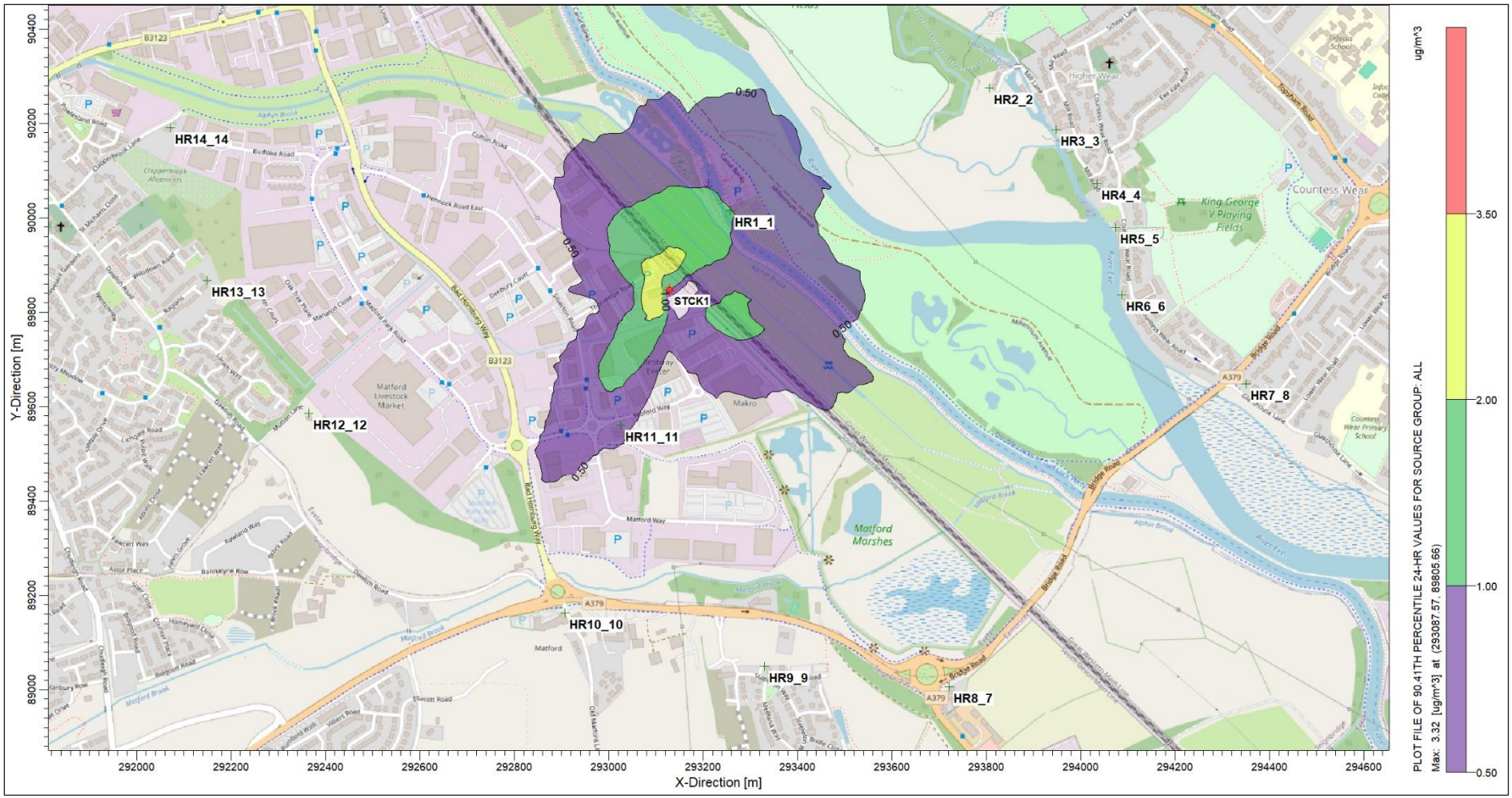
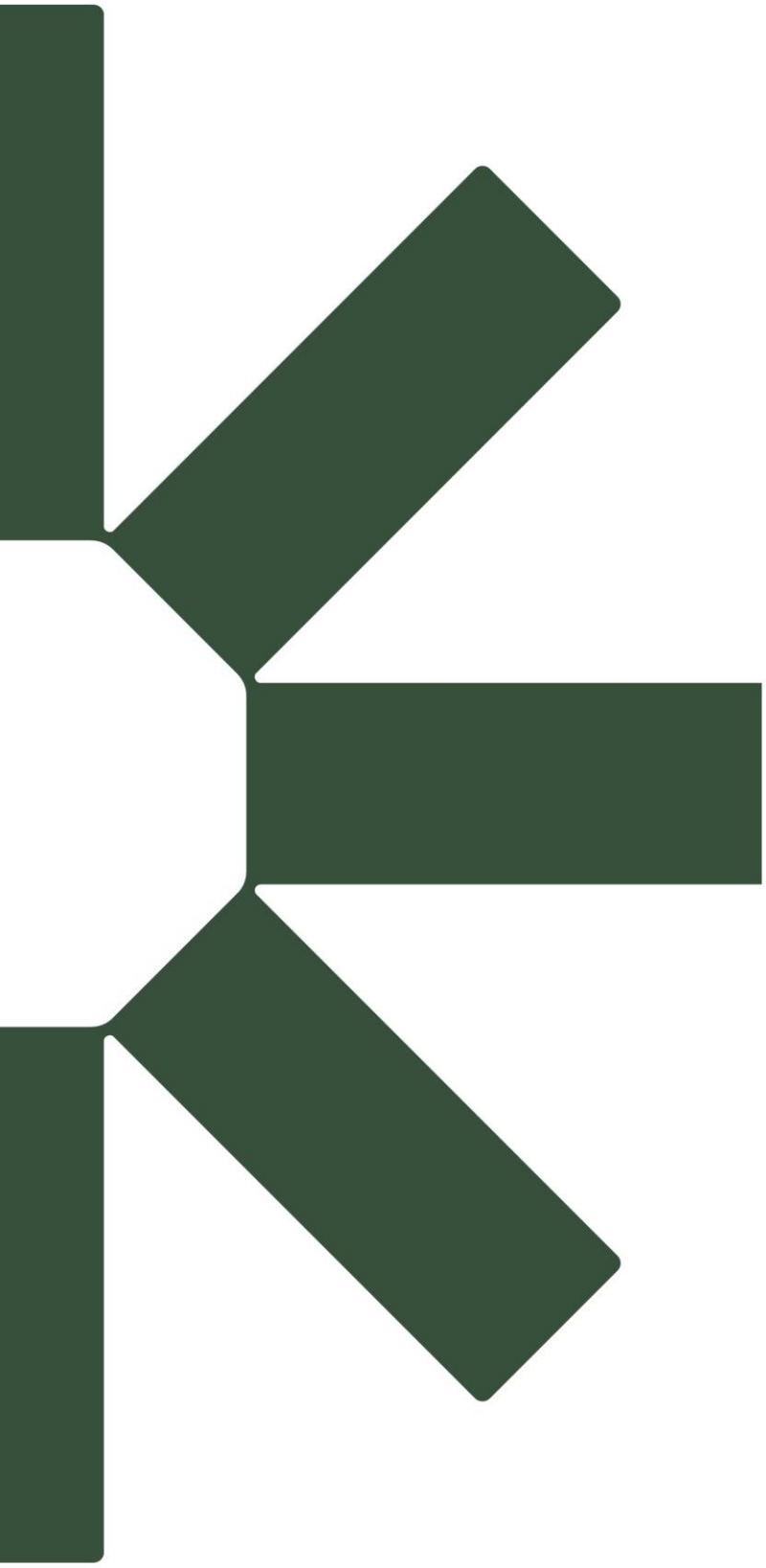


Figure B-2: 24-hour 90.41%ile PM_{10} Process Contribution (2020)

Appendix C Model Files (electronic only)

Model File	Modelled Pollutant
Thorverton Road v1.zip	PM_{10} / $PM_{2.5}$



Making Sustainability Happen