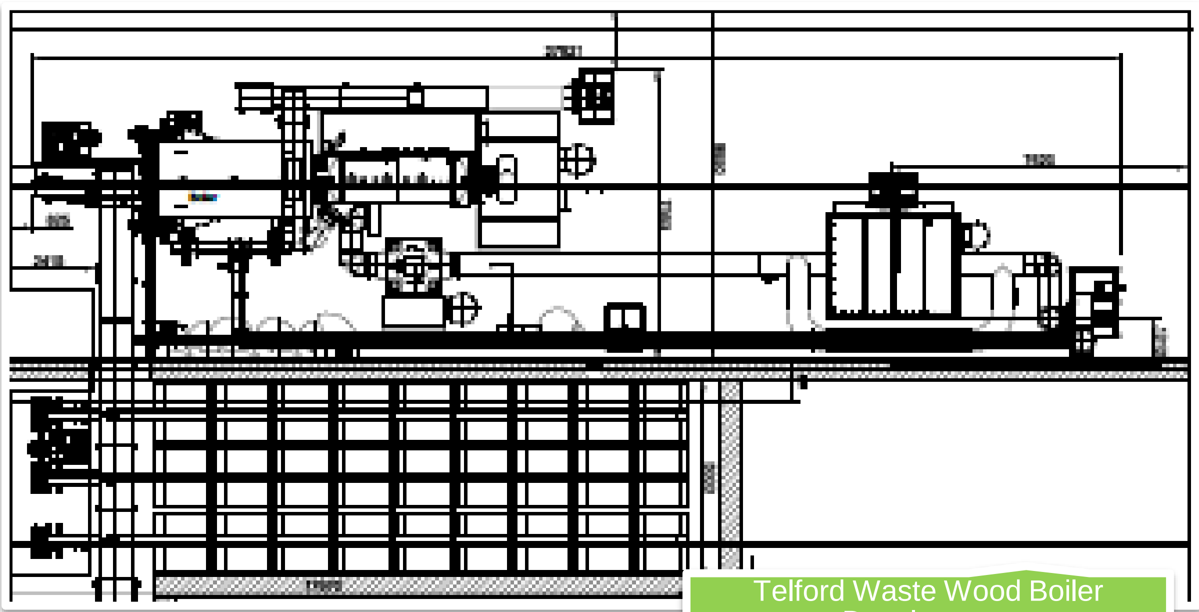
Air Quality Impact Assessment

Issue 3.0

Produced for **Sullivan Projects Ltd c/o Besblock Ltd**

Document Reference **Besblock-4**



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Document Title:	Air Quality Impact Assessment	
Revision:	Issue 3.0	
Date:	03/09/2020	
Document Reference:	Besblock-4	
Prepared For:	Sullivan Projects Ltd c/o Besblock Ltd	
Project Reference:	WRM/PR0893	
Copyright:	WRM Ltd © 2020	
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1.0 INTRODUCTION

WRM Limited (WRM) were commissioned by Sullivan Projects Ltd (hereon referred to as Sullivan Projects) on behalf of Besblock Ltd (hereon referred to as Besblock) to undertake an Air Quality Impact Assessment (AQIA) for the proposed installation of a 1.65MW^{th} waste wood boiler that will in effect replace an existing gas fired boiler. The proposed installation is to be located at an existing manufacturing facility owned and operated by Besblock. This facility is situated at the following address:

Halesfield 21,
Telford,
Shropshire,
TF7 4NF

The Air Quality Impact Assessment is produced as part of a permit application to Telford and Wrekin Council for approval to operate the boiler from an existing building where the boiler will be housed. The AQIA clarifies the following details of the development:

- Stack heights and impact of buildings on pollutant dispersion; and
- Confirmation of emission pollutants and concentrations from each source.

1.1 Site Location

The existing site currently comprises a large concrete block manufacturing facility. The proposed development seeks to install a waste wood boiler to effectively replace an existing gas fired boiler in the northern portion of the eastern edge of site. The development will include the installation of a 1.65MWth boiler and modifications to the building in which the boiler will be housed. Figure 1 indicates the local setting of the site, situated at national grid reference 371262, 305267.

The Besblock site is located on Halesfield 21 of the Halesfield Industrial Estate that connects to the A442, near to the village of Halesfield, Shropshire. The site is approximately 2.8km south of the town of Telford and 3.2km northeast of the River Severn. The nearest city is Wolverhampton approximately 21km to the southeast. The surrounding area is predominantly industrial. The nearest residential property is approximately 670m to the northwest.

The immediate area around the site is characterised by industrial activities. Beyond this to the east is mainly agricultural activities and to the west are residential properties. There is therefore a minor impact on air quality in the area and estimates for 2017 of annual average nitrogen dioxide (NO2) concentrations in the vicinity of the site, from the Department for Environment, Food and Rural Affairs (DEFRA) Background Air Quality Maps, demonstrate this effect.

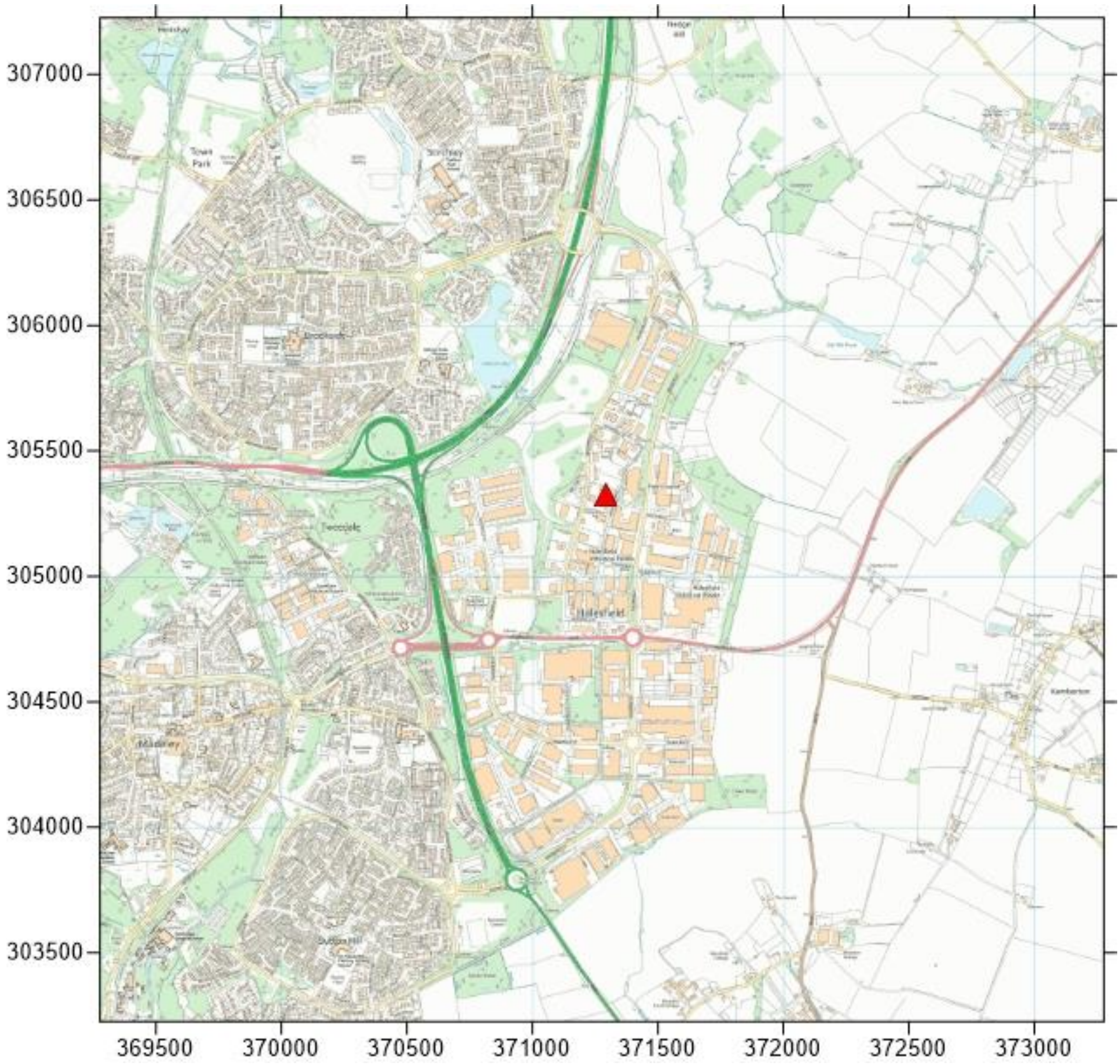


Figure 1 – Site Location on 4km x 4km Georeferenced Base Map

1.2 Proposed Operations

Air quality modelling requires that sources of emissions are defined in terms of dimensions, location and physical characteristics of temperature and velocity. This modelling study has been carried out to assess the potential impact on local air quality due to releases of atmospheric pollutants from the boiler stack.

The waste wood boiler activity comprises of one boiler in which the combustion process takes place, producing heat from Grade C waste wood. The boiler will produce all the heat required for the curing ovens in the concrete block manufacturing facility. The waste wood boiler provides a single point source emission.

1.3 Scoping Assessment

This air quality impact assessment has been prepared by WRM based on a specific design proposed by Sullivan Projects.

This assessment considers the impacts of combustion pollutants from the waste wood boiler on sensitive receptors adjacent to the proposed development. The main aims are to:

- confirm appropriate assessment criteria for the development;
- quantify the main sources of pollutants;
- consider site specific conditions likely to affect dispersion; and
- assess proposed stack heights taking into consideration downwash effects from buildings.

2.0 REGULATORY SETTING

In order to provide meaningful input parameters, to be modelled against a set threshold value, the regulatory background to air quality modelling is provided. The regulatory setting forms the basis for the justification for model input data and the assessment of modelled output data against set values.

2.1 Air Quality Standards

EC Council Directive 96/62/EC on ambient air quality assessment and management (The Air Quality Framework Directive) established a framework through which the European Union (EU) will agree limits or target values for air pollutants. The limits within the EC Directive were implemented by The Air Quality Limit Value Regulations. EC Council Directive 2008/50/EC consolidated earlier air quality directives. The Limit Value Regulations set air quality standards for a range of air pollutants. The UK Government has published an Air Quality Strategy[1] which sets out how the government proposes to fulfil the UK's obligations under the Air Quality Directive. The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland sets out the policy, targets and objectives for a range of air pollutants.

The Technical Guidance[2] to local authorities for the review and assessment of air quality sets out the methods to be used to determine if the air quality objectives are likely to be achieved. The air quality standards are intended to protect human health and should apply to dwellings and land to which the public has access, irrespective of ownership.

2.2 Air Quality Strategy

The ‘Air Quality Strategy for England, Scotland, Wales and Northern Ireland’ (AQS) 2007, contains air quality objectives based on the protection of both human health and vegetation (ecosystems). The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met.

These objectives have been set taking into account the Air Quality Standards defined in the Air Quality Standards Regulations 2007 (now superseded by the Air Quality Standards Regulations 2010).

2.3 Air Quality Management

The Environment Act 1995 requires the UK Government and the devolved administrations for Scotland and Wales to produce a national air quality strategy containing standards, objectives and measures for improving ambient air quality and mechanisms to keep these policies under review. In addition, it sets out the responsibilities of local authorities on air quality management.

Part IV of the Environment Act 1995 requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and

[1] DEFRA (2007) T*he Air Quality Strategy for England, Scotland, Wales and Northern Ireland Vols 1 & 2*.
[2] DEFRA (2009) Review and Assessment Technical Guidance TG(09).

future air quality and whether any air quality objectives prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed air quality objectives are not likely to be achieved, the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives.

DEFRA has published technical guidance for use by local authorities in their review and assessment work. This guidance, referred to in this report as LAQM.TG (09), has been used where appropriate in the assessment presented here.

2.4 General Nuisance

Part III of the Environmental Protection Act (EPA) 1990 (as amended by the Noise and Statutory Nuisance Act 1993) contains the main legislation on Statutory Nuisance and allows local authorities and individuals to take action to prevent a statutory nuisance. Section 79 of the EPA defines, amongst other things, smoke, fumes, dust and smells emitted from industrial, trade or business premises so as to be prejudicial to health or a nuisance, as a potential Statutory Nuisance. It also defines accumulation or deposit, which is prejudicial to health as a nuisance.

2.5 Planning Policy Guidance

Policy guidance for local planning authorities regarding local air quality and new development is provided in the National Planning Policy Framework[3] (NPPF) superseding PPS23, which states that the 'existing, and likely future, air quality in the area [of proposed development plans], including any Air Quality Management Areas (AQMA) or other areas where air quality is likely to be poor' should be considered in the preparation of development plan documents and may also be material in the consideration of individual planning applications where pollution considerations arise.

A planning authority must also consider the potential implications of contamination when it is considering applications for planning permission. Specifically, PPS23 states 'Any consideration of the quality of land, air or water and potential impacts arising from development, possibly leading to an impact on health, is capable of being a material planning consideration, in so far as it arises or may arise from any land use'.

The proposed development will be regulated by the Environment Agency under an Environmental Permit according to the Environmental Permitting (England and Wales) Regulations[4]. The relationship between planning and pollution control is set out in NPPF in which it is stated 'the planning and pollution control systems are separate but complementary. Pollution control is concerned with preventing pollution through the use of measures to prohibit or limit the release of substances to the environment from different sources', whereas 'the

[3] Department for Communities and Local Government (2012) *National Planning Policy Framework*. 2012.
[4] Environment Agency (2010) *Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No, 675)*.

planning system should focus on whether the development itself is an acceptable use of the land, and the impacts of those uses, rather than the control of processes or emissions themselves'. Therefore 'planning authorities should work on the assumption that the relevant pollution control regime will be properly applied and enforced. They should act to complement but not seek to duplicate it'.

2.6 PPC Guidance

The Environment Agency for England has published Guidance[5] that should be taken into account when determining the level of assessment required for PPC process operations. H1 is general Guidance relating to all process operations that are subject to PPC. H1 provides information about methods for quantifying environmental impacts to soil, water and air. H1 includes a list of Environmental Quality Standards (EQS) and Environmental Assessment Levels (EAL) for air quality.

The air quality criteria used in this assessment are based on the EALs published in H1. This Guidance also sets out benchmarks to assess predicted rates of deposition of pollutants to land.

2.7 Air Quality Objectives

The UK Air Quality Strategy (UKAQS 2007), sets out a framework for the short to medium term, and the roles that government, the Environment Agency, local government, industry & business, individuals and transport have in protecting and improving air quality.

The UKAQS includes more exacting standards for some pollutants than required by EC legislation. In a majority of cases, standards are carried into the Environmental Permitting regime as short and long term EALs. The Environment Agency's role in relation to Local Air Quality Management is described, with a commitment to ensuring that regulated installations will not contribute significantly to breaches of AQS objectives or EU limit values.

2.8 Sensitive Receptors

Nature conservation sites should be screened against the relevant standards if they occur within specified distance criteria, as detailed below:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the installation; and
- National Nature Reserves (NNRs), Local Nature Reserves (LNRs), local wildlife sites and ancient woodland within 2km of the location of the installation.

According to the Guidance in TG(09), air quality objectives should apply to all locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant objective. Thus, short-term standards such as the 1-hour objective for NO_2 should apply to footpaths at site boundaries and other areas which may be frequented by the

[5] Environment Agency (2011) *Horizontal Guidance Note H1 – Annex f v.2.2*.

public even for a short period of time. Longer term objectives such as the 24 hour or annual mean should apply at houses or other locations which the public can be expected to occupy on a continuous basis. These objectives do not apply to exposure at the workplace. The long-term impacts on human health from exposure to residual process emissions of dioxins, furans and metals are mainly from ingestion, rather than inhalation.

3.0 EMISSION INVENTORY AND BASELINE DATA

An emission inventory has been created from technical data for the proposed plant development as outlined in Section 1.2. Information has been provided by Sullivan Projects and the technology providers for the build.

3.1 Emission Inventory

WRM has compiled an inventory for the proposed process emissions based on technical data provided by technology providers for the project build. The emission inventory for the process is summarised in Table 1 below. The boiler stack is assumed to be one continuous emission points.

Table 1 – Summary of Emission Sources

Source	Frequency	Conditions
Boiler	Continuous	Elevated Point

3.2 Background Pollution

Estimates of background pollution have been obtained from the DEFRA sponsored air quality archive[6]. The 2017 updates of the maps were used for nitrogen dioxide (NO_2) and particulate matter (PM10), according to DEFRA guidance for new assessments, and incorporate background-based maps for years 2015 to 2030, as such no adjustment factor for year of study was required.

For carbon monoxide (CO), the reference data for 2001 was applied, then projected forward for 2020 using the DEFRA Year Adjustment Calculator[7]. For sulphur dioxide ($SO_{2)}$, year adjustment factors are no longer provided because it is considered that SO_2 background levels would change very little, i.e. the factor would be close to one.

The data in Table 2 below presents the highest reported estimated background concentration within 2km of the proposed installation, within the study area.

For the purposes of data input to the ADMS model, background units must be converted to ppb (parts per billion). The applied conversion factors for ppb to µg/m^3 are 1.91 (NO_2), 2.66 (SO_2) and 1.16 is the conversion factor from ppm (parts per million) to mg/m3 for (CO) (please note, the figure for CO needs converted to ppb following the initial conversion). A conversion factor was not applied to the PM10 figure as conversion to ppm is not required within the model.

[6] DEFRA. LAQM data available from http://laqm.defra.gov.uk/?tool=background04. Accessed 23/03/2020.
[7] DEFRA. Adjustment calculator available from http://laqm.defra.gov.uk/tools-monitoring-data/year-adjustment.html Accessed 23/03/2020.

Table 2 – Applied Background Air Quality Concentrations

NO_2		PM10	CO		SO_2	
(µg/m³)	ppb	(µg/m3)	(mg/m³)	ppb	(µg/m³)	ppb
10.89	5.70	12.05	0.13	113.53	4.18	1.57

3.3 Human Receptors

A desk-top study was undertaken in order to identify any sensitive receptor locations in the vicinity of the site that required specific consideration during the assessment. The site is located in an industrial area and the nearest industrial receptor is 59m to the east of the stack emission point of the proposed development. The nearest residential property is ~670m northwest of the stack emission point. The location of the nearest sensitive receptors and the distances and direction of these receptors from the site are summarised in the table below, and are mapped out in Appendix A. There are no air quality management areas (AQMA) within the local vicinity.

Table 3 – Human Receptor Locations

Receptor	Distance to Site (m)	Coordinates (x,y)
HR01 – S T A Vehicle Centres	189	371276, 305514
HR02 – Logistics Training Services (Midlands)	169	371298, 305496
HR03 – Massive Racing	220	371329, 305549
HR04 – J Peate Auto Services	157	371338, 305484
HR05 – Industrial building	192	371396, 305502
HR06 – Halesfield Community Recycling Centre	363	371515, 305628
HR07 – Precision Colour Printing (1)	59	371367, 305344
HR08 – Precision Colour Printing (2)	97	371321, 305233
HR09 – Vargus Tooling (UK) (1)	171	371352, 305162
HR10 – Vargus Tooling (UK) (2)	200	371358, 305134
HR11 – Neumo UK	165	371314, 305164
HR12 – Citadel International Security Services	348	371293, 304982
HR13 – Warehouse	412	371279, 304917
HR14 – Spiral Galaxy Games	411	371242, 304923
HR15 – BML Hayley	224	371247, 305115
HR16 – Bond Display Cabinets	254	371213, 305093
HR17 – Auto Mechanical & Gailey Recovery	186	371218, 305166

Receptor	Distance to Site (m)	Coordinates (x,y)
HR18 – Tardis Environmental UK	262	371132, 305134
HR19 – WZ Packaging Ltd	458	370964, 305026
HR20 – Industrial Building	594	370815, 304994
HR21 – Industrial Building	575	370812, 305037
HR22 - Ingimex	410	370946, 305132
HR23 – Pelloby Ltd	558	370768, 305173
HR24 – Bespoke Construction Services	560	370760, 305207
HR25 – Residential Cluster	783	370536, 305185
HR26 – Grange Fencing Ltd	191	371138, 305246
HR27 – APH Windows	355	370956, 305337
HR28 – Secal Sheet Metal (Midlands)	370	370942, 305381
HR29 – Residential Cluster on Cygnet Drive	717	370628, 305561
HR30 – Residential Cluster on Lake End Drive	677	370706, 305639
HR31 – Holmer Lake Primary School	801	370666, 305811
HR32 – Budget Gas	116	371195, 305334
HR33 – Residential Cluster on Tadorna Drive (1)	899	370760, 306036
HR34 – Residential Cluster on Tadorna Drive (2)	921	370803, 306103
HR35 – Residential Cluster off Sanderville Close	1097	370804, 306308
HR36 – Residential Cluster on Holmer Lane	741	370999, 305998
HR37 – Residential Cluster on Wroxeter Way	843	371045, 306133
HR38 – Goscobel Close	974	371073, 306277
HR39 – Grange Fencing	76	371256, 305382
HR40 – Cartwrights Waste Disposal Services	140	371254, 305457

3.4 Ecological Receptors

A desk-top study was undertaken in order to identify any ecological receptor locations in the vicinity of the site that required specific consideration during the assessment. In terms of identifying sensitive locations, consideration has been given to sensitive receptors at distances stated within section 2.8.

The location of the sensitive receptors and the distances from the site are summarised in the Table 4, and are mapped out in Appendix A.

Table 4 – Ecological Receptor Locations

Receptor	Habitat	Distance to Site (m)	Coordinates (x,y)
ER01 – Madeley (LNR)	Woodland	888	370483, 305000
ER02 – Madebrook & Stirchley Dingle (LNR & LWS)	Ponds, brook, woodlands, grassland, marsh and hedgerows	1,101	370716, 306267
ER03 – Telford Town Park (LNR & LWS)	Broadleaved woodland, grassland heath, scrub and open water	1,921	370189, 306891
ER04 – Tweedale Wood (LWS)	Oak/Birch/Chestnut woodland, scrub and grassland	778	370529, 305276
ER05 – Madeley Court (LWS)	Pit mounds, pools, scrub, rough grassland	1,360	369962, 305106
ER06 – Ancient & Semi Natural Woodland (1412117)	Woodland	310	371607, 305427
ER07 – Ancient & Semi Natural Woodland (1412120)	Woodland	382	371644, 305518
ER08 – Madebrook & Stirchley Dingle (LWS)	Mosaic, wetland corridor, hedges, reedbeds	1,101	Same as ER02
ER09 – Telford Town Park (LWS)	Wooded and heather covered pit mounds, grasslands, pools	1,921	Same as ER03

3.5 Critical Loads and Levels

The Air Pollution Information System (APIS[8]) is a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. APIS has been used to provide information on:

- identification of whether the habitats present are sensitive;
- critical levels and current baseline concentrations; and
- critical loads and current N deposition rates.

[8] APIS http://www.apis.ac.uk [Accessed 19/03/2019]

4.0 ASSESSMENT METHODOLOGY

The following section outlines the data and model parameters utilised in order to model the emissions from the development at identified sensitive receptors. Identification is provided of data sources, input parameters within the chosen model and acknowledgement of uncertainty inherent with modelling exercises.

4.1 Dispersion Modelling

The transport and transformation of a pollutant in the boundary layer can be predicted with a reasonable degree of confidence using an appropriate mathematical model. The model used for this exercise is ADMS 5.2 which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS 5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions. The model utilises meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages. The model is routinely used by UK environment agencies.

The principal factors affecting the concentration of a pollutant are:

- source characteristics including source strength, height of discharge, density, and temperature of the release;
- prevailing atmospheric conditions including; wind speed, wind direction, cloud cover, precipitation, ambient temperature, and the depth of the boundary layer; and
- adjacent buildings, topography and local surface conditions.

These factors can be assigned numerical values and the resultant downwind concentrations of pollutants may be predicted.

4.2 Approach to Model Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

Potential uncertainties in model results have been minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS 5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using three annual meteorological data sets from the closest observation site to the facility, selecting the year in which the worst-case conditions were identified when modelled;
- Operating conditions - Operational parameters were supplied by Myriad Group Ltd on behalf of Sullivan Projects based on proposed design and anticipated operational activities. As such, these are considered to be representative of likely operating conditions;
- Emission rates - Emission rates were derived from process design and are therefore considered to be representative of potential releases during normal operation;
- Receptor locations - Receptor points were included at sensitive locations to provide consideration of impacts on these areas. Emission levels at any point within the assessment extents may be derived from the output model results; and,
- Variability - All model inputs are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

Results were considered in the context of the relevant assessment levels. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

4.3 Model Parameters

The emission conditions of the identified pollutant sources are based on technical information provided by Myriad Group Ltd on behalf of Sullivan Projects. These are summarised in the table below, in accordance with the requirements of H1 and EA Guidelines. There is one combustion process leading to the emission of pollutants that require assessment, the boiler stack emitting pollutants identified below for assessment inclusion.

Table 5 – Summary of Modelled Source Conditions

Parameter	Boiler
Coordinates (x,y)	371310, 305329
Exit Diameter (mm)	550
Exit Temperature (°C)	160
Efflux Velocity (m/s)	6.4
Release Height (m)	12m (TBC)
NO_x Emission Rate (g/s)	0.23
CO Emission Rate (g/s)	0.10
SO_2 Emission Rate (g/s)	0.28
Total Particulate Matter PM10 (g/s)	0.02
O_2 Emission Content (%)	7.5

The assessment considers pollutants based upon information supplied by technology providers. The assessment includes oxides of nitrogen (NO_x) as NO_2, since these are the main combustion pollutants from the proposed boiler unit. Additional pollutants of CO, PM10 and SO_2 are also included from the boiler unit.

4.3.1 Meteorological Data

Meteorological data used in this assessment was taken from Shawbury met station, over the period of January 2017 to December 2019 (inclusive). Shawbury meteorological station is located approximately 23km northwest of the proposed development. DEFRA guidance LAQM.TG(09) recommends meteorological stations within 30km of an assessment area as being suitable for detailed modelling. This is the closest met station to the proposed site of development which closest represents the land the development is to be situated on. All meteorological data used in the assessment was provided by the Met Office, which is an established distributor of meteorological data within the UK.

The worst-case results vary with the year of hourly sequential meteorological data used to predict dispersion. The worst-case meteorological data for dispersion is for the year 2017 and this has been used in all subsequent analysis. Met data for this period is presented as a wind rose in Figure 2 below, with all data in Appendix B.

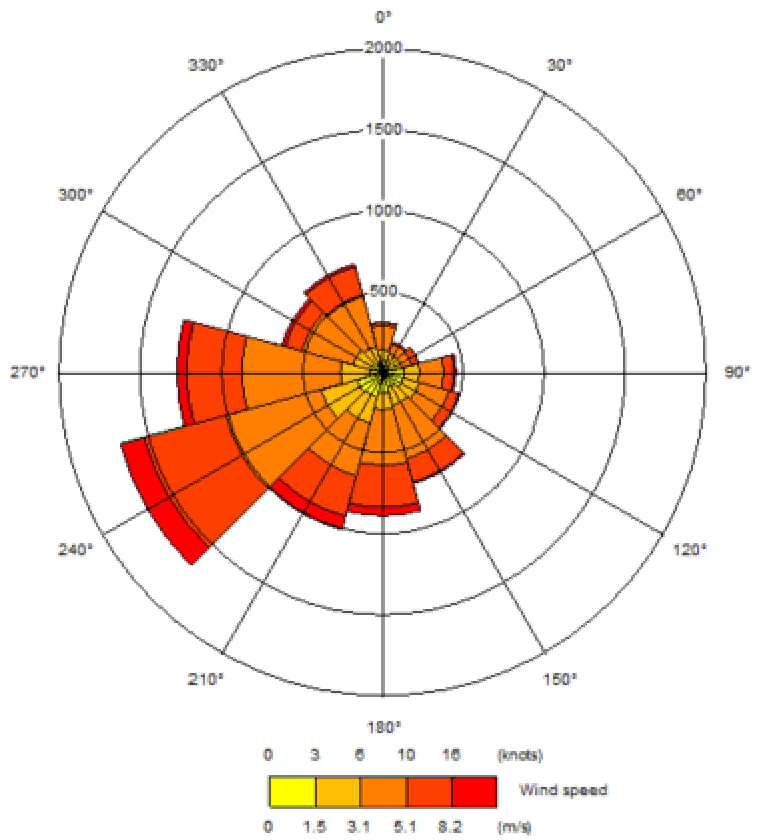


Figure 2 – Wind Rose of Shawbury Meteorological Data for 2017

4.3.2 Terrain

The model terrain algorithm should only be used where slopes are >1:10. The proposed site is on level ground where terrain effects are unlikely to affect dispersion and terrain effects have therefore been discounted.

4.3.3 Buildings

The dispersion model used can take account of the effects of recirculating flow or downwash effects caused by buildings near the point of release, although these effects are generally not important where the release is close to the ground. Building effects have been considered for all point source releases. The details of buildings used in the assessment are presented in the table below, and schematically in Figure 3.

Table 6 – Buildings Included within Model Assessment

Building	Coordinates (x,y)	Shape	Height (m)	Length / Radius (m)	Width (m)	Angle (º)
Building 1	371294, 305319	Rectangle	9.0	41.76	32.0	17
Building 2	371317, 305316	Rectangle	8.08	49.82	14.02	17
Building 3	3713298.5, 305289.5	Rectangle	7.558	12.0	12.81	17
Building 4	371302.1, 305345.6	Rectangle	5.363	13.74	31.67	17
Building 5	371277.7, 305348.1	Rectangle	5.246	12.66	16.31	17
Building 6	371280.6, 305357.4	Rectangle	4.343	6.87	16.31	17
Building 7	371320.7,305343.8	Rectangle	4.730	5.35	4.89	17

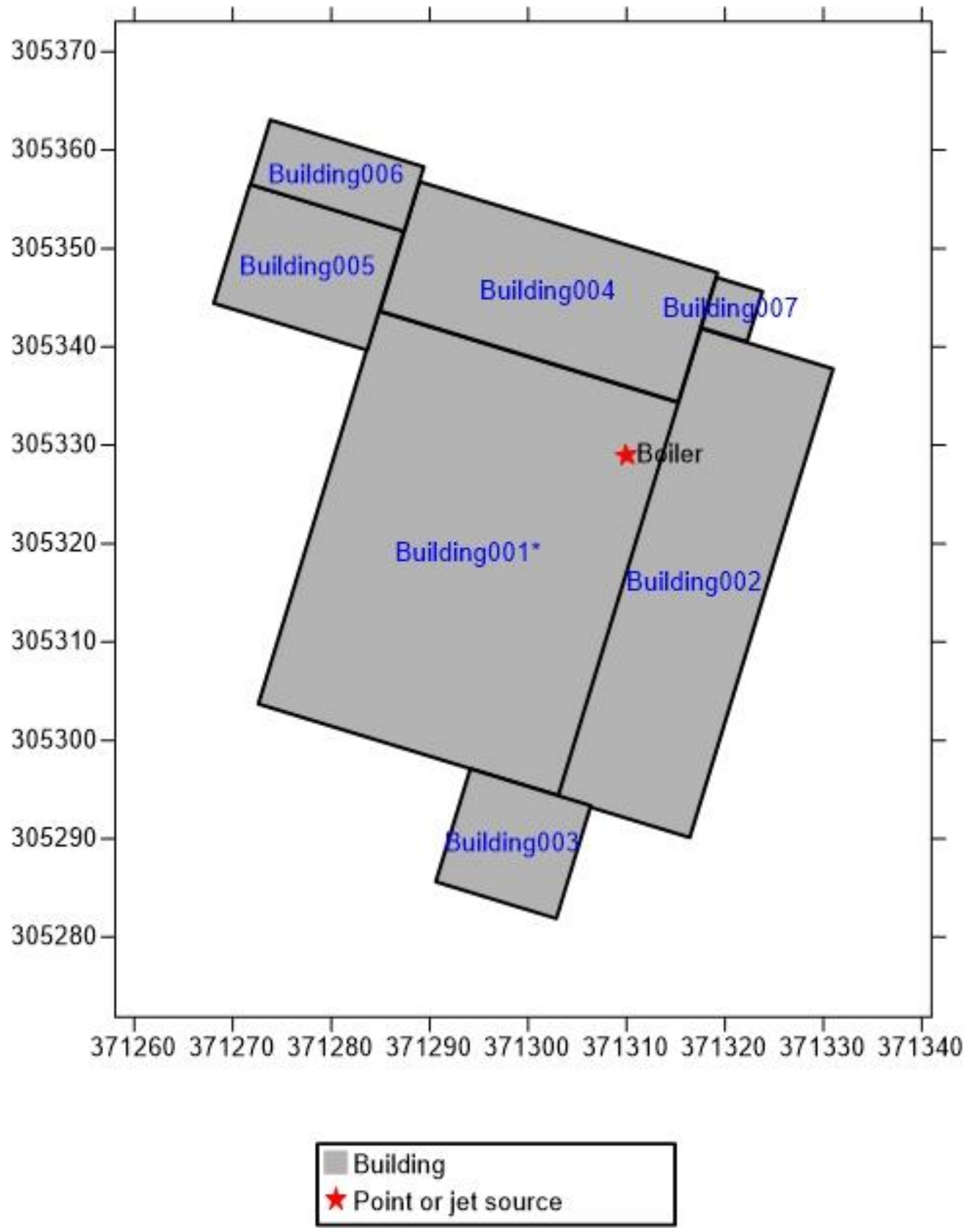


Figure 3 – Building and Point Sources Layout

4.4 Special Treatment of Model Results

4.4.1 Nitric Oxide to NO_2 Conversion

NO_x emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to NO_2. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar radiation and the availability of oxidants, such as ozone (O_3).

Following the EA Air Quality Modelling and Assessment Unit (AQMAU) guidance on conversion ratio for NO_x and NO_2, a worst-case scenario has been applied in that 35% of NO_x is presented as NO_2 in relation to short-term impacts and 70% of NO_x is present as NO_2 in relation to long-term impacts.

4.4.2 Averaging Periods

Where the short-term environmental standard is measured using a time period other than hourly, conversion factors are applied to model results to present the correct concentrations. Hourly concentrations are therefore multiplied by the appropriate factor identified below:

- 1.34 to convert to a 15-minute average
- 0.7 to convert to an 8-hour average
- 0.59 to convert to a 24-hour average

4.5 Human Receptor Assessment

The Environment Agency publishes a list of pollutants to include within assessment where released at source. The H1 document includes a list of Environmental Quality Standards (EQS) and Environmental Assessment Levels (EAL) for air quality. The air quality criteria used in this assessment are based on the EALs published in H1. This Guidance also sets out benchmarks to assess predicted rates of deposition of pollutants to land. The environmental assessment levels for human receptors is provided in the table below for the appropriate averaging period and pollutants.

Table 7 – Human Receptor Environment Assessment Levels (EAL)

Pollutant	Averaging Period	EAL ($\mu g/m^3$)
Nitrogen Dioxide	1-hour mean ≤18 exceedances	200
	Annual mean	40
Sulphur Dioxide	15-min mean ≤35 exceedances	266
	1-hour mean ≤24 exceedances	350
	24-hour mean ≤3 exceedances	125
Particulates PM_{10}	24-hour mean ≤35 exceedances	50
	Annual mean	40
Carbon Monoxide	Maximum daily running 8-hour mean	10,000
Benzene	Annual mean	5

4.6 Ecological Receptor Assessment

The EA's Operational Instruction details how the air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will:

- have a likely significant effect on a European site;
- be an operation likely to damage (OLD) a Site of Special Scientific Interest (SSSI); or

- result in significant pollution of a National Nature Reserve (NNR), Local Nature Reserve (LNR), Local Wildlife Site (LWS) or ancient woodland (AWL).

The environmental assessment levels for ecological receptors is provided in the table below for the appropriate averaging period and pollutants.

Table 8 - Ecological Receptor Environment Assessment Levels (EAL)

Pollutant	Averaging Period	EAL (µg/m^3)
Ammonia	Annual mean	1 (where lichens or bryophytes are present) 3 (where they're not present)
Sulphur Dioxide	Annual mean	10 (where lichens or bryophytes are present) 20 (where they're not present)
Nitrogen Oxide (as NO_2)	Annual mean	30
Nitrogen Oxide (as NO_2)	Daily mean	75
Hydrogen Fluoride	Weekly mean	0.5
Hydrogen Fluoride	Daily mean	5

4.7 Critical Load Assessment

Designated habitats may contain species, habitats or other receptors which are potentially sensitive to atmospheric pollution for which indicative exposure thresholds for their protection have been defined. These thresholds are known as Critical Levels (for airborne concentrations) and Critical Loads (for deposition rates).

Critical levels are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical levels for the protection of vegetation and ecosystems are specified within the Air Quality Standards Regulations.

Critical loads are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical loads are set for the deposition of various substances to sensitive ecosystems.

Empirical critical loads for eutrophication (derived from a range of experimental studies) are assigned based for different habitats, including grassland ecosystems, mire, bog and fen habitats, freshwaters, heathland ecosystems, coastal and marine habitats, and forest habitats. These critical loads can be obtained from the UK Air Pollution Information System (APIS).

4.7.1 Deposition Rates

Deposition rates for the process contribution (PC), were calculated using empirical methods recommended by the EA (AQTAG06)[9]. If the annual average ground level concentration of a pollutant is Pc (µg/m^3) and the dry deposition velocity for that pollutant is Vd (m/s) then the annual dry deposition rate Dr (kg/ha/yr) is calculated from the following formula:

$$D_r = Vd \times Pc \times Mf \times Cf$$

Where:
Mf = 14/46 for NO_2
32/64 for SO_2
1/17 for NH_3
1/35 for HCl

and converts from nitrogen dioxide to nitrogen, sulphur dioxide to sulphur and hydrogen chloride to hydrogen.

Cf = the conversion factor value (315.36) which converts to kg/ha/yr.

Dry deposition velocities vary depending on the type of land mass and weather conditions such as humidity. The following values have been used for V_d, as presented within the Technical Guidance note.

- NO_2 – 0.0015 m/s
- SO_2 – 0.012 m/s
- NH_3 – 0.02 m/s
- HCl – 0.025 m/s

In order to calculate acid deposition in terms of k_{eq}/ha/yr from deposition data (calculated using the equation above) in terms of kg/ha/yr the following conversion factors are used:

- Nitrogen derived acid deposition: 1kg N/ha/yr is equal to 1/14 keq N/ha/yr
- Sulphur derived acid deposition: 1 kg S/ha/yr is equal to 1/16 keq S/ha/yr

4.8 Significance of Impact

This air quality impact assessment (AQIA) will provide quantitative predictions for a range of pollutants and to help assess their significance. The structure for assessing the significance of air quality impacts is set out in the table below.

Table 9 – Assessment Matrix for Determination of Significance

Predicted Impact	Significance	Justification
Process Contribution + baseline greater than EAL	Major	Exceeding any air quality limit value would be unacceptable in terms of human health, or where the impact would have significant ecological impacts.

[9] Environment Agency AQTAG06 *Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air Status*: Updated version, (Approved March 2014).

Predicted Impact	Significance	Justification
Process Contribution + baseline <100% of EAL	Moderate	Risk based approach advocated by Environment Agency taking account of model headroom and uncertainty. May not be acceptable for sensitive ecological and human receptors.
Process Contribution + baseline <70% of EAL	Minor	Risk based approach advocated by Environment Agency taking account of model headroom and uncertainty.
Process Contribution <10% of EAL	Negligible	Adopted risk based approach taking into account the factor of 10.
Process Contribution <1% of EAL	Insignificant	The assessment criteria proposed within H1 screening tool which states that process contributions can be considered insignificant if the long-term process contribution is <1% of the long term environmental standard.

5.0 SENSITIVITY ANALYSIS

This section presents the potential air quality impacts associated with the operational phase of the proposed development, the mitigation measures that will be employed and any residual impacts. Appendix C and D summarise the findings of the potential emissions and the scale and extent of potential impacts. Aspects of the assessment are discussed in more detail below.

It is a requirement of the Royal Meteorological Society Guidelines on Dispersion Modelling[10] and a subsequent review[11] that dispersion modelling studies should include a sensitivity analysis for model inputs, to provide an estimate of the possible errors in the predictions. The potential errors in predictions were outlined in Section 4. The sensitivity analysis conducted for this study considers the likely variability and errors arising from meteorological data, surface roughness and stack heights.

The Environment Agency's method for assessing model uncertainty[12] indicates that the confidence in the model is low. However, the approach to assessment is the method normally accepted by DEFRA, EA and other regulatory bodies. The main causes of model uncertainties are:

- potential combination of the effects of terrain and buildings on dispersion;
- uncertainties in source estimates for diffuse releases; and
- the low model headroom.

Despite these uncertainties, the modelling provides a useful comparison between the likely impact for the baseline and as proposed Scenarios.

5.1.1 Meteorological Variability

Initially, the model predictions consider the variability of emissions around the site for a range of years (Shawbury met station 2017–2019 inclusive). This sensitivity analysis considers the predicted NO_2 for the proposed release conditions. This indicates that for the proposed release conditions, the worst case NO_2 results vary with the year of hourly sequential meteorological data used to predict dispersion.

The worst-case impact predicted to occur varies from year to year and according to receptor. The worst-case factors for year to year have been taken into account in the assessment as identified in the table below.

[10] Royal Meteorological Society (1995) *Atmospheric Dispersion Modelling Guidelines on the justification of choice and use of models and the communication and reporting of results.*
[11] Atmospheric Dispersion Modelling Liaison Committee (2004) *Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to the 1995 Royal Meteorological Society Guidance.*
[12] Ji Ping Shi and Betty Ng (2004) *Risk based pragmatic approach to address model uncertainty. Air Quality Modelling and Assessment Unit.* Environment Agency: Cardiff.

Table 10 – Predicted Environmental Concentration (PEC) of NO_2 (Annual Mean) with Met Data Year Adjustments

Met Data Year	2017	2018	2019
NO_2 (µg/m^3)	19.92	17.47	17.75

5.1.2 Surface Roughness

The area immediately surrounding the site is that of an industrial estate. Beyond that to the east, the land is mainly agricultural in nature, with that to the west being residential. The model runs were initially conducted assuming a surface roughness of 1.0m typically associated with cities and woodland (max).

The dispersion model has been run using surface roughness values of 0.1m, 0.2m, 0.3m, 0.5m and 1.0m across the domain. These are likely to represent the credible range of worst-case dispersion factors within the study area. The worst-case predicted impact occurs at the most affected dwellings when a surface roughness value of 1.0m is assumed (see Table 11 below). This value has therefore been adopted throughout to represent worst case scenario modelling.

Table 11 – PEC of NO_2 (Annual Mean) with Surface Roughness Adjustments

Surface Roughness	0.1m	0.2m	0.3m	0.5m	1.0m
NO_2 (µg/m^3)	16.47	17.42	18.02	18.84	19.92

5.1.3 Release Height

The model sensitivity analysis has so far considered the likely impact from the proposed boiler stack height (12m). Further analysis is undertaken to determine whether increasing the stack heights of the boiler will significantly improve dispersion.

The effect of increased stack height has been considered for all emissions for a range of stack heights between 12m and 16m at 1m intervals. There is a reduction in emissions by increasing the stack height above the initial elevation but at this stage it is not seen to warrant the raising of the stack height above 12m. The results are summarised in Table 12 below.

Table 12 – PEC of NO_2 (Annual Mean) with Amended Stack Heights

Release Height	12m	13m	14m	15m	16m
NO_2 (µg/m^3)	19.92	18.36	16.95	15.75	14.67

6.0 IMPACT ASSESSMENT

This section presents the potential air quality impacts associated with the operational phase of the proposed development, the mitigation measure that will be employed and any residual impacts. Appendix C and D summarise the findings of the potential emissions and the scale and extent of potential impacts. Aspects of the assessment are discussed in more detail below.

6.1 Applied Scenarios

The predicted contours for airborne pollutants are plotted in Appendix C. The predicted concentrations at sensitive receptors are included within Appendix D and summarised in section 6.2. These predictions are based on the worst-case dispersion conditions for surface roughness (1.0m), meteorology (2017), building effects and at the proposed stack height (12m).

The criteria used to assess the significance of these predictions were presented earlier in Section 4.8. The significance of these predicted concentrations and deposits is summarised in Section 6.2, where the predicted value is expressed as a percentage of the Environment Assessment Level (EAL).

6.2 Impact Assessment at Human Receptors

The worst-case air quality impacts are summarised in the following sections for each pollutant and averaging period. The Process Contributions (PCs) and Predicted Environmental Concentrations (PECs) predicted at each sensitive receptor are itemised in Appendix E.

6.2.1 Long Term NO_2

Predicted annual mean maximum NO_2, PCs, and PECs are presented within Table 13. Reference should be made to Appendix C for an illustration of the long-term (annual mean) NO_2 contour plot.

Table 13 – Predicted Max Annual Mean NO_2 Concentrations

	Waste wood boiler				
Emission	**EAL (µg/m³)**	**PC (µg/m³)**	**PC% EAL**	**PEC (µg/m³)**	**PEC% EAL**
Annual Mean NO_2	40	8.95	22.35	19.92	49.8
Significance	Minor (PEC<70% EAL)				

6.2.2 Long Term PM10

Predicted annual mean maximum PM10, PCs and PECs are presented within Table 14. Reference should be made to Appendix C for an illustration of the long-term (annual mean) PM10 contour plot.

Table 14 – Predicted Max Annual Mean PM10 Concentrations

	Waste wood boiler				
Emission	**EAL ($\mu g/m^3$)**	**PC ($\mu g/m^3$)**	**PC% EAL**	**PEC ($\mu g/m^3$)**	**PEC% EAL**
Annual Mean PM10	40	0.75	1.88	12.80	32
Significance	Negligible (PC<10% EAL)				

6.2.3 Short Term NO_2

Predicted 1-hr mean NO_2 maximum PCs and PECs are presented within Table 15. Reference should be made to Appendix C for an illustration of the short-term (1hr mean) NO_2 contour plot.

Table 15 – Max Predicted NO_2 Short Term Concentrations

	Waste wood boiler				
Emission	**EAL ($\mu g/m^3$)**	**PC ($\mu g/m^3$)**	**PC% EAL**	**PEC ($\mu g/m^3$)**	**PEC% EAL**
1hr NO_2	200	52.12	26.06	55.95	27.98
Significance	Minor (PEC<70% EAL)				

6.2.4 Short Term PM10

Predicted 24-hr mean PM10 maximum PCs and PECs are presented within Table 16. Reference should be made to Appendix C for an illustration of the short-term (24hr mean) PM10 contour plot.

Table 16 – Max Predicted PM10 Short Term Concentrations

	Waste wood boiler				
Emission	**EAL ($\mu g/m^3$)**	**PC ($\mu g/m^3$)**	**PC% EAL**	**PEC ($\mu g/m^3$)**	**PEC% EAL**
24hr PM10	50	7.32	14.64	14.43	28.86
Significance	Minor (PEC<70% EAL)				

6.2.5 Short Term SO_2

Predicted short term SO_2 maximum PCs and PECs are presented within Table 17. Reference should be made to Appendix C for an illustration of the short-term SO_2 contour plot.

Table 17 – Max Predicted SO_2 Short Term Concentrations

	Waste wood boiler					
Emission	**EAL (µg/m3)**	**PC (µg/m³)**	**PC% EAL**	**PEC (µg/m³)**	**PEC% EAL**	**Significance**
1hr SO_2	350	178.36	50.96	182.60	52.17	Minor (PEC<70% EAL)
24hr SO_2	125	105.23	84.18	107.73	86.18	Moderate (PEC<100% EAL)
15min SO_2	266	239.00	89.85	244.68	91.98	Moderate (PEC<100% EAL)

6.2.6 Short Term CO

Predicted 8-hr mean CO maximum PCs and PECs are presented within Table 18. Reference should be made to Appendix C for an illustration of the short-term (8hr mean) CO contour plot.

Table 18 – Max Predicted CO Short Term Concentrations

	Waste wood boiler				
Emission	**EAL (µg/m³)**	**PC (µg/m³)**	**PC% EAL**	**PEC (µg/m³)**	**PEC% EAL**
8hr CO	10,000	43.43	0.43	135.84	1.36
Significance	Insignificant (PC< 1% EAL)				

6.2.7 Exceedance Analysis

In addition to UK Air Quality Strategy (AQS) objectives, the modelled pollutant emissions are also considered in context of Ambient Air Directive (AAD) Limit Values for the number of exceedances permitted within a given emission period. The results of this assessment are identified in Table 19 for the emissions resultant from the proposed development. The results identify that no exceedances for any pollutant are modelled under the worst-case exposure scenario.

Table 19 – Summary of Modelled Emission Period Exceedances

Pollutant	Emission Period	Limit	Permitted Exceedances	Modelled Exceedances
NO_2	1hr	200 µg/m³	≤18	0
NO_2	Annual	40 µg/m³	0	0
PM10	24hr	50 µg/m3	≤35	0
PM10	Annual	40 µg/m3	0	0
SO_2	15mins	266 µg/m³	≤35	0
SO_2	1hr	350 µg/m³	≤24	0

Pollutant	Emission Period	Limit	Permitted Exceedances	Modelled Exceedances
SO_2	24hr	125 µg/m³	≤3	0
CO	8hr Average in 24hrs	10,000 µg/m³	0	0

6.3 Impact Assessment at Ecological Receptors

Modelling of impacts at ecological receptors has been undertaken for the proposed site, to determine impacts on critical loads and critical levels, as presented within the following subsections.

6.3.1 Annual Mean NO_2

Predicted annual mean maximum nitrogen oxide as NO_2 PCs and PECs are presented within Table 20 for each sensitive habitat.

Table 20 - Annual Mean NO_2 Concentrations

	Waste wood boiler					
Receptor	EAL (µg/m³)	PC (µg/m³)	PC% EAL	PEC (µg/m³)	PEC% EAL	Significance
ER01	30	0.03	0.1	10.99	36.63	Insignificant (PC< 1% EAL)
ER02	30	0.05	0.17	11.01	36.7	Insignificant (PC< 1% EAL)
ER03	30	0.02	0.07	10.98	36.6	Insignificant (PC< 1% EAL)
ER04	30	0.06	0.2	11.02	36.73	Insignificant (PC< 1% EAL)
ER05	30	0.02	0.07	10.98	36.6	Insignificant (PC< 1% EAL)
ER06	30	0.93	3.1	11.89	39.63	Negligible (PC< 10% EAL)
ER07	30	0.65	2.17	11.61	38.7	Negligible (PC< 10% EAL)

6.3.2 Daily Mean NO_2

Predicted daily mean maximum nitrogen oxide as NO_2 PCs and PECs are presented within Table 21 for each sensitive habitat.

Table 21 - Daily Mean NO_2 Concentrations

	Waste wood boiler					
Receptor	EAL (µg/m³)	PC (µg/m³)	PC% EAL	PEC (µg/m³)	PEC% EAL	Significance
ER01	75	1.04	1.39	3.30	4.40	Negligible (PC<10% EAL)
ER02	75	0.87	1.16	3.13	4.18	Negligible (PC<10% EAL)

	Waste wood boiler					
Receptor	EAL (μg/m³)	PC (μg/m³)	PC% EAL	PEC (μg/m³)	PEC% EAL	Significance
ER03	75	0.44	0.58	2.70	3.60	Insignificant (PC<1% EAL)
ER04	75	0.91	1.21	3.17	4.23	Negligible (PC<10% EAL)
ER05	75	0.70	0.93	2.96	3.95	Insignificant (PC<1% EAL)
ER06	75	2.42	3.23	4.69	6.25	Negligible (PC<10% EAL)
ER07	75	2.07	2.76	4.34	5.78	Negligible (PC<10% EAL)

6.3.3 Annual Mean SO_2

Predicted annual mean maximum SO_2 PCs and PECs are presented within Table 22 for each sensitive habitat.

Table 22 - Annual Mean SO_2 Concentrations

	Waste wood boiler					
Receptor	EAL (μg/m³)	PC (μg/m³)	PC% EAL	PEC (μg/m³)	PEC% EAL	Significance
ER01	20	0.04	0.20	4.28	21.41	Insignificant (PC< 1% EAL)
ER02	20	0.06	0.32	4.31	21.53	Insignificant (PC< 1% EAL)
ER03	20	0.03	0.13	4.27	21.35	Insignificant (PC< 1% EAL)
ER04	20	0.07	0.34	4.31	21.56	Insignificant (PC< 1% EAL)
ER05	20	0.03	0.14	4.27	21.36	Insignificant (PC< 1% EAL)
ER06	20	1.11	5.56	5.35	26.77	Negligible (PC< 10% EAL)
ER07	20	0.78	3.88	5.02	25.09	Negligible (PC< 10% EAL)

6.4 Critical Loads

The process contribution to critical loads for nitrogen deposition and acid deposition are presented in Table 23 below with critical load values.

Table 23 – Critical Load Evaluation

Habitat	Nutrient Nitrogen (kg/ha/yr)			Acid Deposition (k_{eq}/ha/yr)		
	Critical Load	PC	PC as % CL	Critical Load	PC	PC as % CL
ER01	10	0.03	0.3	2.63	<0.01	0.5
ER02	10	0.05	0.5	2.63	<0.01	0.4
ER03	10	0.02	0.2	2.63	<0.01	0
ER04	10	0.06	0.6	2.63	<0.01	0.5
ER05	5	0.02	0.4	1.56	<0.01	0
ER06	10	0.93	9.3	2.63	0.14	11.6
ER07	10	0.65	6.5	2.63	0.10	8.3

The predicted deposition at the ecologically sensitive habitats within the scope of this study are likely to be insignificant for both acid and nitrogen deposition when compared to critical loads (less than 100% of the critical load).

6.5 Stack Height Optimisation

Further to the modelling results stated above, it can be seen that different emission durations for short term SO2 are the only elements to have a significance class of moderate (<100% EAL). All other pollutants are classed as minor (PEC<70% EAL) or below. In order to achieve a significance of minor (PEC<70% EAL), a stack height optimisation exercise is now undertaken in the table below to establish at what stack height all emission durations for short term SO2 fall under this significance.

Table 24 – Stack Height Optimisation

	Waste wood boiler					
Emission	EAL (μg/m3)	PC (μg/m³)	PC% EAL	PEC (μg/m³)	PEC% EAL	Significance
13m Stack Height						
1hr SO_2	350	168.17	48.05	172.41	49.26	Minor (PEC<70% EAL)
24hr SO_2	125	99.22	79.38	101.72	81.38	Moderate (PEC<100% EAL)
15min SO_2	266	225.35	84.72	231.03	86.85	Moderate (PEC<100% EAL)
14m Stack Height						
1hr SO_2	350	157.85	45.1	162.10	46.31	Minor (PEC<70% EAL)
24hr SO_2	125	93.13	74.50	95.64	76.51	Moderate (PEC<100% EAL)
15min SO_2	266	211.52	79.52	217.21	81.66	Moderate (PEC<100% EAL)

	Waste wood boiler					
Emission	EAL (µg/m3)	PC (µg/m³)	PC% EAL	PEC (µg/m³)	PEC% EAL	Significance
15m Stack Height						
1hr SO_2	350	147.62	42.18	151.86	43.39	Minor (PEC<70% EAL)
24hr SO_2	125	87.10	69.68	89.60	71.68	Moderate (PEC<100% EAL)
15min SO_2	266	197.81	74.36	203.50	76.50	Moderate (PEC<100% EAL)
16m Stack Height						
1hr SO_2	350	60.78	17.37	65.03	18.58	Minor (PEC<70% EAL)
24hr SO_2	125	35.86	28.69	38.37	30.70	Minor (PEC<70% EAL)
15min SO_2	266	81.45	30.62	87.14	32.76	Minor (PEC<70% EAL)

As can be seen from the table above, the stack height needs to be 16m in height in order for the emissions durations for SO2 to all be classed with a significance of minor (PEC<70% EAL).

6.6 Assessment Summary

This assessment indicates that air emissions from the waste wood boiler are likely to range from insignificant to minor for all emission sources at both long and short-term exposure scenarios. The assessment includes both human and ecological receptors. Analysis has taken account of the downwash effect of buildings and stack heights.

The short and long-term assessment of the significance of impact from the waste wood boiler is summarised in the table below. In all scenarios, the predicted significance is insignificant, negligible or minor.

Table 25 – Summary of the Assessment of Significance

Receptor Type	Assessment Scenario	Emission	Predicted Significance of Impact
Human	Long Term	NO_2	Minor (PEC<70% EAL)
	Long Term	PM10	Negligible (PC<10% EAL)
	Short Term	NO_2	Minor (PEC<70% EAL)
		PM10	Minor (PEC<70% EAL)
		SO_2	Minor (PEC<70% EAL) following stack optimisation.
		CO	Insignificant (PC<1% EAL)
Environmental	Long Term	See Section 6.3 and Section 6.4	
	Short Term		

7.0 PROPOSED MITIGATION MEASURES

The following measures are proposed to prevent or minimise impacts on air pollution:

- the combustion pollutants from the site shall be compliant with IED emission limits;
- monitoring in line with permit shall be conducted by independent testing agencies;
- supervisory staff shall be trained to ensure that the works are operated within specification; and,
- all process operations shall be subject to routine planned preventative maintenance.

8.0 CONCLUSIONS

The following conclusions are drawn from the modelled output data and justification for model approach discussed throughout.

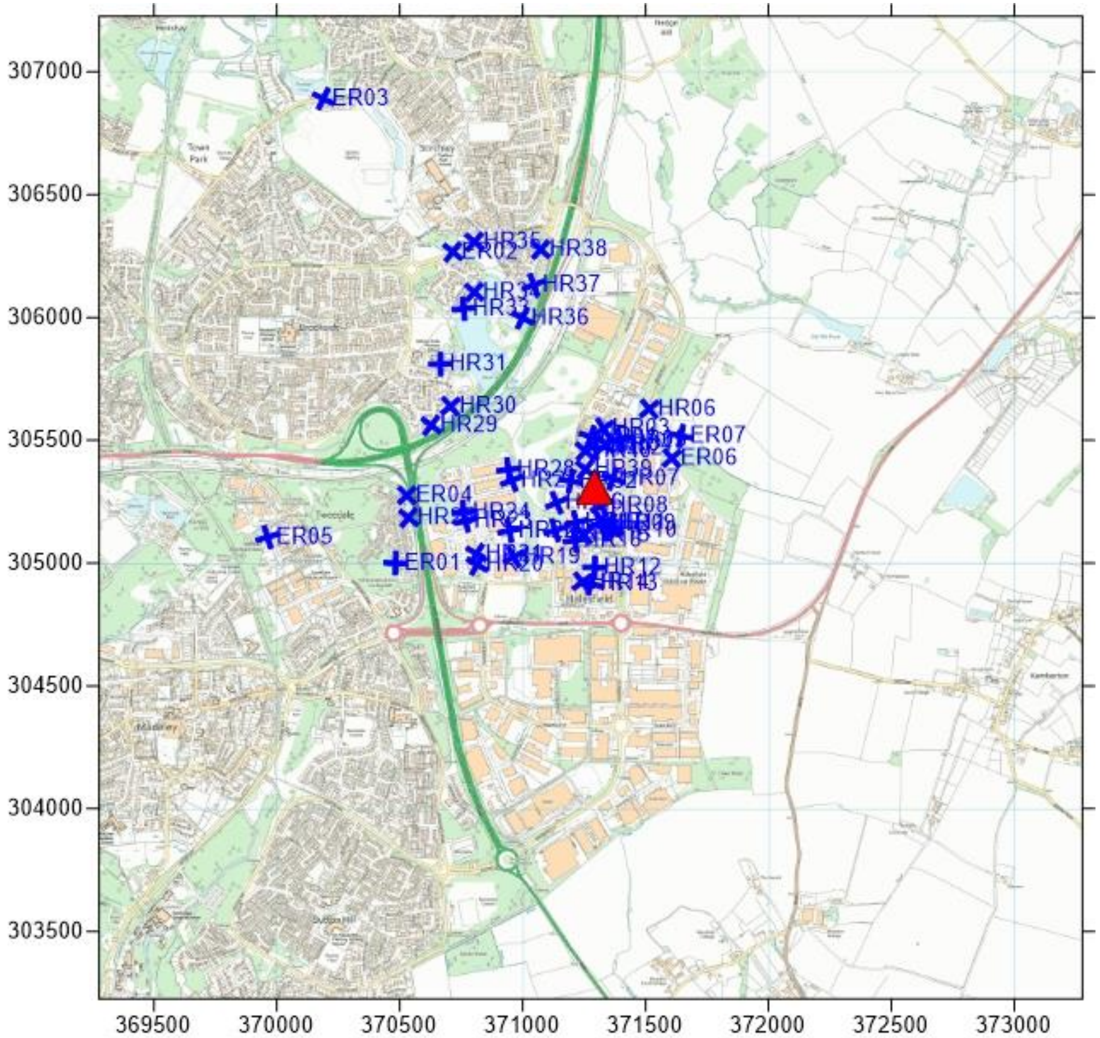
8.1 Human Exposure

- Baseline air quality around the proposed waste wood boiler is within European Limit Values and UK objectives.
- The overall confidence in the model predictions is considered to be of a medium level. A detailed model sensitivity analysis has been conducted to improve the robustness of the predictions.
- The assessment takes account of the worst-case model predictions, the relevant Environmental Assessment Level (EAL) and the significance criteria as detailed.
- Exposure to the annual mean NO_2 is likely to be **minor**.
- Exposure to the annual mean PM10 is likely to be **negligible**.
- Short-term exposure to NO_2, PM10, CO and SO_2 is predicted to range between insignificant and minor, depending on the pollutant, and once the stack optimisation height of 16m has been accounted for.
- The emissions from the proposed waste wood boiler are unlikely to result in any air quality objective or limit value being exceeded.
- Please note, stack optimisation was only undertaken for SO2. As the height of the stack has been increased to 16m from an initial modelling height of 12m for the other pollutants, the results for other pollutants should be even lower with a 16m stack height due to increased dispersion.

8.2 Ecological Exposure

- The critical loads at designated sites within vicinity of the waste wood boiler are likely to be negligible for both acid and nitrogen deposition.

APPENDIX A – SENSITIVE RECEPTORS LOCATION MAP



SENSITIVE RECEPTORS MAP

✚	Sensitive Receptors
▲	Site Location

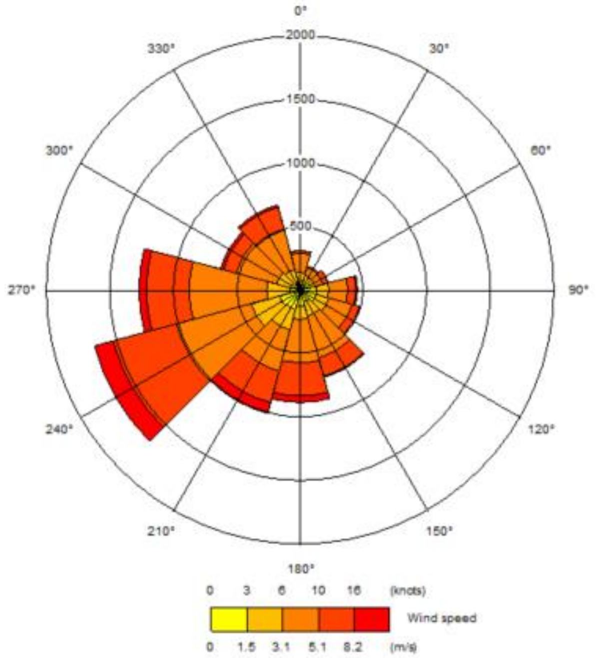
WRM/PR0893/W03

Sullivan Projects Ltd c/o Besblock Ltd

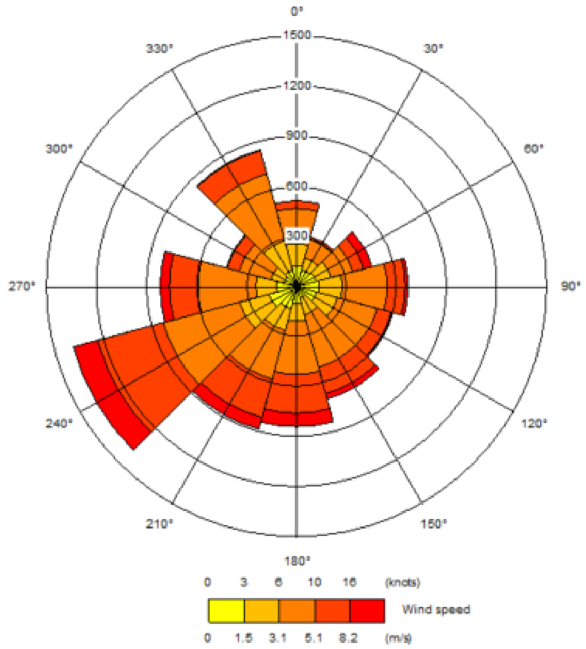
Halesfield 21, Telford

WRM

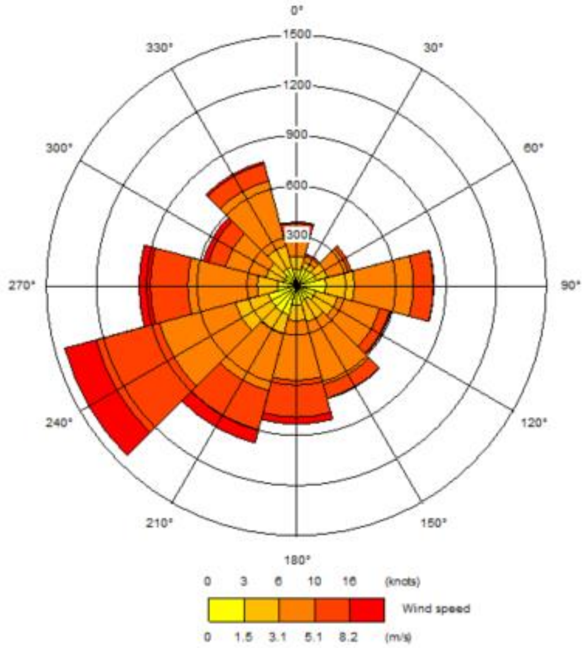
APPENDIX B – WEATHER DATA SETS



Shawbury Met Data - 2017



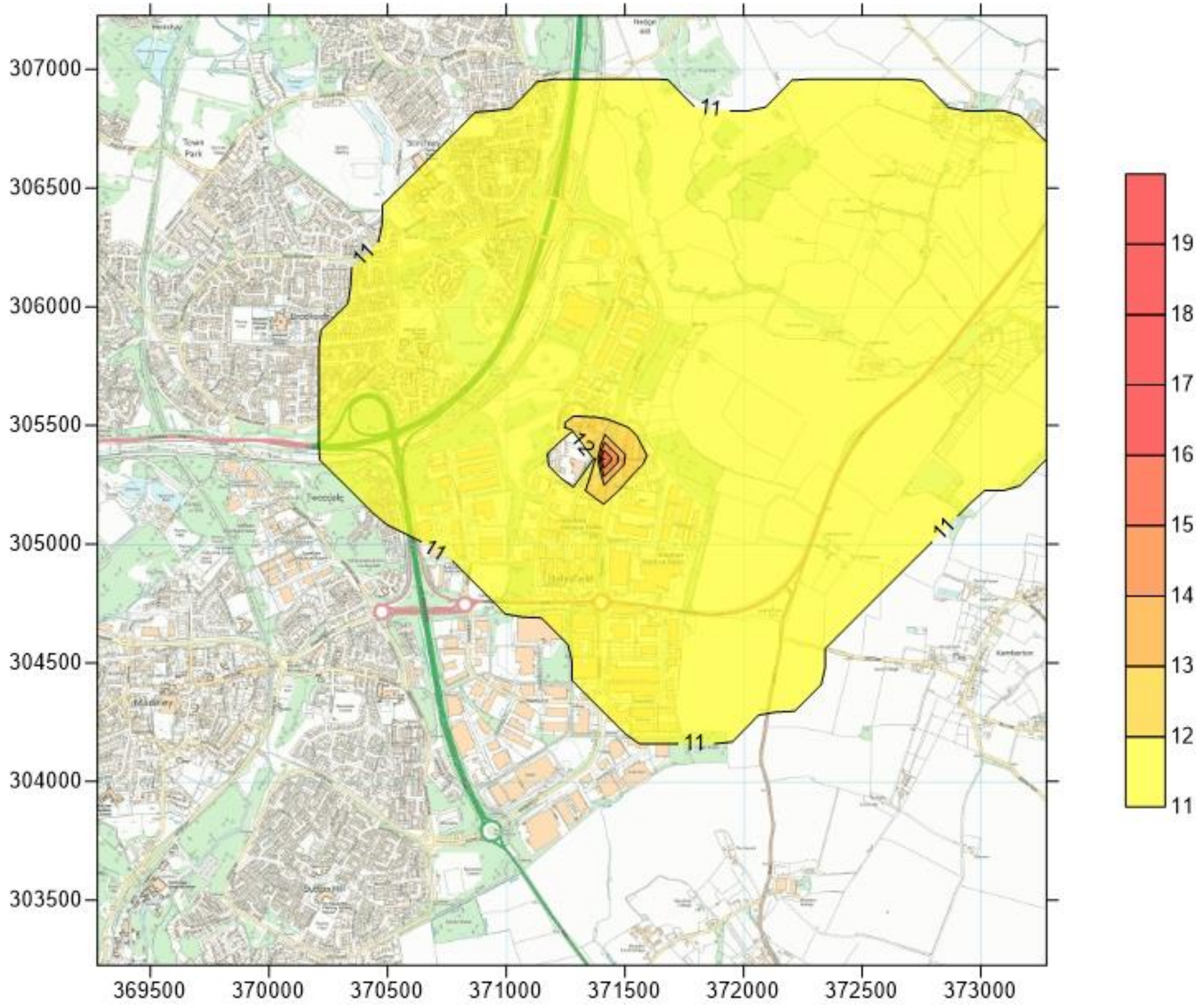
Shawbury Met Data - 2018



Shawbury Met Data - 2019

Data Supplier

APPENDIX C – DISPERSION MODEL PLOTS



Long Term NO_2

Units = µg/m^3

EAL = 40 µg/m^3

SR = 1.0
RH = 12m
Met year = 2017

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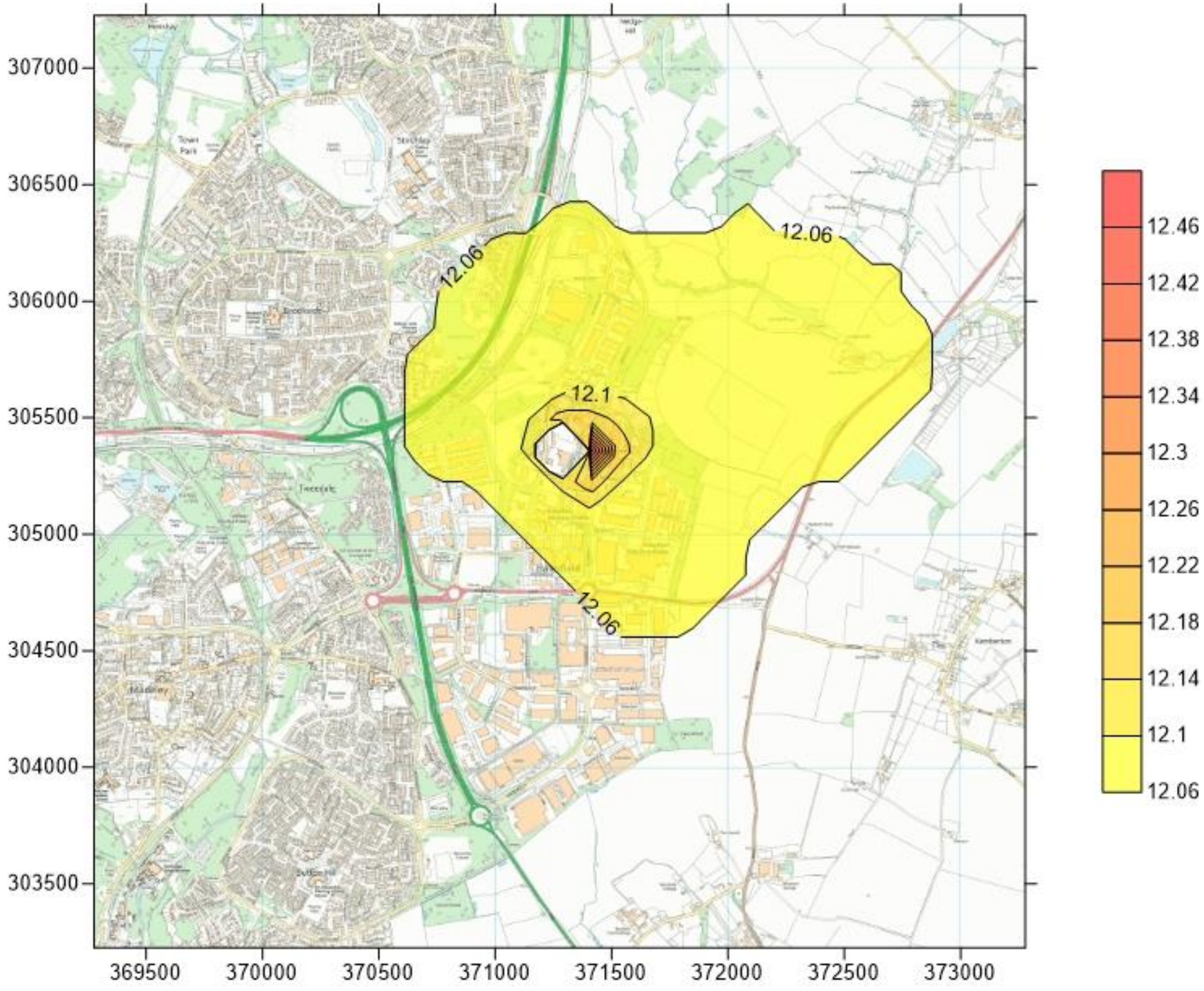

Long Term PM10

Units = µg/m^3

EAL = 40 µg/m^3

SR = 1.0
RH = 12m
Met year = 2017

WRM/PR0893/W03

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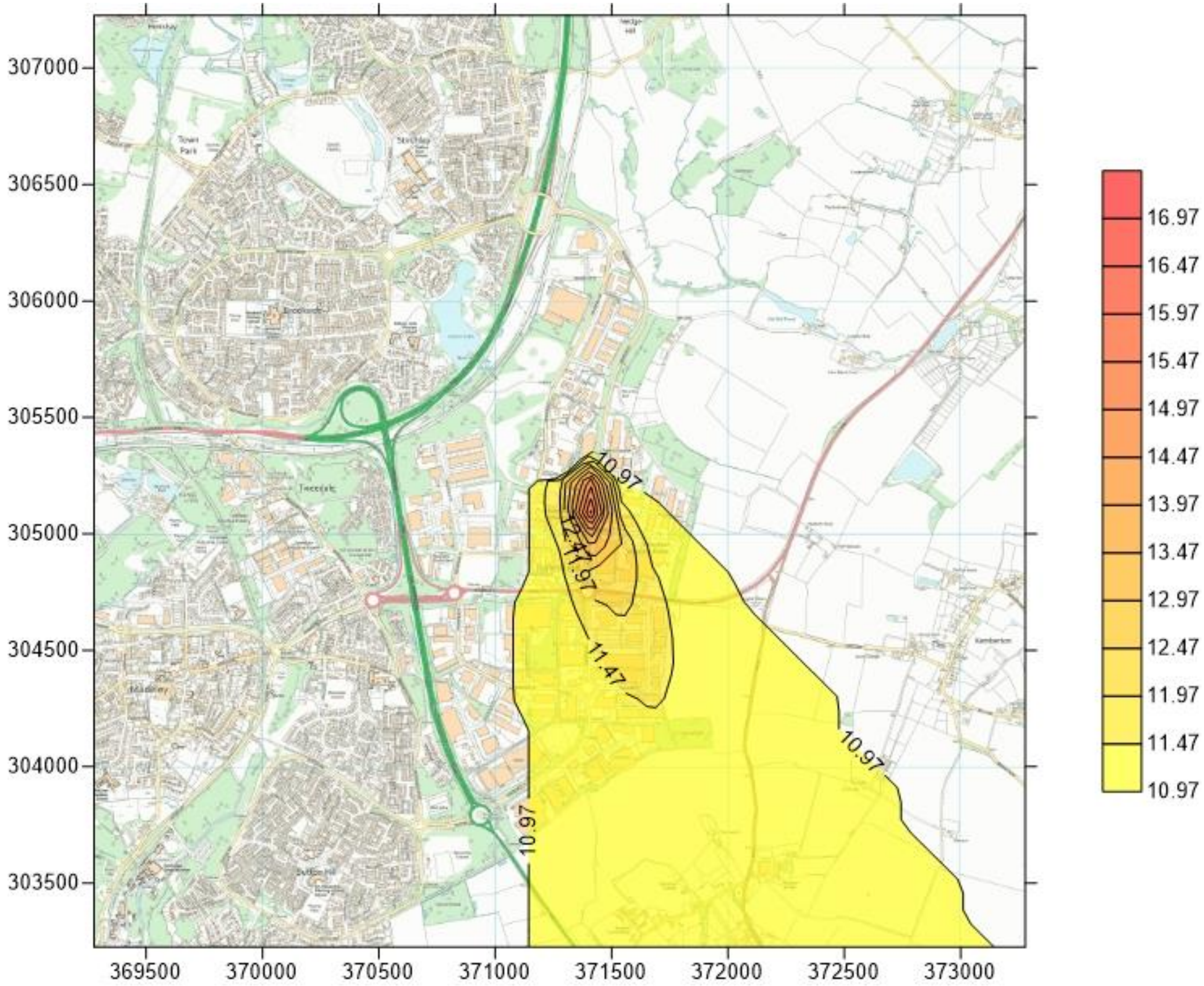
Halesfield 21, Telford



Short Term NO_2

Units = µg/m^3

EAL = 200 µg/m^3

SR = 1.0
RH = 12m
Met year = 2017

WRM/PR0893/W03

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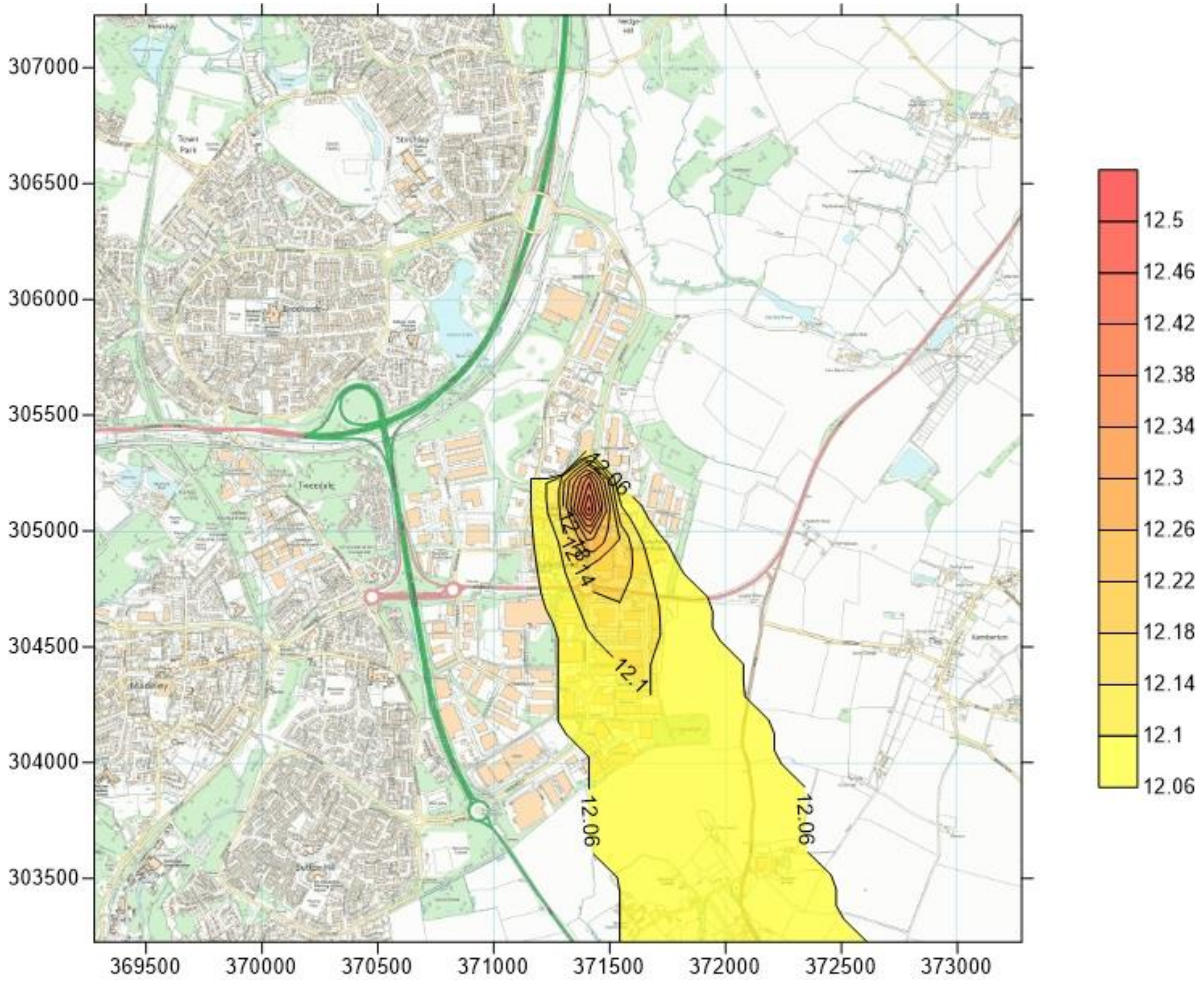
WRM



Short Term PM10

Units = µg/m^3

EAL = 50 µg/m^3

SR = 1.0
RH = 12m
Met year = 2017

WRM/PR0893/W03

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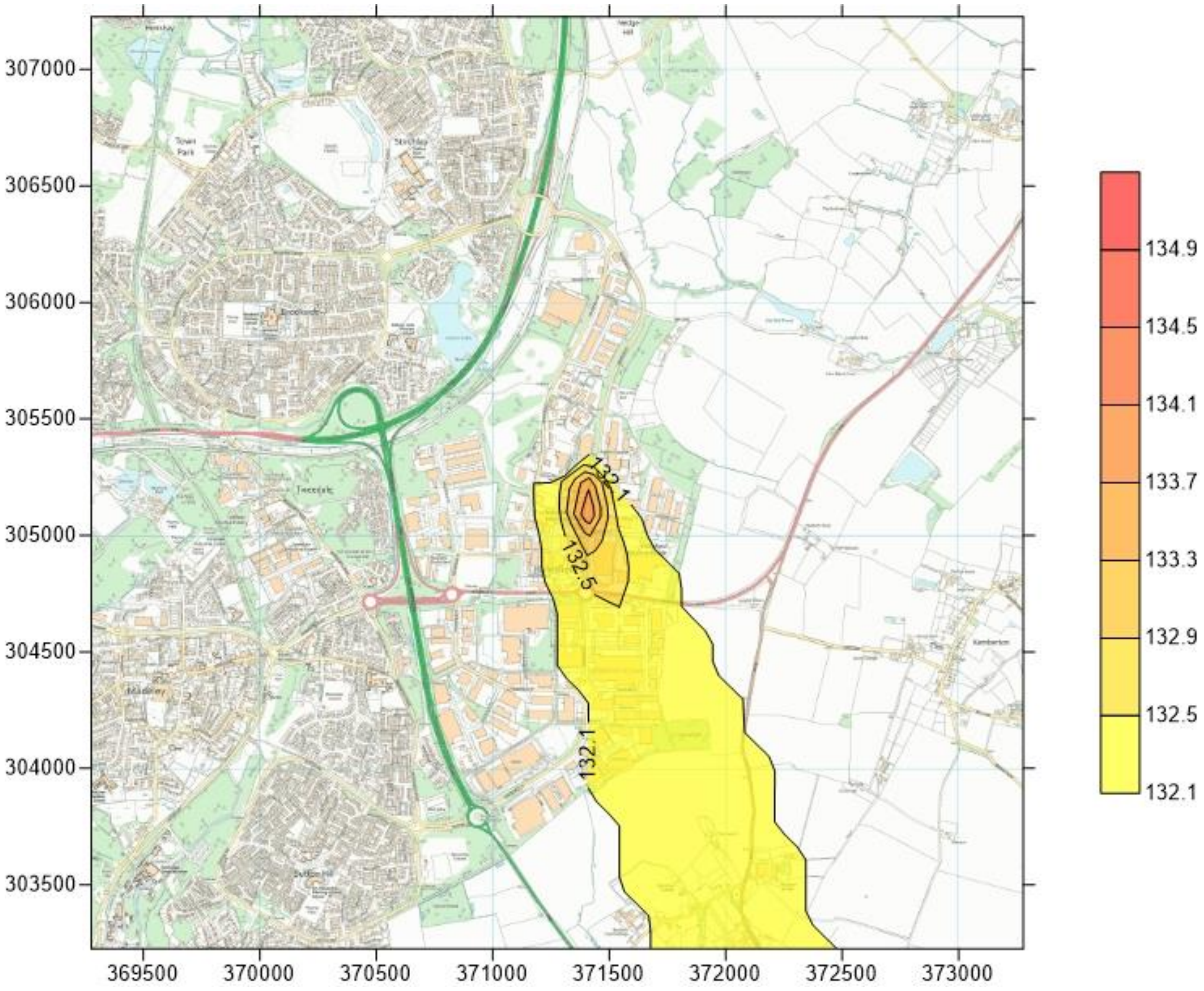
WRM



Short Term CO

Units = µg/m^3

EAL = 10,000 µg/m^3

SR = 1.0
RH = 12m
Met year = 2017

WRM/PR0893/W03

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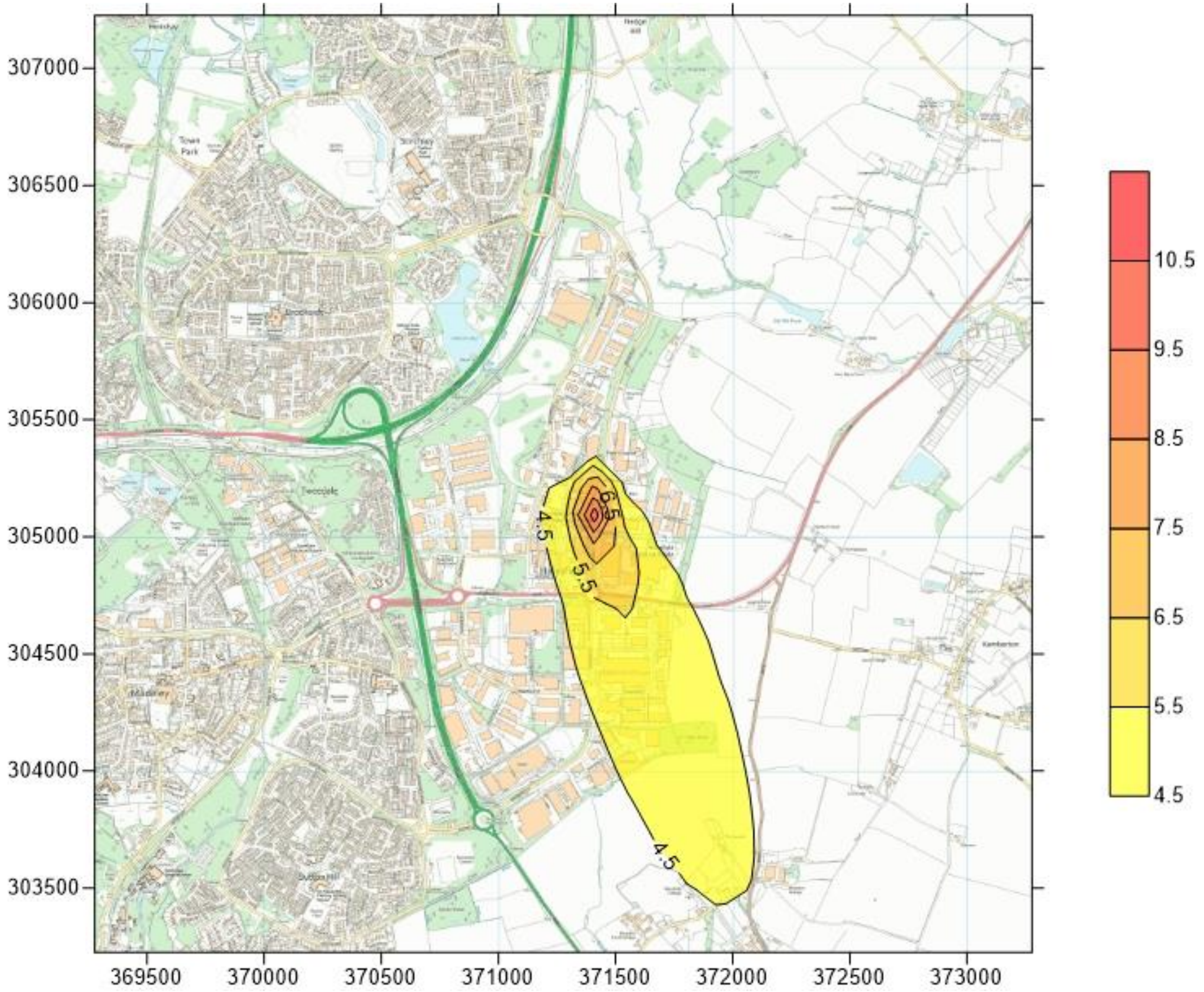
Halesfield 21, Telford



Short Term SO2

Units = µg/m^3

EAL = 266 µg/m^3

SR = 1.0
RH = 16m
Met year = 2017

WRM/PR0893/W03

Sullivan Projects Ltd c/o Besblock Ltd

Halesfield 21, Telford

APPENDIX D – MODEL SENSITIVITY ANALYSIS DATA

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.10	12.06
HR02	371298	305469	0	1.74	12.70
HR03	371329	305549	0	0.82	11.78
HR04	371338	305484	0	1.41	12.37
HR05	371396	305502	0	1.17	12.13
HR06	371515	305628	0	0.48	11.45
HR07	371367	305344	0	8.95	19.92
HR08	371321	305233	0	1.64	12.61
HR09	371352	305162	0	0.84	11.80
HR10	371358	305134	0	0.64	11.60
HR11	371314	305164	0	0.64	11.60
HR12	371293	304982	0	0.16	11.12
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.24	11.20
HR16	371213	305093	0	0.18	11.14
HR17	371218	305166	0	0.29	11.25
HR18	371132	305134	0	0.16	11.12
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.09	11.05
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.32	11.28
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.19	11.15
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.11	12.07
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.06	11.02
HR36	370999	305998	0	0.11	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.08	11.04
HR39	371256	305382	0	2.69	13.65
HR40	371254	305457	0	1.67	12.63
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.93	11.89
ER07	371644	305518	0	0.65	11.61
MAX				**8.95**	**19.92**
Met data	2017				
Surface roughness	1				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.08	12.04
HR02	371298	305469	0	1.71	12.67
HR03	371329	305549	0	0.80	11.76
HR04	371338	305484	0	1.38	12.34
HR05	371396	305502	0	1.06	12.02
HR06	371515	305628	0	0.43	11.39
HR07	371367	305344	0	6.51	17.47
HR08	371321	305233	0	2.63	13.59
HR09	371352	305162	0	1.32	12.28
HR10	371358	305134	0	1.02	11.98
HR11	371314	305164	0	1.09	12.05
HR12	371293	304982	0	0.27	11.23
HR13	371279	304917	0	0.20	11.16
HR14	371242	304923	0	0.17	11.13
HR15	371247	305115	0	0.40	11.36
HR16	371213	305093	0	0.28	11.25
HR17	371218	305166	0	0.44	11.40
HR18	371132	305134	0	0.26	11.22
HR19	370964	305026	0	0.12	11.08
HR20	370815	304994	0	0.09	11.05
HR21	370812	305037	0	0.10	11.07
HR22	370946	305132	0	0.18	11.14
HR23	370768	305173	0	0.14	11.11
HR24	370760	305207	0	0.15	11.11
HR25	370536	305185	0	0.09	11.05
HR26	371138	305246	0	0.66	11.62
HR27	370956	305337	0	0.31	11.27
HR28	370942	305381	0	0.28	11.24
HR29	370628	305561	0	0.10	11.06
HR30	370706	305639	0	0.11	11.07
HR31	370666	305811	0	0.08	11.05
HR32	371195	305334	0	1.78	12.74
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.05	11.01
HR36	370999	305998	0	0.10	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.07	11.03
HR39	371256	305382	0	3.27	14.23
HR40	371254	305457	0	1.68	12.64
ER01	370483	305000	0	0.07	11.03
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.09	11.05
ER05	369962	305106	0	0.04	11.00
ER06	371607	305427	0	0.70	11.66
ER07	371644	305518	0	0.51	11.47
MAX				**6.51**	**17.47**
Met data	2018				
Surface roughness	1				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.11	12.08
HR02	371298	305469	0	1.74	12.70
HR03	371329	305549	0	0.80	11.76
HR04	371338	305484	0	1.38	12.34
HR05	371396	305502	0	1.11	12.07
HR06	371515	305628	0	0.46	11.42
HR07	371367	305344	0	6.79	17.75
HR08	371321	305233	0	1.89	12.86
HR09	371352	305162	0	0.98	11.94
HR10	371358	305134	0	0.75	11.71
HR11	371314	305164	0	0.73	11.69
HR12	371293	304982	0	0.17	11.14
HR13	371279	304917	0	0.12	11.08
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.22	11.18
HR16	371213	305093	0	0.15	11.11
HR17	371218	305166	0	0.23	11.19
HR18	371132	305134	0	0.15	11.11
HR19	370964	305026	0	0.08	11.04
HR20	370815	304994	0	0.07	11.03
HR21	370812	305037	0	0.09	11.05
HR22	370946	305132	0	0.15	11.11
HR23	370768	305173	0	0.14	11.10
HR24	370760	305207	0	0.15	11.11
HR25	370536	305185	0	0.10	11.06
HR26	371138	305246	0	0.56	11.52
HR27	370956	305337	0	0.36	11.32
HR28	370942	305381	0	0.33	11.29
HR29	370628	305561	0	0.11	11.07
HR30	370706	305639	0	0.11	11.07
HR31	370666	305811	0	0.08	11.04
HR32	371195	305334	0	2.00	12.96
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.06	11.02
HR36	370999	305998	0	0.11	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.07	11.04
HR39	371256	305382	0	3.09	14.05
HR40	371254	305457	0	1.75	12.71
ER01	370483	305000	0	0.06	11.02
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.11	11.07
ER05	369962	305106	0	0.05	11.01
ER06	371607	305427	0	0.72	11.68
ER07	371644	305518	0	0.54	11.50
MAX				**6.79**	**17.75**
Met data	2019				
Surface roughness	1				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.27	12.23
HR02	371298	305469	0	1.86	12.82
HR03	371329	305549	0	0.87	11.83
HR04	371338	305484	0	1.41	12.37
HR05	371396	305502	0	1.16	12.12
HR06	371515	305628	0	0.55	11.51
HR07	371367	305344	0	5.51	16.47
HR08	371321	305233	0	1.31	12.27
HR09	371352	305162	0	0.89	11.85
HR10	371358	305134	0	0.67	11.63
HR11	371314	305164	0	0.59	11.55
HR12	371293	304982	0	0.15	11.11
HR13	371279	304917	0	0.11	11.08
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.21	11.17
HR16	371213	305093	0	0.15	11.11
HR17	371218	305166	0	0.23	11.19
HR18	371132	305134	0	0.14	11.10
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.08	11.04
HR24	370760	305207	0	0.09	11.05
HR25	370536	305185	0	0.06	11.02
HR26	371138	305246	0	0.30	11.26
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.19	11.15
HR29	370628	305561	0	0.09	11.05
HR30	370706	305639	0	0.10	11.06
HR31	370666	305811	0	0.08	11.04
HR32	371195	305334	0	0.91	11.87
HR33	370760	306036	0	0.09	11.05
HR34	370803	306103	0	0.09	11.05
HR35	370804	306308	0	0.08	11.04
HR36	370999	305998	0	0.15	11.11
HR37	371045	306133	0	0.13	11.09
HR38	371073	306277	0	0.11	11.07
HR39	371256	305382	0	1.20	12.16
HR40	371254	305457	0	1.85	12.81
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.07	11.03
ER03	370189	306891	0	0.03	10.99
ER04	370529	305276	0	0.07	11.03
ER05	369962	305106	0	0.03	10.99
ER06	371607	305427	0	1.16	12.12
ER07	371644	305518	0	0.76	11.72
MAX				**5.51**	**16.47**
Met data	2017				
Surface roughness	0.1				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.26	12.22
HR02	371298	305469	0	1.87	12.83
HR03	371329	305549	0	0.87	11.83
HR04	371338	305484	0	1.43	12.39
HR05	371396	305502	0	1.18	12.14
HR06	371515	305628	0	0.53	11.49
HR07	371367	305344	0	6.45	17.42
HR08	371321	305233	0	1.42	12.38
HR09	371352	305162	0	0.90	11.86
HR10	371358	305134	0	0.68	11.64
HR11	371314	305164	0	0.61	11.57
HR12	371293	304982	0	0.15	11.12
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.22	11.19
HR16	371213	305093	0	0.17	11.13
HR17	371218	305166	0	0.25	11.21
HR18	371132	305134	0	0.15	11.11
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.08	11.04
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.02
HR26	371138	305246	0	0.31	11.27
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.20	11.16
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.08	11.04
HR32	371195	305334	0	0.98	11.94
HR33	370760	306036	0	0.08	11.04
HR34	370803	306103	0	0.08	11.04
HR35	370804	306308	0	0.07	11.03
HR36	370999	305998	0	0.14	11.10
HR37	371045	306133	0	0.12	11.08
HR38	371073	306277	0	0.10	11.06
HR39	371256	305382	0	1.51	12.47
HR40	371254	305457	0	1.84	12.80
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.06	11.02
ER03	370189	306891	0	0.03	10.99
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.03	10.99
ER06	371607	305427	0	1.12	12.08
ER07	371644	305518	0	0.73	11.69
MAX				**6.45**	**17.42**
Met data	2017				
Surface roughness	0.2				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.23	12.20
HR02	371298	305469	0	1.86	12.82
HR03	371329	305549	0	0.86	11.82
HR04	371338	305484	0	1.43	12.39
HR05	371396	305502	0	1.18	12.15
HR06	371515	305628	0	0.52	11.48
HR07	371367	305344	0	7.05	18.02
HR08	371321	305233	0	1.49	12.45
HR09	371352	305162	0	0.89	11.86
HR10	371358	305134	0	0.68	11.64
HR11	371314	305164	0	0.62	11.58
HR12	371293	304982	0	0.15	11.11
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.23	11.19
HR16	371213	305093	0	0.17	11.13
HR17	371218	305166	0	0.27	11.23
HR18	371132	305134	0	0.16	11.12
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.04	11.00
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.31	11.27
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.20	11.16
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.03	11.99
HR33	370760	306036	0	0.08	11.04
HR34	370803	306103	0	0.08	11.04
HR35	370804	306308	0	0.06	11.03
HR36	370999	305998	0	0.13	11.09
HR37	371045	306133	0	0.11	11.07
HR38	371073	306277	0	0.09	11.05
HR39	371256	305382	0	1.75	12.71
HR40	371254	305457	0	1.83	12.79
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.06	11.02
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	1.07	12.04
ER07	371644	305518	0	0.71	11.67
MAX				**7.05**	**18.02**
Met data	2017				
Surface roughness	0.3				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.19	12.15
HR02	371298	305469	0	1.83	12.79
HR03	371329	305549	0	0.84	11.80
HR04	371338	305484	0	1.43	12.39
HR05	371396	305502	0	1.19	12.15
HR06	371515	305628	0	0.51	11.47
HR07	371367	305344	0	7.88	18.84
HR08	371321	305233	0	1.56	12.52
HR09	371352	305162	0	0.88	11.84
HR10	371358	305134	0	0.67	11.64
HR11	371314	305164	0	0.63	11.59
HR12	371293	304982	0	0.16	11.12
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.23	11.19
HR16	371213	305093	0	0.17	11.13
HR17	371218	305166	0	0.28	11.24
HR18	371132	305134	0	0.16	11.12
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.32	11.28
HR27	370956	305337	0	0.20	11.17
HR28	370942	305381	0	0.20	11.16
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.08	12.04
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.06	11.02
HR36	370999	305998	0	0.12	11.08
HR37	371045	306133	0	0.10	11.06
HR38	371073	306277	0	0.08	11.04
HR39	371256	305382	0	2.13	13.09
HR40	371254	305457	0	1.79	12.75
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.06	11.02
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	1.03	11.99
ER07	371644	305518	0	0.69	11.65
MAX				**7.88**	**18.84**
Met data	2017				
Surface roughness	0.5				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.10	12.06
HR02	371298	305469	0	1.74	12.70
HR03	371329	305549	0	0.82	11.78
HR04	371338	305484	0	1.41	12.37
HR05	371396	305502	0	1.17	12.13
HR06	371515	305628	0	0.48	11.45
HR07	371367	305344	0	8.95	19.92
HR08	371321	305233	0	1.64	12.61
HR09	371352	305162	0	0.84	11.80
HR10	371358	305134	0	0.64	11.60
HR11	371314	305164	0	0.64	11.60
HR12	371293	304982	0	0.16	11.12
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.24	11.20
HR16	371213	305093	0	0.18	11.14
HR17	371218	305166	0	0.29	11.25
HR18	371132	305134	0	0.16	11.12
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.09	11.05
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.32	11.28
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.19	11.15
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.11	12.07
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.06	11.02
HR36	370999	305998	0	0.11	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.08	11.04
HR39	371256	305382	0	2.69	13.65
HR40	371254	305457	0	1.67	12.63
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.93	11.89
ER07	371644	305518	0	0.65	11.61
MAX				**8.95**	**19.92**
Met data	2017				
Surface roughness	1.0				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.10	12.06
HR02	371298	305469	0	1.74	12.70
HR03	371329	305549	0	0.82	11.78
HR04	371338	305484	0	1.41	12.37
HR05	371396	305502	0	1.17	12.13
HR06	371515	305628	0	0.48	11.45
HR07	371367	305344	0	8.95	19.92
HR08	371321	305233	0	1.64	12.61
HR09	371352	305162	0	0.84	11.80
HR10	371358	305134	0	0.64	11.60
HR11	371314	305164	0	0.64	11.60
HR12	371293	304982	0	0.16	11.12
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.10	11.06
HR15	371247	305115	0	0.24	11.20
HR16	371213	305093	0	0.18	11.14
HR17	371218	305166	0	0.29	11.25
HR18	371132	305134	0	0.16	11.12
HR19	370964	305026	0	0.07	11.03
HR20	370815	304994	0	0.05	11.01
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.09	11.05
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.08	11.04
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.32	11.28
HR27	370956	305337	0	0.20	11.16
HR28	370942	305381	0	0.19	11.15
HR29	370628	305561	0	0.08	11.04
HR30	370706	305639	0	0.09	11.05
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.11	12.07
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.06	11.02
HR36	370999	305998	0	0.11	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.08	11.04
HR39	371256	305382	0	2.69	13.65
HR40	371254	305457	0	1.67	12.63
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.06	11.02
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.93	11.89
ER07	371644	305518	0	0.65	11.61
MAX				**8.95**	**19.92**
Met data	2017				
Surface roughness	1.0				
Stack height	12m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.07	12.03
HR02	371298	305469	0	1.66	12.62
HR03	371329	305549	0	0.79	11.75
HR04	371338	305484	0	1.36	12.32
HR05	371396	305502	0	1.13	12.09
HR06	371515	305628	0	0.47	11.43
HR07	371367	305344	0	7.40	18.36
HR08	371321	305233	0	1.49	12.46
HR09	371352	305162	0	0.81	11.77
HR10	371358	305134	0	0.62	11.58
HR11	371314	305164	0	0.61	11.57
HR12	371293	304982	0	0.15	11.11
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.09	11.06
HR15	371247	305115	0	0.23	11.19
HR16	371213	305093	0	0.17	11.13
HR17	371218	305166	0	0.28	11.24
HR18	371132	305134	0	0.15	11.12
HR19	370964	305026	0	0.06	11.02
HR20	370815	304994	0	0.04	11.00
HR21	370812	305037	0	0.05	11.01
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.07	11.03
HR24	370760	305207	0	0.07	11.03
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.31	11.27
HR27	370956	305337	0	0.19	11.15
HR28	370942	305381	0	0.19	11.15
HR29	370628	305561	0	0.07	11.03
HR30	370706	305639	0	0.08	11.04
HR31	370666	305811	0	0.07	11.03
HR32	371195	305334	0	1.03	11.99
HR33	370760	306036	0	0.07	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.05	11.02
HR36	370999	305998	0	0.11	11.07
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.07	11.03
HR39	371256	305382	0	2.30	13.26
HR40	371254	305457	0	1.60	12.56
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.05	11.01
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.91	11.87
ER07	371644	305518	0	0.63	11.59
MAX				**7.40**	**18.36**
Met data	2017				
Surface roughness	1.0				
Stack height	13m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.03	11.99
HR02	371298	305469	0	1.58	12.55
HR03	371329	305549	0	0.77	11.73
HR04	371338	305484	0	1.30	12.26
HR05	371396	305502	0	1.09	12.05
HR06	371515	305628	0	0.45	11.41
HR07	371367	305344	0	5.99	16.95
HR08	371321	305233	0	1.34	12.30
HR09	371352	305162	0	0.77	11.73
HR10	371358	305134	0	0.60	11.56
HR11	371314	305164	0	0.58	11.54
HR12	371293	304982	0	0.15	11.11
HR13	371279	304917	0	0.11	11.07
HR14	371242	304923	0	0.09	11.05
HR15	371247	305115	0	0.22	11.19
HR16	371213	305093	0	0.17	11.13
HR17	371218	305166	0	0.26	11.22
HR18	371132	305134	0	0.15	11.11
HR19	370964	305026	0	0.06	11.02
HR20	370815	304994	0	0.04	11.00
HR21	370812	305037	0	0.04	11.00
HR22	370946	305132	0	0.08	11.04
HR23	370768	305173	0	0.06	11.03
HR24	370760	305207	0	0.07	11.03
HR25	370536	305185	0	0.05	11.01
HR26	371138	305246	0	0.29	11.25
HR27	370956	305337	0	0.19	11.15
HR28	370942	305381	0	0.18	11.14
HR29	370628	305561	0	0.07	11.03
HR30	370706	305639	0	0.08	11.04
HR31	370666	305811	0	0.06	11.03
HR32	371195	305334	0	0.95	11.91
HR33	370760	306036	0	0.06	11.03
HR34	370803	306103	0	0.07	11.03
HR35	370804	306308	0	0.05	11.01
HR36	370999	305998	0	0.10	11.06
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.07	11.03
HR39	371256	305382	0	1.94	12.90
HR40	371254	305457	0	1.52	12.48
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.05	11.01
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.89	11.85
ER07	371644	305518	0	0.61	11.57
MAX				**5.99**	**16.95**
Met data	2017				
Surface roughness	1.0				
Stack height	14m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	1.00	11.96
HR02	371298	305469	0	1.50	12.47
HR03	371329	305549	0	0.74	11.70
HR04	371338	305484	0	1.23	12.20
HR05	371396	305502	0	1.05	12.01
HR06	371515	305628	0	0.44	11.40
HR07	371367	305344	0	4.79	15.75
HR08	371321	305233	0	1.20	12.16
HR09	371352	305162	0	0.74	11.70
HR10	371358	305134	0	0.58	11.54
HR11	371314	305164	0	0.55	11.51
HR12	371293	304982	0	0.14	11.10
HR13	371279	304917	0	0.10	11.06
HR14	371242	304923	0	0.09	11.05
HR15	371247	305115	0	0.22	11.18
HR16	371213	305093	0	0.16	11.12
HR17	371218	305166	0	0.25	11.21
HR18	371132	305134	0	0.14	11.11
HR19	370964	305026	0	0.06	11.02
HR20	370815	304994	0	0.04	11.00
HR21	370812	305037	0	0.04	11.00
HR22	370946	305132	0	0.07	11.04
HR23	370768	305173	0	0.06	11.02
HR24	370760	305207	0	0.07	11.03
HR25	370536	305185	0	0.04	11.00
HR26	371138	305246	0	0.28	11.24
HR27	370956	305337	0	0.18	11.14
HR28	370942	305381	0	0.18	11.14
HR29	370628	305561	0	0.07	11.03
HR30	370706	305639	0	0.08	11.04
HR31	370666	305811	0	0.06	11.02
HR32	371195	305334	0	0.87	11.83
HR33	370760	306036	0	0.06	11.02
HR34	370803	306103	0	0.06	11.02
HR35	370804	306308	0	0.05	11.01
HR36	370999	305998	0	0.10	11.06
HR37	371045	306133	0	0.09	11.05
HR38	371073	306277	0	0.07	11.03
HR39	371256	305382	0	1.61	12.58
HR40	371254	305457	0	1.44	12.40
ER01	370483	305000	0	0.03	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.05	11.01
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.87	11.83
ER07	371644	305518	0	0.59	11.55
MAX				**4.79**	**15.75**
Met data	2017				
Surface roughness	1.0				
Stack height	15m				
Sullivan Design c/o Besblock					

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) NO_2 Boiler
HR01	371276	305514	0	0.96	11.92
HR02	371298	305469	0	1.42	12.38
HR03	371329	305549	0	0.72	11.68
HR04	371338	305484	0	1.17	12.13
HR05	371396	305502	0	1.01	11.97
HR06	371515	305628	0	0.43	11.39
HR07	371367	305344	0	3.71	14.67
HR08	371321	305233	0	1.06	12.02
HR09	371352	305162	0	0.71	11.67
HR10	371358	305134	0	0.55	11.51
HR11	371314	305164	0	0.52	11.48
HR12	371293	304982	0	0.14	11.10
HR13	371279	304917	0	0.10	11.06
HR14	371242	304923	0	0.09	11.05
HR15	371247	305115	0	0.21	11.17
HR16	371213	305093	0	0.16	11.12
HR17	371218	305166	0	0.24	11.20
HR18	371132	305134	0	0.14	11.10
HR19	370964	305026	0	0.06	11.02
HR20	370815	304994	0	0.04	11.00
HR21	370812	305037	0	0.04	11.00
HR22	370946	305132	0	0.07	11.03
HR23	370768	305173	0	0.06	11.02
HR24	370760	305207	0	0.07	11.03
HR25	370536	305185	0	0.04	11.00
HR26	371138	305246	0	0.27	11.23
HR27	370956	305337	0	0.18	11.14
HR28	370942	305381	0	0.17	11.13
HR29	370628	305561	0	0.07	11.03
HR30	370706	305639	0	0.07	11.03
HR31	370666	305811	0	0.06	11.02
HR32	371195	305334	0	0.81	11.77
HR33	370760	306036	0	0.06	11.02
HR34	370803	306103	0	0.06	11.02
HR35	370804	306308	0	0.05	11.01
HR36	370999	305998	0	0.10	11.06
HR37	371045	306133	0	0.08	11.04
HR38	371073	306277	0	0.07	11.03
HR39	371256	305382	0	1.26	12.22
HR40	371254	305457	0	1.36	12.32
ER01	370483	305000	0	0.02	10.99
ER02	370716	306267	0	0.05	11.01
ER03	370189	306891	0	0.02	10.98
ER04	370529	305276	0	0.05	11.01
ER05	369962	305106	0	0.02	10.98
ER06	371607	305427	0	0.85	11.81
ER07	371644	305518	0	0.58	11.54
MAX				**3.71**	**14.67**
Met data	2017				
Surface roughness	1.0				
Stack height	16m				
Sullivan Design c/o Besblock					

APPENDIX E – LT PC/PEC DATA OUTPUT

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m^3) NO_2 Boiler	LT PC (ug/m^3) PM10 Boiler	LT PEC (ug/m^3) NO_2 Boiler	LT PEC (ug/m^3) PM10 Boiler	LT PC (ug/m^3) SO2 Boiler	LT PEC (ug/m^3) SO2 Boiler
HR01	371276	305514	0	1.10	0.09	12.06	12.14		
HR02	371298	305469	0	1.74	0.14	12.70	12.19		
HR03	371329	305549	0	0.82	0.07	11.78	12.12		
HR04	371338	305484	0	1.41	0.12	12.37	12.17		
HR05	371396	305502	0	1.17	0.10	12.13	12.15		
HR06	371515	305628	0	0.48	0.04	11.45	12.09		
HR07	371367	305344	0	8.95	0.75	19.92	12.80		
HR08	371321	305233	0	1.64	0.14	12.61	12.19		
HR09	371352	305162	0	0.84	0.07	11.80	12.12		
HR10	371358	305134	0	0.64	0.05	11.60	12.10		
HR11	371314	305164	0	0.64	0.05	11.60	12.10		
HR12	371293	304982	0	0.16	0.01	11.12	12.06		
HR13	371279	304917	0	0.11	0.01	11.07	12.06		
HR14	371242	304923	0	0.10	0.01	11.06	12.06		
HR15	371247	305115	0	0.24	0.02	11.20	12.07		
HR16	371213	305093	0	0.18	0.01	11.14	12.06		
HR17	371218	305166	0	0.29	0.02	11.25	12.07		
HR18	371132	305134	0	0.16	0.01	11.12	12.06		
HR19	370964	305026	0	0.07	0.01	11.03	12.05		
HR20	370815	304994	0	0.05	0.00	11.01	12.05		
HR21	370812	305037	0	0.05	0.00	11.01	12.05		
HR22	370946	305132	0	0.09	0.01	11.05	12.06		
HR23	370768	305173	0	0.07	0.01	11.03	12.06		
HR24	370760	305207	0	0.08	0.01	11.04	12.06		
HR25	370536	305185	0	0.05	0.00	11.01	12.05		
HR26	371138	305246	0	0.32	0.03	11.28	12.08		
HR27	370956	305337	0	0.20	0.02	11.16	12.07		

Receptor name	X(m)	Y(m)	Z(m)	LT PC (ug/m³) NO_2 Boiler	LT PC (ug/m³) PM10 Boiler	LT PEC (ug/m³) NO_2 Boiler	LT PEC (ug/m³) PM10 Boiler	LT PC (ug/m³) SO2 Boiler	LT PEC (ug/m³) SO2 Boiler
HR28	370942	305381	0	0.19	0.02	11.15	12.07		
HR29	370628	305561	0	0.08	0.01	11.04	12.06		
HR30	370706	305639	0	0.09	0.01	11.05	12.06		
HR31	370666	305811	0	0.07	0.01	11.03	12.06		
HR32	371195	305334	0	1.11	0.09	12.07	12.14		
HR33	370760	306036	0	0.07	0.01	11.03	12.06		
HR34	370803	306103	0	0.07	0.01	11.03	12.06		
HR35	370804	306308	0	0.06	0.00	11.02	12.05		
HR36	370999	305998	0	0.11	0.01	11.07	12.06		
HR37	371045	306133	0	0.09	0.01	11.05	12.06		
HR38	371073	306277	0	0.08	0.01	11.04	12.06		
HR39	371256	305382	0	2.69	0.22	13.65	12.27		
HR40	371254	305457	0	1.67	0.14	12.63	12.19		
ER01	370483	305000	0	0.03	0.00	10.99	12.05	0.04	4.28
ER02	370716	306267	0	0.05	0.00	11.01	12.05	0.06	4.31
ER03	370189	306891	0	0.02	0.00	10.98	12.05	0.03	4.27
ER04	370529	305276	0	0.06	0.00	11.02	12.05	0.07	4.31
ER05	369962	305106	0	0.02	0.00	10.98	12.05	0.03	4.27
ER06	371607	305427	0	0.93	0.08	11.89	12.13	1.11	5.35
ER07	371644	305518	0	0.65	0.05	11.61	12.10	0.78	5.02
MAX				**8.95**	**0.75**	**19.92**	**12.80**	**1.11**	**5.35**
Surface Roughness		1.0							
Buildings		On							
Stack Height		**12m**							
Met Data		2017							
			Sullivan Projects c/o Besblock						

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