# Environmental Risk Assessment

Poole CHP Plant

FOR: POOLE SUSTAINABLE ENERGY LTD

PROJECT NUMBER: ECCS 115 008

PREPARED BY: EC CONSULTANCY SERVICES LTD

# Environmental Risk Assessment

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## Environmental Risk Assessment – ECCS 115 008 R 002 A

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| **For:** | Poole Sustainable Energy Ltd |
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# CONTENTS

1 Introduction ..... 1
1.1 Overview ..... 1
1.2 Scope and Objectives of The Assessment ..... 1
1.3 Site Location And Environmental Setting ..... 1
1.4 Relevant Legislation and Guidance ..... 3
1.5 Proposed Activities ..... 3
1.6 Associated Hazards And Risks ..... 4
1.7 Sensitive Receptors ..... 4
1.8 Ecological Sensitive Receptors ..... 5
1.9 Point Source Emissions ..... 7
2 Environmental Risk Assessments ..... 8
2.1 Scope of Assessments Completed ..... 8
2.2 Amenity Impacts ..... 8
2.3 Noise ..... 10
2.4 Odour ..... 11
2.5 Point Source Emissions to Atmosphere ..... 11
2.6 Point Source Emissions To Sewer ..... 12
2.7 Fugitive Emissions ..... 13
2.8 Wastes Generated On Site ..... 14
2.9 Abnormal Operations Or Accidents ..... 14
2.10 Global Warming Potential ..... 15
2.11 Climate Change Risk Assessment ..... 15
3 Conclusions ..... 18
3.1 Conclusions Of Risk Assessment ..... 18
Appendices ..... 19
Appendix A – Risk Assessment & Management Controls ..... 20
Appendix B – Noise Impact Assessment ..... 25
Appendix C – Climate Change Risk Assessment ..... 26
Appendix D – Air Quality Assessment ..... 27
Appendix E – Nature & Heritage Screening Report ..... 28

# Tables & Figures

**Figure 1.3.1 Site Location** ..... 2
**Table 1.6.1 Identified Hazards** ..... 4
**Figure 1.7.1 Location of Human Sensitive Receptors** ..... 5
**Table 1.8.1 Human and Ecological Sensitive Receptors** ..... 6
**Table 1.9.1a Point Source Emissions to Atmosphere** ..... 7
**Table 1.9.1b Point Source Emissions to Sewer** ..... 7
**Figure 2.2.1a Isometric image of Proposed CHP Plant** ..... 9
**Figure 2.2.1b Discharge point into sewer** ..... 9
**Table 1.10.1a Energy Consumption** ..... 15
**Table 1.10.1b Global Warming Potential Impacts** ..... 15
**Table 2.11.1a Climate Change Risk Screening** ..... 16
**Figure 2.11.1b Climate Change Predicted Sea Level Rises Map** ..... 17

# 1 INTRODUCTION

## 1.1 OVERVIEW

This Environmental Risk Assessment has been prepared on behalf of Poole Sustainable Energy Ltd (hereby referred to as the 'Operator') in support of an Environmental Permit application for the proposed new CHP Plant to be co-located at an existing bakery operated by Pork Farms Ltd in Poole, Dorset.

The Operator is applying for a bespoke Installation Environmental Permit comprising a Directly Associated Activity (DAA), under the Environmental Permitting (England and Wales) (Amendment) Regulations 2016 ('EPR') as the new CHP plant will be technically connected to the existing permitted activities at the Poole Bakery (the Stationary Technical Unit or STU) but operated by a different legal entity. Activities associated with the existing bakery occur at the premises twenty-four hours a day, seven days a week (existing Permit EPR/ EP3639WV).

The proposed CHP Plant is captured under Chapter ii activities listed within Annex I within the Industrial Emissions Directive (2010/75/EU).

## 1.2 SCOPE AND OBJECTIVES OF THE ASSESSMENT

This Environmental Risk Assessment (ERA) has been prepared specifically in answer to Question 6 and 6b within Part B2 and Question 2, 3b and 3c of Part B3 of the Environment Agency's Application Forms.

The objectives of this ERA are to:

- Identify potential sources of risk and hazards that the activity may present to the environment;
- Identify nearby sensitive receptors;
- Screen out those that are insignificant and don't require detailed assessment;
- Where appropriate identify potentially significant risks and undertake detailed assessment;
- Where appropriate choose the right control measures; and
- Report the findings of the assessment.

This report contains justification for all risk assessments completed and those screened out from requiring further consideration and provides an overall assessment of the acceptability of the proposed CHP plant.

## 1.3 SITE LOCATION AND ENVIRONMENTAL SETTING

The proposed new CHP plant is to be situated outside the curtilage of the existing STU host site (Poole Pork Farms Ltd), on land off Sterte Avenue West. The proposed CHP Plant will occupy a small footprint area of approximately 480m$^2$ and will be located amongst existing buildings (to the western boundary of the Poole Pork Farms Ltd Factory) and to the east of other existing business units on the Sterte Road Industrial Estate.

The site is located approximately 97m north of the nearest identified houses on Sterte Avenue, and 80m north-east of those on Sterte Avenue West. The industrial estate is located three quarters of a mile to the north of Poole town centre and 260m east of a duel carriageway section of the A350, beyond which lies Holes Bay (which forms part of Poole Harbour, a designed Special Protection Area (SPA)).

There is a public road (Sterte Avenue West) that terminates at the southern boundary of the proposed CHP plant, however as there are no uses other than the Poole Pork Farms Ltd Factory beyond the curtilage of the CHP site, there is no reason for the public to pass by. There are also no residential, leisure, or office areas that require access past the proposed CHP Plant.

The proposed installation boundary is shown on drawing referenced *B1-13-19-08v2 Site Permit Plan 19-12-2019*. The sites location is illustrated within Figure 1.3.1 below.

The full site address is:

Poole CHP Plant
Poole Sustainable Energy Ltd
10-20 Sterte Road
Sterte Road Industrial Estate
Sterte
Poole
Dorset
BH15 2AS
Site Grid Reference: SZ 00898 91779

***Figure 1.3.1 Site Location***

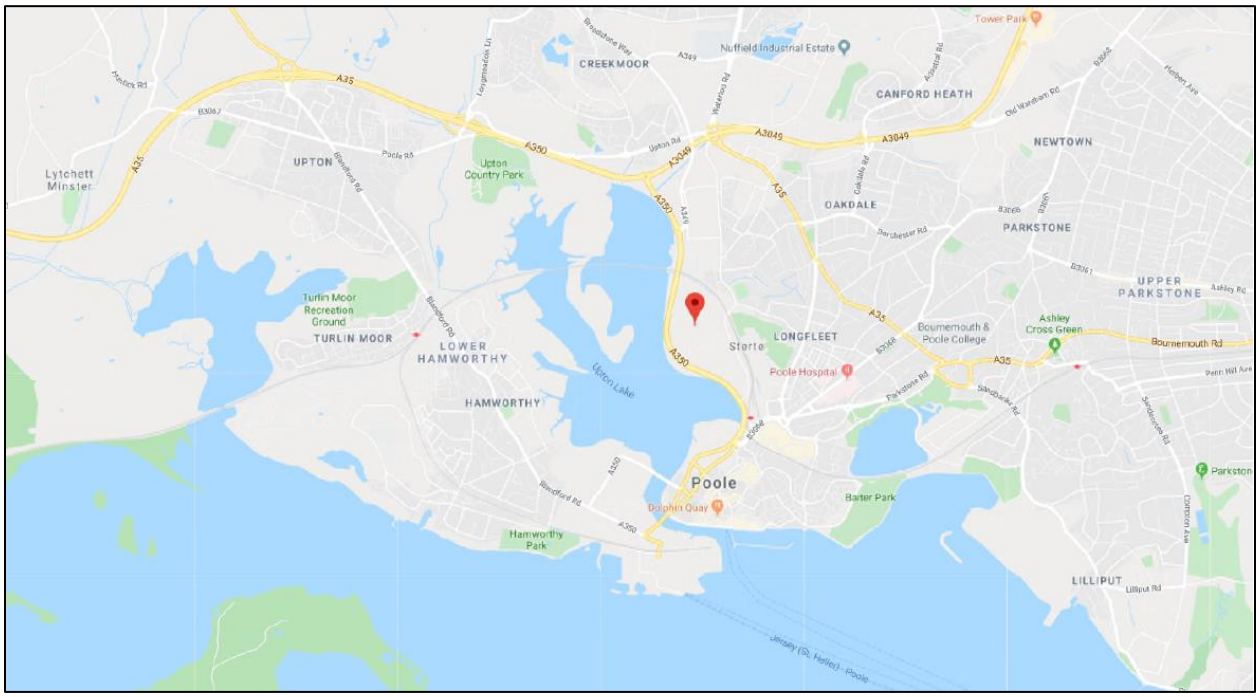



Image sourced from Google Maps ©2019

## 1.4 Relevant Legislation and Guidance

Guidance for undertaking an Environmental Risk Assessment for an Installation was published on 1 February 2016 and is available via the following link: Environment Agency Risk Assessment Guidance.

## 1.5 Proposed Activities

The existing Poole Bakery is operated by Pork Farms Ltd (part of the Addo Food Group) and is a long-established business and employer in the local area having occupied the site for over two decades and employing around 850 people. Pork Farms Ltd operate a chilled savoury pastry business supplying the food retail sector under brands and retailers' own labels within the United Kingdom (UK). The primary listed activity at the site is the treating and processing of materials intended for the production of food products from animal raw materials at a plant with a finished product production capacity of more than 75 tonnes per day (S6.8 Part A(1)(d)(i) listed activity). Activities associated with the bakery occur at the premises twenty-four hours a day, seven days a week.

The proposed new development will consist of a single containerised genset, natural gas fired 1,287MWe CHP unit (~3,390 – 3,559 kWth gross thermal input, ~1,287 kWe electrical power output) and waste heat boiler (~2,334 kWth or ~2,585 kWth gross thermal input) designed to produce heat, steam and supply electricity to the adjacent host site (Poole Bakery).

The plant is designed to reduce the dependence of Poole Bakery facility upon sourcing energy from the National Grid. In doing so it will reduce the $CO_2$ footprint generated by that power, as the power will not be subject to the normal losses associated with transmission from the centralised point of generation to the consumer.

The equipment will be installed in a secured compound area of approximately 480 $m^2$, and will include:

- 1 x containerised combined heat and power unit - 13m (L) x 3m (W) x 3m (H) comprising one Energy MTU 12V4000 GS CHP generator including exhaust stack of 15m height;
- 1 x cooling fan block - 3m (L) x 2m (W) x1.5m (H), mounted on top of the CHP container;
- 1 x Hot water buffer tank, 2m (dia.) x 3m (H);
- 1 x combination Yorkshireman Low NOx Waste Heat Boiler in a dedicated boiler house 8m (W) x 8m (W) x 6m (H) including exhaust stack of 15m height;
- GRP pumps and metering cabinet - 2m (W) x 1m (D) x 2m (H);
- Fencing around the compound area to a height of 2m (H);
- Pipe bridge with 4m clearance, 5m in length (L).

The system will consist of the following termination points:

- Natural Gas connection onto the site;
- 11kV electrical connection to the existing on-site 11kV connection;
- Connection to the Bakery's existing HV ring-main;
- Connection to the Bakery's electrical incomer meter;
- Connection to the Bakery's existing condensate recovery system;
- Connection to the Bakery's existing portable water system;

- Connection to the Bakery's existing site effluent drainage system; and
- Connection to the Bakery's steam infrastructure.

## 1.6 Associated Hazards And Risks

This report follows the Environment Agency's Guidance and begins by identifying potential hazards and risks to the environment from the proposed development. Hazards and risks to be considered within this assessment are presented within Table 1.6.1 below.

***Table 1.6.1 Identified Hazards***

| Proposed Poole CHP Plant | | |
|---|---|---|
| **No.** | Hazard / Risk | **Details** |
| **1.** | **Amenity Impacts** | Potential Dust, Litter, Mud, Pest/Vermin from normal operations and during routine maintenance |
| **2.** | **Noise** | Potential noise sources include MTU engine; exhaust silencer and cooling fan block |
| **3.** | **Odour** | Potential odour sources include fuel source (natural gas), exhaust emissions, chemical store |
| **4.** | **Point Source Emissions to Air** | Potential harmful emissions from exhaust stacks from combustion process |
| **5.** | **Point Source Emissions to Sewer** | Potentially harmful substances or high temperatures released to sewer |
| **6.** | **Fugitive Emissions** | Potential uncontrolled releases to the environment from the CHP plant; the waste heat boiler unit; or chemicals stored on site |
| **7.** | **Wastes Generated on Site** | Under normal operations predicted wastes will include waste lubrication oil from the MTU engine; oil rags & cloths from maintenance works; and empty chemical drums |
| **8.** | **Abnormal Operations or Accidents** | Potential hazards include fire, vandalism/arson, explosion, plant or equipment failure, major / minor spillages due to loss of containment, gas leak, flooding, power outage, adverse weather conditions |
| **9.** | **Global Warming Potential** | Direct and indirect emissions produced by the energy the proposed activity will consume |

## 1.7 Sensitive Receptors

Nearby human sensitive receptors are illustrated within the satellite image in Figure 1.7.1 below. Properties identified in orange are the closest human sensitive receptors to the proposed CHP Plant.

***Figure 1.7.1 Location of Human Sensitive Receptors***

Image sourced from What3Words ©2019

## 1.8 ECOLOGICAL SENSITIVE RECEPTORS

A search was carried out using the government website 'www.magic.gov.uk' as well as a nature and heritage conservation screen assessment obtained from the Environment Agency. The results of these searches are as follows:

- Poole Harbour is situated 290m West of the site and is designated as a Sites of Special Scientific Interest (SSSIs), a Special Protection Area (pSPA or SPA), as well as a RAMSAR designated site;
- Dorset Heaths, Isle of Portland to Studland Cliffs, and Dorset Heaths (Purbeck & Wareham) & Studland Dunes are all designated Special Areas of Conservation (SAC) identified within 10km radius of the proposed CHP plant;
- Solent and Dorset Coast, Dorset Heathlands are both designated Special Protection Areas (pSPA or SPA) within 10km radius of the proposed plant;
- Dorset Heathlands is also designated as a SSSI;
- Millifield Pond situated north-west of the site and is designated as a Local Nature Reserve (LNR);

- There are a further two Local Wildlife Sites (LWS) within 2km radius of the site (also situated to the north-west of the site). These are named locally as Hole's Bay Relief Road and Creekmoor Ponds.

There are several protected species designations within 500m of the propose site. Protected species includes the European eel Anguilla Anguilla, Twaite shad Alosa fallax, Allis shad Alosa alosa and River Lamprey Lampetra fluviatilis. The mudflats approximately 290m to the west of the proposed site are also designated as a protected habitat.

Table 1.8.1 below provides further details of all sensitive receptors considered within this risk assessment.

***Table 1.8.1 Human and Ecological Sensitive Receptors***

| Receptor | Type | Distance (m) | Direction From Site |
|---|---|---|---|
| **Pork Farms Ltd** | Business | Adjacent | - |
| **Elite Fabrication & Welding Ltd** | Industrial | 50 | South-west |
| **Medicare Systems** | Industrial | 65 | South-west |
| **Residential properties on Sterte Avenue West (No.69,71, 73,75)** | Residential | 80 | South-West |
| **Residential properties on Sterte Road (No.22,24,26,28)** | Residential | 190 | South |
| **Residential properties on Sterte Road (No.92,94,96, 98, 100,102)** | Residential | 195 | East |
| **Holes Bay / Poole Harbour (SSSI / SPA / RAMSAR / Protected Species Habitat)** | Ecological | 290 | West |
| **Hole's Bay Relief Road LWS** | Ecological | 1000 | North West |
| **Dorset Heathlands SPA/Ramsar Dorset Heaths SAC** | Ecological | 1430 | North West |
| **Millfields Pond LNR** | Ecological | 1430 | North West |
| **Creekmoor Ponds LWS** | Ecological | 1430 | North West |
| **Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC** | Ecological | 3700 | South West |
| **Dorset Heaths (SAC)** | Ecological | 2,500 | North West |
| **Solent and Dorset coast (PSPA)** | Ecological | 6,000 | South East |
| **Isle of Portland to Studland Cliffs (SAC)** | Ecological | 10,200 | South |

## 1.9 POINT SOURCE EMISSIONS

There will be a single point source emission to atmosphere (containing two flues) from the CHP plant. Table 1.9.1a below provides details of the proposed point source emission to air from the CHP Plant.

***Table 1.9.1a Point Source Emissions to Atmosphere***

| Emission Point Reference and Location | Source of Emission | Emissions |
|---|---|---|
| **A1a 400903, 91782** | Release from CHP exhaust stack | Oxides of Nitrogen (NO and $NO_2$ expressed as $NO_2$) Carbon Monoxide |
| **A1b 400903, 91782** | Release from boiler exhaust stack | Oxides of Nitrogen (NO and $NO_2$ expressed as $NO_2$) Carbon Monoxide |

Pork Farms Ltd have a Sewerage Discharge Consent from Wessex Water Plc for the entire bakery site. Sources of aqueous effluent from the proposed CHP plant will comprise uncontaminated surface water and small amounts of boiler blowdown. The CHP unit will have no separate point source releases to sewer but will tie into the existing bakery's site drainage (effluent drains) which passes through an effluent treatment plant prior to discharging to sewer (as detailed within Table 1.9.1b below). The location of all point source emissions from the site is illustrated within the Site Permit Plan provided within the Drawing sections of this application.

***Table 1.9.1b Point Source Emissions to Sewer***

| Emission Point Reference and Location | Source of Emission | Emissions |
|---|---|---|
| **S1 400909 091782** | Release of effluent from CHP Plant into wider site effluent drainage system | Water |

# 2 ENVIRONMENTAL RISK ASSESSMENTS

## 2.1 SCOPE OF ASSESSMENTS COMPLETED

A number of assessments have been considered to determine the environmental risks posed by the CHP plant and to identify whether the level of risk is considered acceptable with appropriate mitigation or if further measures are required.

During pre-application discussions held with the Environment Agency, it was established early on in the project conception phase, that the following bespoke quantitative modelling assessments would be required:

- **Noise**. A Noise Impact Assessment (NIA) would be required to assess the potential impact of predicted sound to be generated from the proposed CHP plant upon the nearest sensitive receptors; and provide suitable mitigation if deemed necessary; and
- **Air Quality**. An Air Quality (AQ) Assessment would be required to establish if emissions from the proposed stack risk exceedances of either human-health or ecological-health related air quality standards (AQSs).

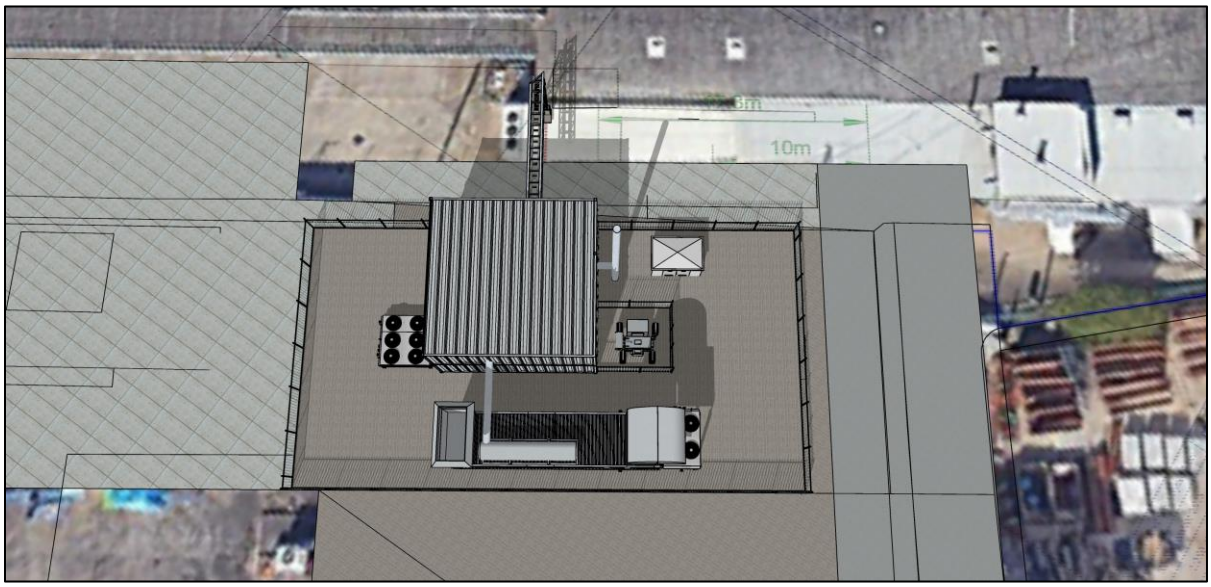
All other hazards identified within Table 1.6.1 above have been considered and either assessed qualitatively or screened out as requiring no further assessment.

Techniques to minimise the environmental impacts associated with the proposed CHP Plant are outlined within the Operational Techniques and Monitoring Plan (ECCS 115 008 R 003 A) and in the Risk Assessment and Management Control Table presented within Appendix A to this report.

## 2.2 AMENITY IMPACTS

The proposed CHP plant will sit within a small footprint of land (480m$^2$), located adjacent to the existing Poole Bakery Site. The proposed development is illustrated within the isometric image in Figure 2.2.1a below.

***Figure 2.2.1a Isometric image of Proposed CHP Plant***




Source: Castellum Consulting © 2019

The site will be serviced primarily with an impermeable concrete base. The site will have a gentle gradient towards the eastern corner, where all drainage from the site will connect to the existing sewer pipe which services the adjacent bakery (as illustrated within Figure 2.2.1b below). A copy of the drainage plan for the wider Bakery site is provided within Appendix F of the Operational Techniques & Monitoring Plan (ECCS 115 008 R 003 A).

***Figure 2.2.1b Discharge point into sewer***

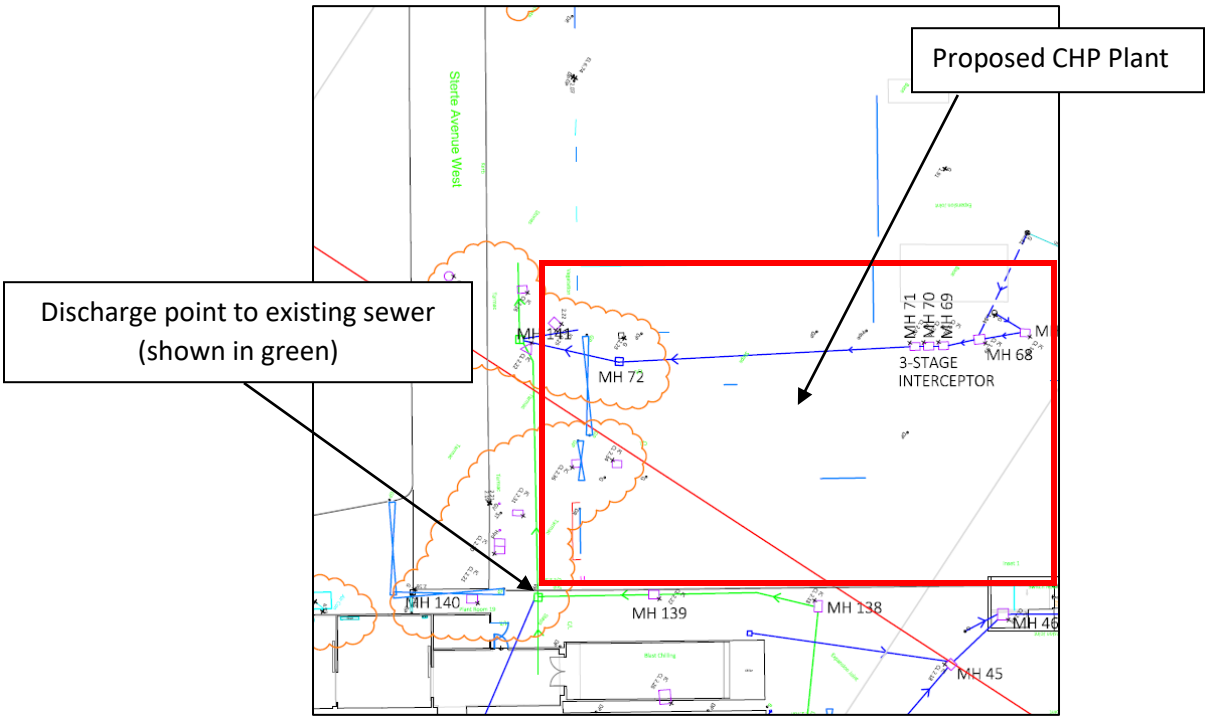



Image sourced from Pork Farms Ltd © 2019

All hazardous substances including transformer oil and lubrication oil used for the engines will be serviced with dedicated bunds that will be designed to C736 standards. Any clean uncontaminated rainwater captured within the transformer bund will be drained manually after inspection and discharged from site via emission point S1. Used lubrication oil for the engines will be stored within a double skinned waste oil tank stored within the containerised unit, prior to being collected and removed off site to a suitable facility for onwards recovery. Staff will follow COSHH risk assessments & wear appropriate PPE when handling any potentially hazardous substance.

Site infrastructure will not contain any amenity facilities which may attract pests or vermin. Operational staff and visitors to the site will have permission to use existing welfare facilities located within the wider Poole Bakery site.

In consideration of the above, the potential for the proposed activities to generate dust, litter or mud during normal operations or during routine maintenance is considered to be very low and has been screened out as not requiring further assessment.

## 2.3 NOISE

The existing Poole Bakery operations is a 24hr operation, thus the proposed CHP plant will also operate 24hrs a day. Under normal operations there is potential for the site to generate noise which may impact on nearby sensitive receptors both during the day and night. Identified noise sources from the proposed CHP plant include the following infrastructure:

- MTU gas engine, housed within a purpose-built acoustic enclosure;
- Air outlet attenuators;
- Exhaust silencer and stack; and
- Cooling equipment including fans and pumps.

A Noise Impact Assessment (NIA) was undertaken to assess the potential impact of predicted sound to be generated from the proposed CHP plant upon the nearest sensitive receptors. The assessment utilised measured baseline data from an on-site survey undertaken in August 2019. The measured data obtained from the survey was then used to construct and calibrate a noise model using LimA software. The calibrated model was used to predict the specific sounds levels at each of the receptors, assuming a typical operating scenario.

The results from the model were then compared against the measured background sound levels recorded to determine impact. The assessment concluded that the rating level from the proposed CHP plant can be considered ‘low impact’ at each sensitive receptor.

Based in the conclusions of the noise impact assessment, noise from the site is not predicted to have an unacceptable impact or cause pollution to nearby residential receptors, and no additional mitigation measures or noise abatement is required. A Noise Management Plan is also deemed not necessary.

## 2.4 ODOUR

Under normal operations, there will be very minimal potential sources of odour from the proposed CHP plant. Potential odour sources identified within Table 1.6.1 above include natural gas, exhaust emissions, or potential odours from any chemicals stored on site.

Natural gas will arrive on site via over ground pipework and there will be no requirement for additional storage on site. All above ground pipework infrastructure will consist of stainless steel and will undergo pressure testing during dry commissioning to ensure they are fit for purpose. The Plant Operations Manager will undertake weekly routine maintenance checks to ensure the plant is operating within normal parameters and to visually inspect for any damage or leaks within the pipework.

Odours from exhaust gases are considered insignificant as the combustion process will destroy 99% of any potentially odorous components within the natural gas fuel.

A small volume of chemicals is required to be stored on site. Chemicals will be stored within a dedicated COSHH cabinet serviced with integral secondary containment providing 110% of the volume of drum. Staff will follow COSHH risk assessments & wear appropriate PPE when handling substances during transfer and replacement of old drums with new. Containers will be regularly inspected to ensure they remain fit for purpose and containment remains intact with no potential for odour release. Full details of all raw materials to be stored at the site are detailed within the Operational Techniques and Monitoring Plan (*ECCS 115 008 R 003 A*).

Based on the above proposed control measures and the output of the risk assessment in Appendix A of this report, the potential risk to the environment from odours is considered to be negligible.

## 2.5 POINT SOURCE EMISSIONS TO ATMOSPHERE

There is to be a single point source emission to atmosphere (containing two flues) from the proposed CHP plant. These will discharge via a 15m high exhaust stack.

During pre-application discussions held with the Environment Agency, it was established early on that a bespoke quantitative Air Quality Modelling Assessment would be required to support this permit application.

Therefore, a quantitative Air Quality (AQ) Assessment was undertaken in December 2019 to identify predicted emissions from the proposed CHP plant and their potential impact on nearby sensitive receptors (including ecological receptors). The object was to establish if the predicted impacts would be significant from both a human health and ecological perspective. A copy of the full assessment is provided within Appendix D to this report.

The proposed fuel (natural gas) is characterised by low emissions of Sulphur dioxide ($SO_2$) and particulate matter, thus these parameters were screened out early on as not significant. $CO_2$ generation can be minimised by controlling combustion conditions, whilst the engine provides complete destruction to an efficiency of >99% of any VOCs within the gas, thus these parameters were also screened out as not requiring any further assessment.

The assessment therefore considered the principle emissions to atmosphere from the proposed CHP Plant, which are the generation of oxides of nitrogen (NOx) and carbon monoxide (CO). These both have the potential to affect human health. Emissions of NOx also has the potential to affect nearby habitat sites in the form of airborne concentrations of NOx, acidification and nutrient nitrogen deposition.

Modelling was carried out in line with EA guidance: "Air emissions risk assessment for your environmental permit"; and "Emissions from specified generators. Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators Version 1". Impacts were predicted using the ADMS-5.2 dispersion model developed by Cambridge Environmental Research Consultants (CERC).

Predicted Concentrations within the modelling represented an extreme conservative and worst-case approach, as the modelling assumed the CHP plant would operate at the maximum load and results are presented for the worst-case meteorological year.

The assessment concluded that the Process Contribution (PC) for NOx exceeded the 1% long-term Annual Mean Air Quality Standards (AQS), however the maximum Predicted Environmental Concentration (PEC) at any location with relevant exposure to the AQS was well below the AQS, thus there is no risk that the long-term AQS will be exceeded as a result of emissions from the proposed CHP Plant.

Similarly, the PC for NOx also exceeded the 10% short-term 1-hour mean of the AQS, however the PEC would remain well below the AQS, thus the risk also concluded that there is no risk that the short term AQS for NOx will be exceeded as a result of emissions from the proposed CHP Plant.

In respect of impact on designated ecological sites, the maximum PCs were deemed insignificant at all designated ecological sites, with the exception of Poole Harbour where the maximum annual mean NOx PC exceeded 1%.

At Poole Harbour, the assessment concludes that the total PEC (baseline + PC) will be below the long-term environmental standard and thus the impact of the proposed CHP Plant on Poole Harbour is therefore judged to be not significant.

## 2.6 POINT SOURCE EMISSIONS TO SEWER

There is to be a single point source emission to sewer from the proposed CHP plant. As detailed within section 2.2 above, the site will primarily be serviced with an impermeable concrete base with some areas of the site design in accordance with SUDS (Sustainable Urban Drainage Systems). All surface water within the site will be captured and directed into the existing host sites effluent drainage system. As the footprint of the proposed CHP compound area is already serviced with impermeable hard standing, the capacity requirements of the drainage system have not changed. A copy of the drainage plan for the wider Bakery site is provided within Appendix F of the Operational Techniques & Monitoring Plan (ECCS 115 008 R 003 A).

Emissions to sewer via discharge point S1 will consist of the following elements under normal operations:

- **Surface water run-off.** This will be clean rainwater run-off captured from within the confines of the site on areas impermeable concrete pad;

- **Boiler Blowdown**. During normal operations boilers are blown down to control the composition of the boiler water. This blowdown is a concentration of the small amounts of solids remaining in the boiler feed water, plus any chemicals used for treating the water, e.g. phosphates etc. The temperature of the blowdown water is predicted to be approx. 40$^{o}$C and unlikely to cause any harm to the drainage network.

A small volume of condenser overflow will also be produced. This will evaporate out of the purpose-built condensate vessels to be located adjacent to the CHP container. As such there will be no effluent from the condenser overflow entering the drainage system.

The primary potential hazards identified would be under abnormal operations, from oils or chemicals due to accidental release from spillages during transferring of substances to and from site. Spillages could also occur from overfilling of vessels.

All chemicals and oils to be stored within this area will be provided with secondary containment and will be located on sealed hardstanding. Spill kits will be available with materials suitable for absorbing and containing minor spills and site staff will be trained in their use and in the spill clean-up procedures. Deliveries of chemicals will be supervised by the Operator's personnel. Hazards from potential Accidents are considered in more detail within Section 2.9 below.

Based on the above proposed control measures and the output of the risk assessment in Appendix A of this report, the potential risk to the environment from point source emissions to sewer is considered to be low.

## 2.7 FUGITIVE EMISSIONS

Fugitive emissions can be from either intentional (i.e. vented) or unintentional (i.e. leaked) sources. The design of the proposed CHP plant has considered the need for emergency vents or pressure relief valves to be built into the system as part of the integral safety procedures for equipment on site. There are steam pressure relief valves in order to release steam in the event of overpressure. These vents will be located at height and away from potential access from Operational Staff or pedestrian access ways. As steam will not contain any harmful substances this can be screened out as requiring further assessment.

There is potential for unintentional, uncontrolled fugitive releases of harmful substances to the environment from the CHP plant. These may arise from the MTU engine or any chemicals stored on site. However, the likelihood of a release is very low, and any emissions would be localised and restricted within the footprint of the site.

The key sensitive receptors identified as at risk to any fugitive emissions include the adjacent Poole Bakery and the local human population.

As detailed in section 2.2 above, site drainage will discharge to sewer. There should be no direct run-off from the site to surface waters.

Whilst extremely unlikely, the nature of any fugitive emissions to air would comprise either of natural gas in the event of a leak; VOCs released following loss of containment and a spillage on site or uncontrolled emissions from damaged or loosened pipework.

The assessment in Appendix A concludes that these potential hazards from fugitive emissions to air are considered to be low following implementation of appropriate control measures.

## 2.8 WASTES GENERATED ON SITE

There will be very minimal volumes of waste produced on site. Wastes which are produced will primarily consist of waste lubrication oil from the MTU engine and other maintenance fluids / oily rags or residual chemical containers.

All Hazardous wastes will be removed from site by an appropriately permitted waste contractor and will be recovered at a permitted facility. As a waste producer, the Operator will receive consignee returns every quarter from their consignee dealing with their hazardous wastes.

Records of all wastes removed from site will be recorded, held securely, and made available for inspection by the Environment Agency upon request. Should any new waste streams be generated during either normal or abnormal operations, the Operator will apply the principles of the Waste Hierarchy prior to removal off site.

## 2.9 ABNORMAL OPERATIONS OR ACCIDENTS

There is potential for hazards and exposure from abnormal, emergency scenarios or accidents on site to anyone living or working close to the proposed CHP plant. The key sensitive receptors include the local human population and adjacent businesses. An assessment of each hazard identified has been evaluated and the potential risk and prevention measures described within the Risk Assessment and Management Control table provided within Appendix A to this report.

The Operator has prepared a series of Emergency Protocols / Accident Plans (copies provided within the Operational Technique & Monitoring Plan Report *ECCS 115 008 R 003 A*) which detail procedures and actions to be taken to minimise the potential causes of accidents, and the consequences in the event of an incident occurring. The Emergency Protocols which will form part of the EMS have been developed to put measures in place to prevent and manage accidents, incidents and non-conformances and include the following key emergency or abnormal scenarios:

- Emergency Management Plan;
- External Incident;
- Extreme or adverse weather conditions;
- Fire and Emergency Action Plan;
- Fire and Emergency on Site;
- Fire and Emergency Out of Hours;
- Flooding;
- Large Chemical Spillage;
- Pre-Start Procedure;
- Minor and Major Injury;
- Power Outage;
- Small Spillages or Leaks;
- Gas Leak;
- Critical Level Alarms.

In consideration of the output of the risk assessment in Appendix A, the potential risks from abnormal scenarios or accidents is considered low following the implementation of appropriate control measures.

## 2.10 Global Warming Potential

The global warning potential (GWP) of the proposed CHP plant has been calculated in accordance with the Environment Agency's GWP Guidance.

The calculations and GWP scores for the proposed CHP plant are provided within Tables 2.10.1a and 2.10.1b below. These have been derived from carbon dioxide emissions from the direct combustion of natural gas and indirect production of electricity. This is based on worst case scenarios with the facility operating continuously throughout the year at maximum load.

The primary objective of the proposed CHP plant is to reduce the dependence of the Pork Farms Ltd upon energy from the National Grid. In doing so it will reduce the $CO_2$ footprint generated by that power, as the power will not be subject to the normal losses associated with transmission from the centralised point of generation to the consumer and heat from the CHP will be supplied that would otherwise require its own fuel (and associated $CO_2$). The actual global warming impact of the wider Pork Farms Ltd Site will be reduced as a result of this development.

***Table 1.10.1a Energy Consumption***

| Number | Energy Source | Emissions Type | Delivered MWh/yr | Conversion Factor | Primary MWh/yr | $CO_2$ Factor | $CO_2$ Tonnes/yr |
|---|---|---|---|---|---|---|---|
| 1 | Electricity from public supply | Indirect | 1,913 | 2.40 | 4,591 | 0.166 | 762 |
| 2 | Natural Gas | Direct | 28,144 | 1.00 | 28,144 | 0.19 | 5,347 |

***Table 1.10.1b Global Warming Potential Impacts***

| Emissions Type | Source | Annual Rate MWh/yr | GWP Value per Tonne | Annual GWP |
|---|---|---|---|---|
| $CO_2$ Energy | Direct Emissions | 28,144 | 1.00 | 28,144 |
| $CO_2$ Energy | Indirect Emissions | 1,913 | 1.00 | 1,913 |

## 2.11 Climate Change Risk Assessment

As of 3 October 2019, the Environment Agency introduced a new requirement for applicants applying for a bespoke waste or installation permit. If the Facility is expected to operate for more than 5 years, the applicant must complete the climate change risk screening tool, even if the Facility is not expected to be operational after 2050. The Environment Agency's guidance 'Adapting to climate change: risk assessment for your environmental permit' was followed and following a conservative approach, a Climate Change Risk Assessment (CCRA) was completed.

The proposed CHP Plant has been designed to achieve a minimum 20 to 25-year operating life. It is highly probably however, that the plant will continue to operate beyond 2045. As such, a conservative **approach**

has been applied and a minimum of 40 years operational life assumed for the purpose of this exercise. The results of the Risk Screening tool are presented within Table 2.11.1a below.

***Table 2.11.1a Climate Change Risk Screening***

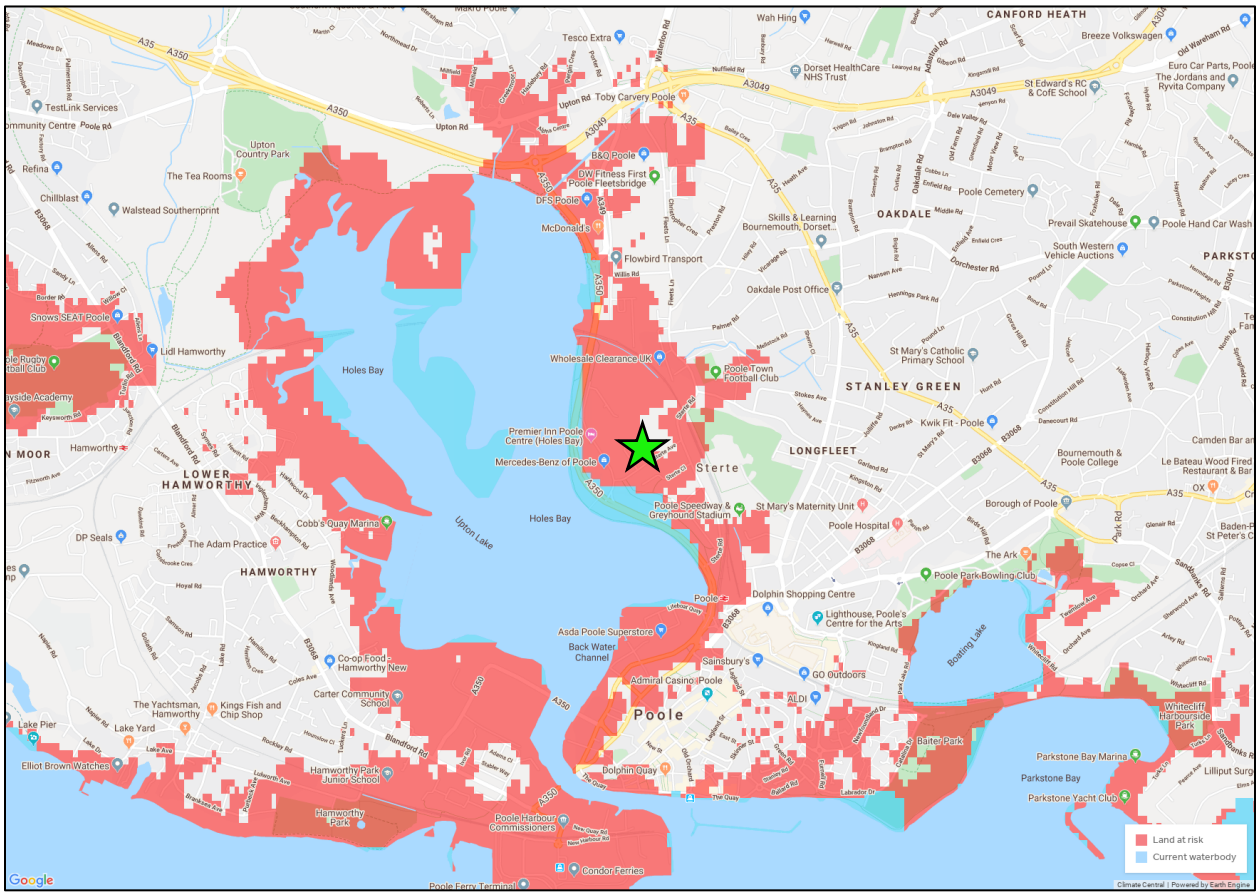
| Category | Screening Question | Score | Poole CHP Plant Score |
|---|---|---|---|
| **1. TIMESCALES** | How long will a permit be required for this site / activity? | | |
| | 5 years or less of operation | 0 | |
| | Less than 20 years of operation | 1 | **1** |
| | Until between 2040 and 2060 (between 20 and 40 years from now) | 3 | |
| | Until 2060 or beyond (more than 40 years from now) | 5 | |
| **2. FLOODING** | What is your site's risk of flooding from rivers or the sea? | | |
| | Not in a flood-risk zone | 0 | |
| | Very low or Low | 1 | **1** |
| | Medium | 2 | |
| | High | 5 | |
| **3. WATER USE** | If you use water for your site operations or fire prevention, what is the source of your water? | | |
| | Water not required | 0 | |
| | Mains Water | 1 | **1** |
| | Surface water or groundwater abstraction | 5 | |
| | | **TOTAL SCREENING SCORE** | **3** |

For proposed facilities with a total screening score of 5 or more, applicants must also complete the relevant CCRA. Although the above risk screening score is 3 and therefore below the threshold, a CCRA has still been completed. As the proposed CHP plant is based in the South-West of England, the CCRA worksheet for South-West England has been completed. A copy of the complete worksheet is provided within Appendix C to this report.

The assessment concluded that the site is currently not at risk of flooding however is at risk from predicted rising sea levels and potential for localised flooding. The CHP plant may also be at risk from rises in summer temperatures.

Figure 2.11.1b below confirms that the proposed site is at risk of rises in sea level by 2050 without further flood defence measures. The site location is illustrated with a green star, whilst the areas at risk of sea level rise by 2050 are shown in red.

***Figure 2.11.1b Climate Change Predicted Sea Level Rises Map***




Source: Climatechange.org Interactive Map ©2019

# 3 CONCLUSIONS

## 3.1 CONCLUSIONS OF RISK ASSESSMENT

This Environmental Risk Assessment has been prepared on behalf of Poole Sustainable Energy Ltd in support of the Environmental Permit application for the proposed new CHP Plant in Poole, Dorset.

The Operator is applying for a bespoke Installation Environmental Permit comprising a Directly Associated Activity, under the Environmental Permitting (England and Wales) Regulations 2016.

The assessment has followed the Environment Agency's guidance and best practice on '*Risk Assessments for your Environmental Permit*'.

A number of environmental risk assessments have been carried out to determine whether the proposed CHP plant can be operated without causing pollution to the environment. Bespoke quantitative modelling assessments were undertaken for both noise and air quality:

- **Noise**. A Noise Impact Assessment (NIA) was undertaken to identify maximum noise ratings; establish the potential impact of the proposed CHP plant on nearby residential receptors; and provide suitable mitigation where required; and
- **Air Quality**. An Air Quality (AQ) Assessment was undertaken to establish if emissions from the proposed stack risk exceedances of either human-health or ecological-health related air quality standards (AQSs).

Taking into consideration all potential emissions as well as the intended design and operational management and mitigation practices to be implemented, all assessments have considered the possible impacts on nearby sensitive receptors and have concluded that potential impacts from the proposed CHP plant will not be significant.

As presented within the report, the Operator will implement appropriate control measures and management systems to ensure that the proposed CHP plant does not have any significant impacts or represent an unacceptable risk to the local environment.

# APPENDICES

# APPENDIX A – RISK ASSESSMENT & MANAGEMENT CONTROLS

**Table A: Risk Assessment and Risk Management Techniques**

| Hazard | Receptor | Pathway | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk |
|---|---|---|---|---|---|---|
| **Amenity Impacts** | | | | | | |
| Dust, litter or Debris | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air or tracked via vehicle wheels leaving site | There will be minimal vehicle movements to and from site as fuel (natural gas) will be delivered to site via pipework. Only small volumes of chemicals and maintenance crew will arrive via vehicle.<br>The small compound will be serviced with either hardstanding or concrete therefore removing any risk of mud or debris<br>Any litter waste generated by staff / maintenance crew will be stored in secure bins and regularly removed off site | Low | Low | Low |
| Pest/Vermin | | Travel across land or air | The proposed CHP plant will not have an amenity facility within the confines of the site. Welfare facilities including cafeteria within the existing Poole Bakery site will be made available for staff and/or visitors to use. There will be no putrescible / degradable wastes stored on site that may attract pests/vermin. | Low | Low | Low |
| **Noise** | | | | | | |
| Loss of Noise Attenuation on MTU Engine | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Noise through the air | CHP engine is to be housed within purpose built acoustic enclosure; the enclosure inlet & outlet cooling ventilation fitted with acoustic attenuators + acoustic louvres; and the exhaust silencer fitted<br>The Operator will implement an effective planned preventative maintenance regime to ensure equipment and above-mentioned attenuation measures remain fit for purpose and equipment operates within optimum conditions and minimises generation of noise and/or vibration.<br>Operational procedures will be in place to investigate and respond to any complaints about noise. Records will be maintained on site. | Moderate | Moderate | Low |
| Loss of Noise Attenuation on Exhaust Silencer & Exhaust Stacks | | | | Moderate | Moderate | low |
| Loss of Noise Attenuation on Cooling Fans / Pumps | | | | Moderate | Moderate | Low |
| **Odour** | | | | | | |
| Gas Leak | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air | All pipework associated with the plant will be constructed of steel and will undergo CQA integrity tests prior to the site being commissioned.<br>The Operations Plant Manager will undertake weekly routine checks across to site to identify any gas leaks.<br>In the event a leak is detected the Operators Emergency Protocols will be followed. | Low | Low | Low |

| Hazard | Receptor | Pathway | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk |
|---|---|---|---|---|---|---|
| Abnormal exhaust gases | | | The Operator will implement a Planned Preventative Maintenance programme that will include regular checks on the CHP unit to ensure it is operating within optimum conditions. SCADA system will continuously monitor the plants performance. In the event any abnormal conditions are detected, or critical alarms raised, the Operational Plant Manager will be alerted via text message / phone call. The Plant Manager will have remote access to the plant out-of-hours | Low | Low | Low |
| Loss of containment of stored chemicals | | | The small compound will be serviced with either hardstanding or concrete and impermeable surfacing for all areas used to store chemicals or hazardous substances | Low | Low | Low |
| **Accidents** | | | | | | |
| Fugitive emissions of natural gas due to gas leak | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air | There is potential for unintentional, uncontrolled fugitive releases of natural gas to the environment from the CHP plant. These may arise from the MTU engine. All pipework associated with the plant will be constructed of stainless steel and will undergo CQA integrity tests prior to the site being commissioned. The Operations Plant Manager will undertake weekly routine checks across to site to identify any gas leaks. In the event a leak is detected the Operators Emergency Protocols will be followed. | Low | Low | Low |
| Accidental release of potential polluting substances due to mechanical failure | Local Workforce at adjacent businesses; Nearby Human Residential Receptors; Nearby natural habitats; | Transportation through the air; Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | The design of the proposed CHP plant has considered the need for emergency vents or pressure relief valves to be built into the system as part of the integral safety procedures for equipment on site. There are steam traps / air vents build into the design, in order to release steam in the event of overpressure. These vents will be located at height and away from potential access from Operational Staff or pedestrian access ways. Pressure relief valves output on the closed loop hot water circuit will be guided into IBCs to contain any over pressure related excess. As steam will not contain any harmful substances this can be screened out as requiring further assessment. | Moderate | Moderate | low |
| Abnormal release of gases from CHP exhaust stack | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air | The Operator will implement a Planned Preventative Maintenance programme that will include regular checks on the CHP unit to ensure it is operating within optimum conditions. SCADA system will continuously monitor the plants performance. In the event any abnormal conditions are detected, or critical | Moderate | Moderate | low |

| Hazard | Receptor | Pathway | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk |
|---|---|---|---|---|---|---|
| | | | alarms raised, the Operational Plant Manager will be alerted via text message / phone call.<br>Emissions from the stack will undergo periodic monitoring, as detailed within the Operational Techniques & Monitoring Plan Document (*ECCS 115 008 R 003 A*). | | | |
| Contaminated effluent discharged off site | Poole Bakery Drainage System & downstream Sewage Treatment Works | Transportation across land and into drainage channels | Under normal operations there is very low probability of any contaminated effluent discharging off site.<br>Chemicals will only be stored within areas serviced with appropriate secondary containment.<br>Spill kits will be available on site and staff will receive internal training on their use. Any spill kit equipment used will be replenished as soon as practically possible. | Low | Low | Low |
| Loss of containment of wastes stored on site | Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation across land, percolation through soils, and into drainage channels via direct run-off from site | All wastes will be stored in suitable containers will hazardous wastes serviced with appropriate secondary containment<br>Only small volumes of wastes will be stored at any one time and will be removed from site for onwards disposal at regular intervals. | Low | Low | Low |
| Accidental release of potential polluting substances due to vehicle collision | Nearby natural habitats;<br>Local Workforce at adjacent businesses | Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | There will be minimal vehicle movements to and from site as fuel (natural gas) will be delivered to site via pipework. Only small volumes of chemicals and maintenance crew will arrive via vehicle.<br>Due to the small size of the CHP compound vehicles will likely park outside the walled boundary in the yard area. | Low | Low | Low |
| Accidental release of potential polluting substances through flooding | Nearby natural habitats;<br>Local Workforce at adjacent businesses | Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | The Site is designated as a Flood Zone 1 with low probability of flooding. Flooding will likely only occur in flash flood events of if local drains become blocked.<br>Drains will regularly be inspected to ensure they are kept free of debris.<br>Any potentially polluting substances will be stored off the ground within stored containers, thus reducing the risk of release in the event of a flood. | Low | Low | Low |
| Accidental release of potential polluting substances due to adverse weather conditions | Nearby natural habitats;<br>Local Workforce at adjacent businesses | Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | Weather conditions will be monitored frequently, and appropriate action taken. Access to the boiler roof will be prohibited during storm events, and the decision on whether to close the site will be at the discretion of the senior managers, this includes turning the generator off remotely if required. Primary consideration will be given to staff safety and environmental considerations of the operatives & running the site. The plant can be monitored and | Low | Low | Low |

| Hazard | Receptor | Pathway | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk |
|---|---|---|---|---|---|---|
| | | | controlled remotely if adverse weather prevents staff attending site. | | | |
| Arson and / or vandalism and / or theft causing the release of polluting materials to air (smoke or fumes), water or land. | Nearby natural habitats; Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air; Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | The CHP compound area is to be located adjacent to the Poole Bakery Site. The Bakery has strict security measures which prevent unauthorised access across their site. These include fencing of the site and security gates and CCTV cameras. The CHP plant will consist of its own security fence to prevent unauthorised access or local workforce wondering onto the site. Access to the CHP plant will be either via the bakeries existing security gate for pedestrians or maintenance crew can will be able to access the site via its own gate off Sterte Ave West. | Moderate | Moderate | low |
| Accidental fire/explosion causing the release of polluting materials to air (smoke or fumes), water or land from on-site machinery | Nearby natural habitats; Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air; Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | The existing Poole Bakery site follows strict security measures to prevent unauthorised access. These include fencing of the site and security gates and CCTV cameras. The CHP Plant will have a No Smoking Policy which is to be strictly enforced by Site Rules and by signage around site. This will be incorporated into the Environmental Management System. All plant and equipment and electrical installations will be kept maintained and in good working condition and subject to routine inspection and maintenance. Good housekeeping measures will be in place including the cleaning of small leaks of oils or other flammable liquids immediately. Emergency Protocols have been compiled to manage foreseeable risks from the proposed CHP plant. The Operators Environmental Management System will also include procedures and actions required in the event of fire or spillage to control and minimise their spread. Localised firefighting equipment will be maintained in accordance with fire regulations. | Moderate | Moderate | low |
| Accidental release of potential polluting substances due to power outage | Nearby natural habitats; Local Workforce at adjacent businesses; Nearby Human Residential Receptors | Transportation through the air; Percolation through soils, direct run-off from site across the ground and entering existing combined drainage system. | SCADA system will continuously monitor the plants performance. In the event a power outage is detected a critical alarm will be raised and the Operations Plant Manager alerted via text message / phone call. The plant shall automatically undertake a be controlled shut-down mitigating against the event and risk of any potentially polluting substances being released. The plant will be fitted with emergency 'E. Stop'. | Moderate | Moderate | low |

# APPENDIX B – NOISE IMPACT ASSESSMENT

# Sound Assessment:
## Poole CHP Plant, Dorset

November 2019

Experts in noise and vibration assessment and management

## Document Control

| | | | |
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| **Job Number** | J1088 |

| | |
|---|---|
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Document Status and Review Schedule

| Report No. | Date | Status | Reviewed by |
|---|---|---|---|
| J1088A/1/F1 | 14 November 2019 | Final | Chris Youdale (Senior Consultant) |

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## Contents


1 Introduction ..... 3
2 Site Description ..... 4
3 Description of Process ..... 7
4 Relevant British Standards and Guidance ..... 9
5 Baseline Conditions ..... 11
6 Assessment Methodology ..... 14
7 Results ..... 18
8 Best Available Techniques (BAT) ..... 21
9 Conclusion ..... 22
10 Glossary ..... 23
11 Appendices ..... 25
A1 Sound Level Meter Specifications ..... 26
A2 Site Photographs ..... 29
A3 Measured Sound Levels ..... 30
A4 Sound Source and Model Data ..... 31


## Tables


Table 1: Nearest Noise Sensitive Receptor Locations ..... 5
Table 2: Summary of Survey Details ..... 12
Table 3: Measured Sound Levels ..... 13
Table 4: Summary of Background Sound Levels used in the Assessment ..... 13
Table 5: Modelled Dimensions for Proposed Buildings ..... 15
Table 6: Subjective Method – Rating Level Corrections for Tonal Sounds ..... 16
Table 7: Subjective Method – Rating Level Corrections for Impulsive Sounds ..... 16
Table 8: BS 4142:2014+A1:2019 Assessment – Night-time Operational Hours ..... 18
Table 9: BS 4142:2014+A1:2019 Assessment – Night-time Operational Hours – With Boiler ..... 19
Table A10: Measured Sound Levels at M1 ..... 30
Table A11: Measured Sound Levels at M2 ..... 30
Table A12: Sound Source Descriptions ..... 31
Table A13: LimA Attribute Descriptions ..... 32
Table A14: Sound Source Spectral Data ..... 33
Table A15: Sound Source Spectral Data for CHP ..... 34

Table A16: Spectrum Identification References for CHP Sound Sources ..... 34
Table A17: Modelled Proposed Building Corner Grid References ..... 35

**Figures**

Figure 1: Site Boundary and Noise Sensitive Receptor Locations ..... 4
Figure 2: Site Layout ..... 7
Figure 3: Sound Monitoring Locations ..... 11

Figure A2.1: Monitoring Location 1 ..... 29
Figure A2.2: Monitoring Location 2 ..... 29

# 1 Introduction

1.1 Noise Consultants Ltd ('NCL') have carried out an assessment to assess the potential impact of sound upon the nearest noise sensitive receptors (NSRs) as a result of a natural gas fired Combined Heat and Power (CHP) plant (the 'facility'), located at 10-20 Sterte Avenue in Poole, Dorset, BH15 2AS (the 'site').

1.2 The assessment has been prepared in support of the Environmental Permit application (EPR/PP3503BZ/A001) to be submitted to the Environment Agency (EA). The site will be operated by Poole Sustainable Energy Limited as a Directly Associated Activity (DAA) to the adjacent bakery and Stationary Technical Unit (STU) (existing Permit EPR/EP3639WV).

1.3 The existing Poole Bakery is operated by Pork Farms Ltd (part of the Addo Food Group) and is a long-established business. Pork Farms Ltd operate a chilled savoury pastry business supplying the food retail sector under brands and retailers' own labels within the United Kingdom (UK).

1.4 Activities include the manufacture of hot and cold pies and pasties through the treatment and processing of materials intended for the production of food products. Activities associated with the bakery occur at the premises twenty-four hours a day, seven days a week.

1.5 The assessment sets out the results of a baseline sound survey and addresses the likely impacts of sound associated with the proposed development on the surrounding area during the operational phase, in accordance with BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' (BS 4142:2014+A1:2019).

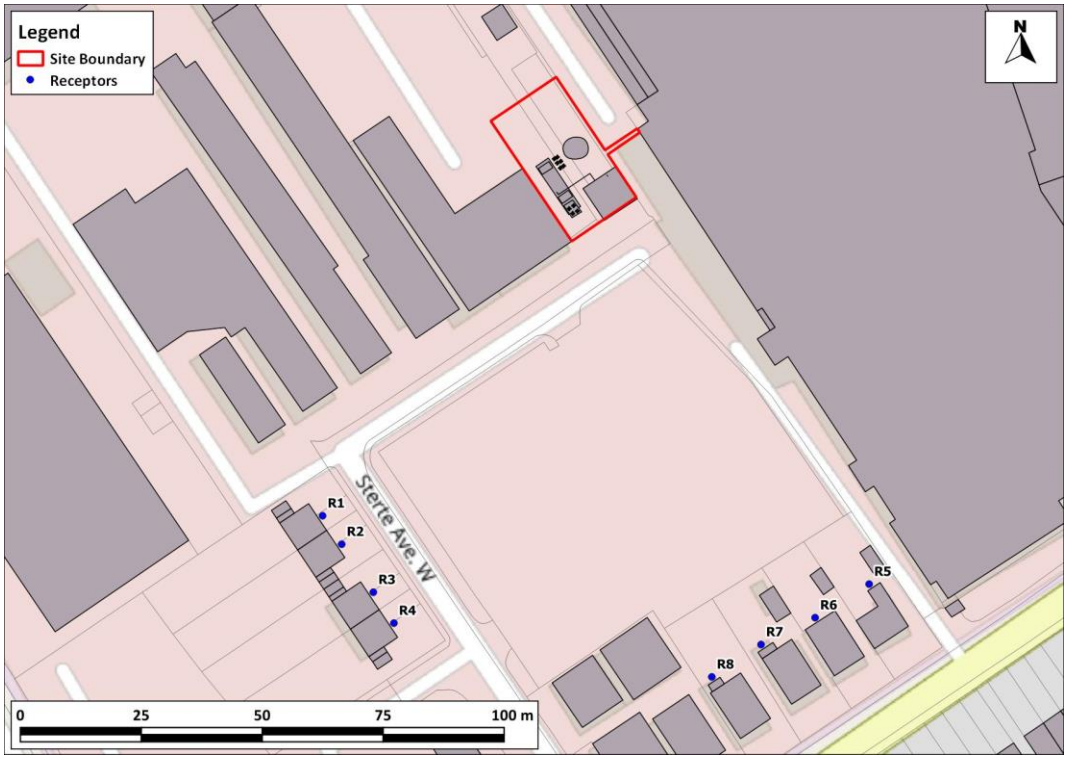
1.6 This report has been prepared with reference to relevant policy and guidance documents.

# 2 Site Description

2.1 The site is located in Sterte (Grid Reference: SZ 00898 91779), approximately 1.2 km north of Poole town centre. The proposed new CHP plant is to be situated outside the curtilage of the existing STU host site (Poole Bakery), on land off Sterte Avenue West. The proposed CHP Plant will occupy a small footprint area of approximately 480m$^2$ and will be located amongst existing buildings to the western boundary of the Poole Bakery Factory and to the east of other existing business units on the Sterte Road Industrial Estate.

2.2 The nearest noise sensitive receptors (NSRs) to the site are 4No. dwellings on Sterte Avenue West (approximately 80m to the south west of the site boundary), and 4No. dwellings on Sterte Avenue (approximately 97m to the south/south east of the site boundary). **Figure 1** presents the location of the site boundary and the NSRs.

**Figure 1: Site Boundary and Noise Sensitive Receptor Locations**




2.3 **Table 1** summarises the locations of the NSRs to the site.

**Table 1: Nearest Noise Sensitive Receptor Locations**

| Receptor Ref. | Description | Co-ordinates of Modelled Receptor | |
|---|---|---|---|
| | | X (Easting) | Y (Northing) |
| R1 | Dwelling on Sterte Avenue West to the south west of the site boundary | 400844 | 91716 |
| R2 | Dwelling on Sterte Avenue West to the south west of the site boundary | 400848 | 91710 |
| R3 | Dwelling on Sterte Avenue West to the south west of the site boundary | 400854 | 91700 |
| R4 | Dwelling on Sterte Avenue West to the south west of the site boundary | 400858 | 91694 |
| R5 | Dwelling on Sterte Avenue to the south/south east of the site boundary | 400957 | 91702 |
| R6 | Dwelling on Sterte Avenue to the south/south east of the site boundary | 400946 | 91695 |
| R7 | Dwelling on Sterte Avenue to the south/south east of the site boundary | 400934 | 91689 |
| R8 | Dwelling on Sterte Avenue to the south/south east of the site boundary | 400924 | 91683 |

2.4 Planning consent was granted in December 2018 for the construction of an office and industrial unit (8.2m high) for use by Suttles Special Projects together with a secured storage yard and 3No. terraced industrial units (7.1m high) (APP/17/00443/F). This development is proposed on land at 30 Sterte Avenue West which lies directly between the site and the NSRs.

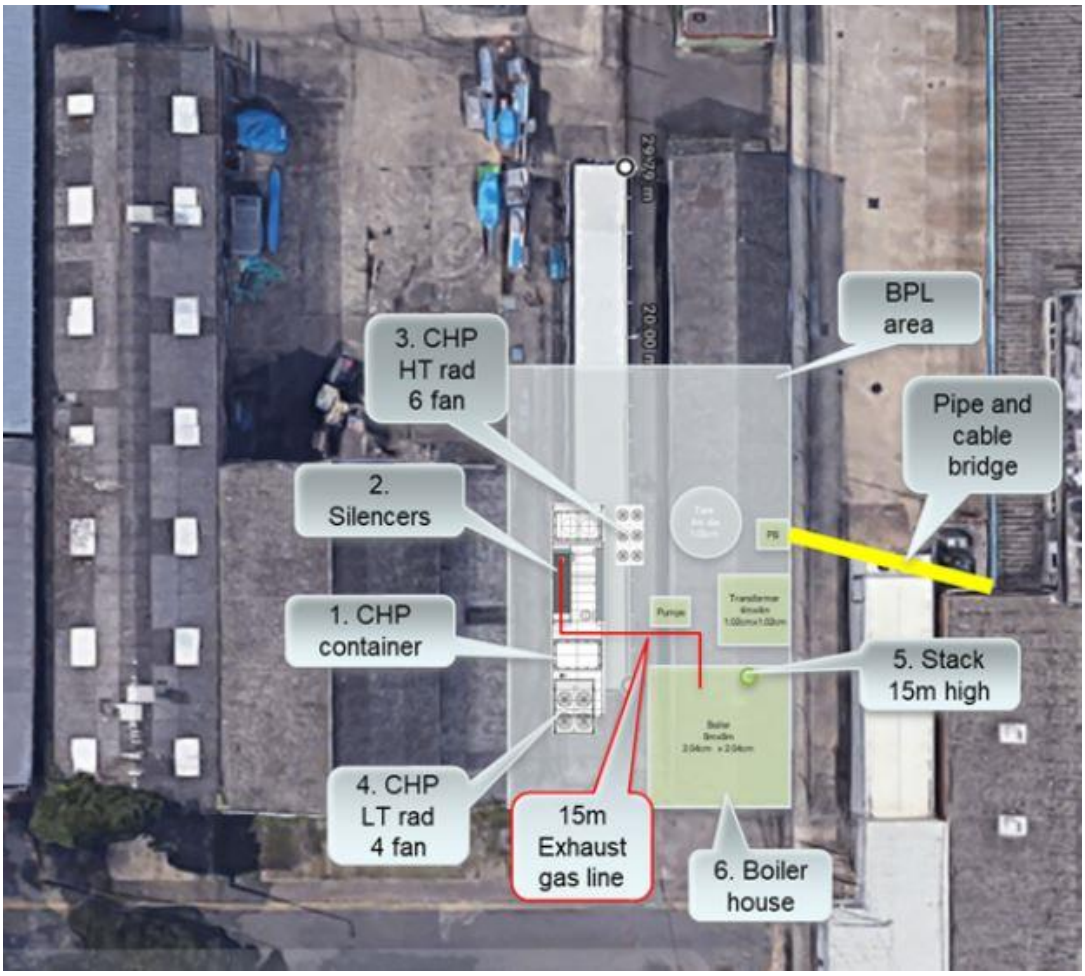
# 3 Description of Process

## Overview of Plant Requiring Permit

3.1 The proposed facility will consist of a single containerised genset, natural gas fired 3.175 MWth CHP unit (~3,517 kWth gross thermal input, ~1,285 kWe electrical power output) and waste heat boiler (~2,334 kWth or ~2,585 kWth gross thermal input) designed to produce heat, steam and supply electricity to the adjacent host site (Poole Bakery). The purpose of this new plant is to produce lower cost and lower $CO_2$ electricity, heat and steam, that can be supplied to the bakery directly, to reduce its dependence upon energy sourced from the National Grid.

3.2 The facility comprises 1No. containerised Onsite Energy MTU 12V4000 GS CHP generator and 1No. Yorkshireman boiler (within building), both powered by natural gas. The combustion gases will be exhausted from a 15m high vertical stack. **Figure 2** presents the proposed site layout.

**Figure 2: Site Layout**



## Operating Conditions

3.3 The facility has the potential to operate up to 8,760 hours per year at any time during the day or night, for the purposes of electricity and heat generation. Heat from the engine is captured from both the engine jacket and exhaust; the jacket heat is captured in the form of hot water which is stored in a hot water buffer vessel; and the exhaust heat is used to generate steam. The heat and hot water are utilised across several parts of the Addo site, before returning to the energy plant cooler. Electricity from the engine is used to power the Addo site, with an additional connection to the National Grid for surplus.

3.4 The boiler plant will operate when demand for heat cannot be met by the CHP alone. It is understood that the boiler will run at a significantly reduced load rate over a yearly period. This assessment has assumed full load rate as a worst-case scenario.

# 4 Relevant British Standards and Guidance

## Integrated Pollution Prevention and Control (IPPC) - H3 Horizontal Guidance Note for Noise – Part 2 Noise Assessment and Control (version 3, June 2004)

4.1 The purpose of the IPPC Horizontal Guidance Note for Noise Assessment and Control is to provide supplementary information, relevant to all sectors, to assist Applicants in preventing and minimising emissions of noise and vibration.

4.2 Part 2 'Noise Assessment and Control' describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. It forms a background to Part 1 and will assist in determining BAT for a given installation. It is aimed equally at the Regulator and at Operators.

4.3 The H3 Guidance Note refers to the use of BS 4142:1997 *'Method for rating industrial noise affecting mixed residential and industrial areas'* methodology for the assessment of noise from industrial activities. This has now been superseded by BS 4142:2014+A1:2019 therefore the assessment has been undertaken with reference to the latest revision of the British Standard.

## BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*'

4.4 BS 4142:2014+A1:2019 is used to rate and assess sound of an industrial nature including but not limited to assessing sound from proposed, new, modified or additional sources of industrial sound. It contains guidance on the monitoring and assessment of industrial and commercial sound sources (including fixed installations comprising mechanical and electrical plant and equipment) affecting sensitive receptors.

4.5 The methodology relies on comparing the operational rating level, $L_{Ar,Tr}$, with the background sound level, $L_{A90,T}$ (i.e. the level that would be present without the development) over a representative time period. BS 4142:2014+A1:2019 provides guidance on the measurement of background sound, the determination of specific sound and calculation of the rating level.

4.6 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. A character correction should therefore be added to the specific sound level to obtain the rating level, where such features are present at the assessment location. This can be approached in three ways however the subjective method is considered appropriate for this assessment. This states that the specific sound level should be corrected if a tone, impulse or other characteristic occurs, or is expected to be present for new sound sources.

4.7 BS 4142:2014+A1:2019 assessment methodology also states that:

- Typically, the higher the rating level is above the background sound level the greater the magnitude of impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

# 5 Baseline Conditions

## Background Sound Survey

5.1 To quantify current background sound levels at the NSRs, a survey was conducted on 2 August 2019. The survey was designed to capture sound levels during the night-time period, which is typically when the quietest sound levels occur during a 24-hour period. Basing the assessment calculations on night-time background sound levels is considered to be a conservative approach.

5.2 **Figure 3** presents the sound monitoring locations, which are described in **Table 2** below. The sound monitoring locations were selected to represent the acoustic environment at the closest NSRs to the site. Photographs of the monitoring locations are shown in **Appendix A2**.

**Figure 3: Sound Monitoring Locations**

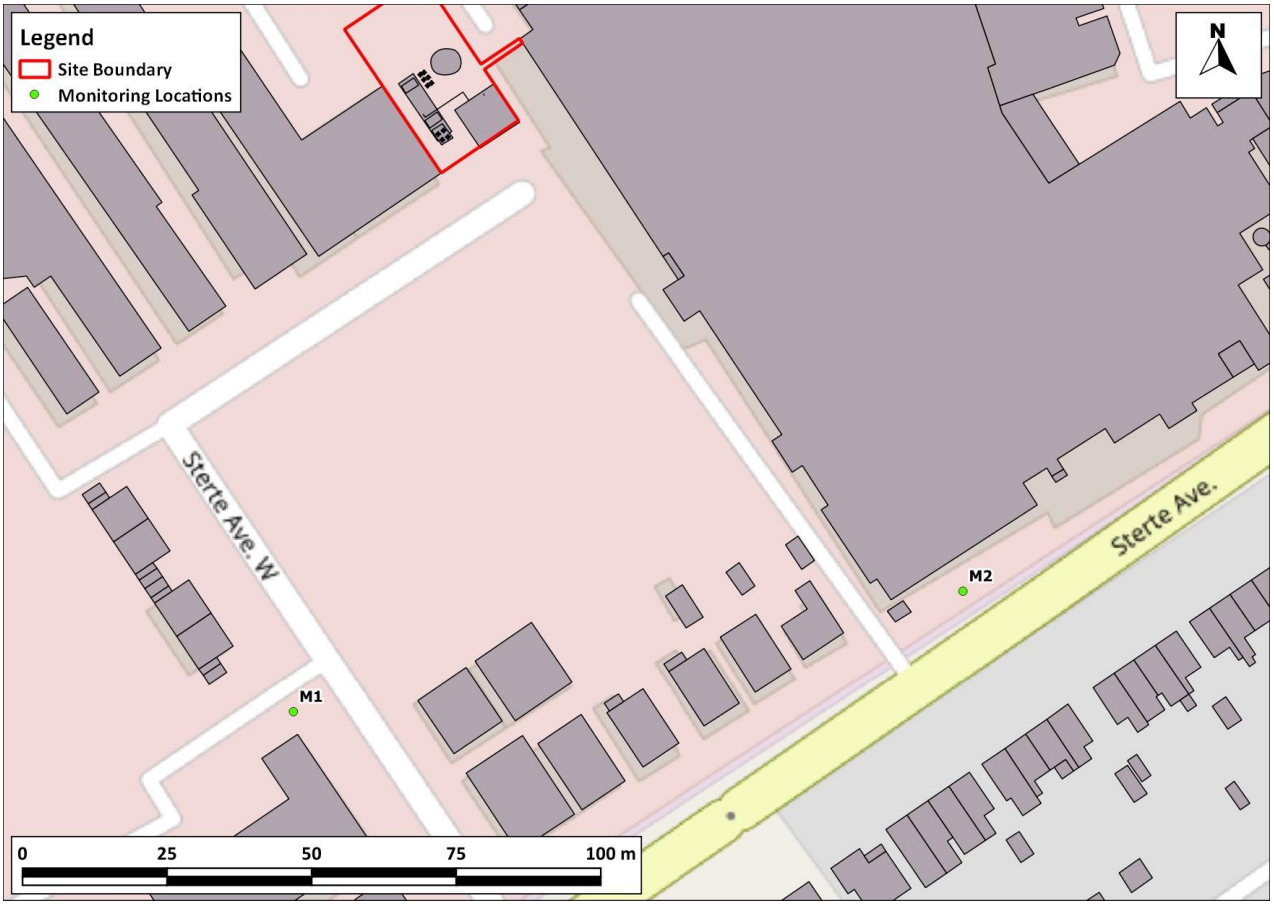


**Table 2: Summary of Survey Details**

| Monitoring Location | Description | Measurement Date/Time |
|---|---|---|
| M1 | Representative of dwellings on Sterte Avenue West to the south west of the site. | 02/08/2019 01:49 hrs – 02:49 hrs |
| M2 | Representative of dwellings on Sterte Avenue to the south/south east of the site. Monitoring location was screened from existing plant located on the western façade of Poole Bakery. | 02/08/2019 01:45 hrs – 03:00 hrs |

5.3 Monitoring was supplemented by observations of the acoustic environment at each monitoring location during the survey.

5.4 The calibration levels of the SLM were checked before and after each measurement with no significant drift in calibration recorded. Windshields were fitted to the microphones to minimise the effects of any wind-induced noise.

5.5 Details of the monitoring instrumentation (model/serial numbers and calibration details) are presented in **Appendix A1**. All instrumentation was configured to report the environmental parameters $L_{Aeq}$, $L_{A10}$, $L_{90}$ and $L_{Amax}$ in one-third octave bands.

5.6 All measurements were conducted, where possible, in accordance with BS 4142:2014+A1:2019 and BS 7445-1:2003 '*Description and measurement of environmental noise. Guide to quantities and procedures'* (BS 7445:2003).

### Survey Observations

5.7 Observations of the acoustic environment were undertaken at M1 and M2 during the night-time survey.

5.8 At M1, sound associated with industrial plant at the existing Poole Bakery premises was noted to be audible along with distant road traffic noise from the west. Occasional noise from seagulls was also heard on occasions.

5.9 At M2, distant road traffic noise from the south was audible. Sound associated with industrial plant at the existing Poole Bakery premises was noted to be audible but less dominant due to screening provided by the Poole Bakery building.

### Meteorological Conditions During the Survey

5.10 Weather conditions on 2 August 2019 were noted to be fine and dry with an average wind speed of $2ms^{-1}$. The average temperature was 15°C and no precipitation occurred.

## Survey Results

5.11 A summary of the measured sound levels at each monitoring location is shown in **Table 3** (rounded to the nearest decibel). The full measured data set is shown in **Appendix A3**.

**Table 3: Measured Sound Levels**

| Monitoring Location | Time Period | dB $L_{Aeq, 15min}$ | dB Mean $L_{A90, 15min}$ | dB Mode $L_{A90, 15min}$ | dB $L_{Amax}$ |
|---|---|---|---|---|---|
| M1 | 02/08/2019 01:49 hrs – 02:49 hrs | 50 | 49 | 49 | 62 |
| M2 | 02/08/2019 01:45 hrs – 03:00 hrs | 46 | 45 | 45 | 59 |

5.12 In order to determine the background sound level to use for the assessment process, comparisons between the mean and mode have been undertaken, however they were found to be of equal value. The adopted background sound levels for each NSR based on the sound survey results are shown in **Table 4**.

**Table 4: Summary of Background Sound Levels used in the Assessment**

| Time Period | Monitoring Location | NSR Location | dB $L_{A90, 15min}$ |
|---|---|---|---|
| Facility Operational Hours (00:00 – 24:00) | M1 | R1 – R4 | 49 |
| | M2 | R5 – R8 | 45 |

# 6 Assessment Methodology

## Source Sound Levels

6.1 Sound levels for the key facility components have been provided by Basepower Ltd in order to enable a noise model to be constructed.

6.2 Less significant components including pumps and transformers have not been included in the noise model as Basepower Ltd have advised NCL that sound associated with these sources will be negligible compared to the key components. The NSRs will also be screened from these components by the boiler house building, with reference to the site layout shown in **Figure 2**.

6.3 The boiler unit has not been included in the calculation of the rating level as part of the BS 4142:2014+A1:2019 assessment as it will be housed within a building and therefore sound associated with this source will be negligible. Further details are discussed in Paragraph 7.5.

6.4 The sound source data and assumptions as used in noise model are detailed in **Appendix A4**. The noise modelling files have been provided separately.

## Noise Modelling

6.5 The propagation of sound levels arising from the operation of the proposed development has been determined through noise modelling. Noise modelling has been undertaken using Stapelfeldt's LimA computational noise modelling software (v12.0), which accounts for variances in propagation due to barrier and ground effects, such as those due to existing buildings or over water. LimA allows the calculation of sound levels at specific single points, or over a calculation grid of specified size. The noise model includes 2m DTM contours to represent the terrain.

### Modelling Assumptions

6.6 The calculation method given in ISO 9613 '*Acoustics – Attenuation of sound during propagation outdoors*' Parts 1 and 2 have been used to predict the sound propagation in the model. The calculation results are considered to be worst case as they assume downwind propagation, which in reality would not occur at all times due to changes in wind direction. Predictions assume hard ground attenuation (G=0). Receiver heights in the model have been set at 1.5m above ground which represents ground floor level for R5-R8 (which are bungalows), and at 4m height above ground which represents first floor level for R1-R4 (which are 2-storey).

6.7 All existing building heights have been assumed as 8m for the purposes of this assessment, with the exception of the dwellings at R5-R8 which have been assumed as 4m. Heights assumed for proposed buildings are shown in **Table 5**.

**Table 5: Modelled Dimensions for Proposed Buildings**

| Building | Height (m) | Length (m) | Width (m) |
|---|---|---|---|
| CHP Container | 3 | 12 | 3 |
| Boiler House Building | 6 | 8 | 8 |

6.8 In the absence of sound levels for the control room within the container, the whole of the container has been modelled using sound levels for the CHP sound break-out from the container. Sound levels within the control room would expect to be lower than within the CHP room therefore this is a worst-case assessment.

*6.9* In the absence of definitive sound data being available for the stack in isolation, this has been modelled assuming the sound levels as per the exhaust gas line. As a worst case assessment, the model has not included any sound reductions afforded as the sound travels along the gas line from the CHP silencer to the stack.

## BS 4142:2014+A1:2019 Procedure

6.10 The basic procedure of a BS 4142:2014+A1:2019 assessment is to compare the operational sound level from the source(s) at the assessment location(s) (the specific sound level, $L_s$) with the existing acoustic environment, (background sound level, $L_{A90,T}$).

6.11 The assessment is performed by comparing the rating level of the sound source(s), $L_{Ar,Tr}$, against the background sound level, $L_{A90,T}$. The background sound level should be measured during a period in absence of the influence of sound from the industrial sources. Guidance is provided on how to monitor and determine the background sound level, specific sound level and rating level.

6.12 Where there are certain acoustic features of the specific sound level, $L_s$ that would likely increase the significance of impact, then an appropriate character correction is added to the specific sound level, $L_s$. This is referred to as the rating level $L_{Ar,Tr}$.

### Character Correction Considerations

*Tonality*

6.13 A tonal correction between 0 and +6 dB can be applied for sounds that range from not tonal to prominently tonal. Several methodologies are presented in BS 4142:2014+A1:2019 in order to determine the appropriate correction to be applied. **Table 6** presents the subjective assessment method corrections for tonal sounds.

**Table 6: Subjective Method – Rating Level Corrections for Tonal Sounds**

| Subjective assessment of sound source at the receptor | Correction |
|---|---|
| The tone is just perceptible at the receptor | +2 dB |
| The tone is clearly perceptible at the receptor | +4 dB |
| The tone is highly perceptible at the receptor | +6 dB |

6.14 Due to the extremely industrial nature of the existing acoustic environment at the NSRs to the site, it is considered that no audible tones would be perceptible at the NSRs a result of the proposed facility. It is on this basis that no tonality corrections have been applied to the assessment.

*Impulsivity*

6.15 An impulsivity correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level.

6.16 **Table 7** presents the subjective method corrections for impulsive sounds.

**Table 7: Subjective Method – Rating Level Corrections for Impulsive Sounds**

| Subjective assessment of sound source at the receptor | Correction |
|---|---|
| Impulsivity is just perceptible at the receptor | +3 dB |
| Impulsivity is clearly perceptible at the receptor | +6 dB |
| Impulsivity is highly perceptible at the receptor | +9 dB |

6.17 Due to the extremely industrial nature of the existing acoustic environment at the NSRs to the site it is highly unlikely that any potential sound of an impulsive nature would be perceptible at the NSRs, thus no penalty has been considered appropriate to be applied to the assessment. The facility is not expected to include any sound sources likely to produce sound of impulsive nature.

*Intermittency and Other Sound Characteristics*

6.18 Where the specific sound level features characteristics that are neither tonal nor impulsive, though otherwise are of an intermittent character, a penalty of 3 dB can be applied. Assuming that the proposed plant items are kept well maintained and serviced regularly, no further penalties are required for this assessment.

### Reference Time Periods

6.19 The appropriate reference time interval for assessing a sound source is dependent upon when it operates i.e. during the daytime or night-time. BS 4142:2014+A1:2019 determines the reference time interval as 1 hour during the day and 15 minutes at night. The proposed plant and machinery is proposed to operate during both daytime (07:00-23:00) and night-time hours (23:00-07:00), however only a night-time assessment has been undertaken as a worst case. The plant is assumed to operate for 100% of the reference time interval.

# 7 Results

## Assessment of Impacts

7.1 As detailed in Paragraph 4.7, the greater the rating level is above the background sound level, $L_{A90,T}$, the greater the significance of sound impact. The noise model has been used to determine the specific sound levels for night-time operational periods (assuming a typical operating scenario) at the NSRs as shown in **Table 8**.

7.2 The background sound level as detailed in **Table 4** have been used in the assessment. **Table 8** details the BS 4142:2014+A1:2019 assessment for the night-time operational hours at the NSRs. The assessment calculations have been based on the predicted free-field sound levels at each single point NSR location.

**Table 8: BS 4142:2014+A1:2019 Assessment – Night-time Operational Hours**

| Description | NSR | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| Specific Sound Level, dB $L_{Aeq,T}$ | 24 | 24 | 27 | 27 | 31 | 32 | 32 | 31 |
| Rating Level, dB $L_{Ar,Tr}$ | 24 | 24 | 27 | 27 | 31 | 32 | 32 | 31 |
| Background sound level, dB $L_{A90}$ | 49 | 49 | 49 | 49 | 45 | 45 | 45 | 45 |
| Rating Level – Background Sound Level | -25 | -25 | -22 | -22 | -14 | -13 | -13 | -14 |
| BS 4142:2014 Outcome | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated |

7.3 The assessment of the sound levels predicted at each of the NSRs indicates that any industrial sound from the proposed facility is likely to have a '**low impact'** at all of the NSRs as shown in **Figure 1**. Additional mitigation measures are therefore unlikely to be required.

7.4 It should also be noted that the existing acoustic environment includes existing commercial/industrial uses including the adjacent Poole Bakery. It is therefore considered that the proposed development would not be out of context with the existing use of the area, and therefore any potential impact of sound associated with the proposed development is likely to be less discernible at the NSRs.

### Boiler Assessment

7.5 The boiler unit has not been included in the calculation of the rating level as part of the BS 4142:2014+A1:2019 assessment as it will be housed within a building and therefore sound associated with this source will be negligible. It is understood that the sound pressure level for the boiler (excluding building) will be 70 dB at 1m. It is however anticipated that the boiler will run at a significantly reduced rate over a yearly period therefore the noise output may potentially be lower than considered in this assessment. The noise model has been used to predict the sound level for this source at the NSRs in order to determine the likely sound attenuation that the building will require to achieve in order to avoid adverse impacts. The boiler has been modelled as a point source assumed to be 3m above ground level. As details of the building are not decided at this stage the building has been excluded from the model calculation.

7.6 **Table 9** details the BS 4142:2014:2019 assessment including the boiler unit (unhoused), based on the assumptions above.

**Table 9: BS 4142:2014+A1:2019 Assessment – Night-time Operational Hours – With Boiler**

| Description | NSR | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| Specific Sound Level, dB $L_{Aeq,T}$ | 34 | 35 | 36 | 36 | 36 | 36 | 36 | 37 |
| Rating Level, dB $L_{Ar,Tr}$ | 34 | 35 | 36 | 36 | 36 | 36 | 36 | 37 |
| Background sound level, dB $L_{A90}$ | 49 | 49 | 49 | 49 | 45 | 45 | 45 | 45 |
| Rating Level – Background Sound Level | -15 | -14 | -13 | -13 | -9 | -9 | -9 | -8 |
| BS 4142:2014 Outcome | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated | Low impact indicated |

7.7 It can be seen from **Table 9** that the assessment of the sound levels at each of the NSRs indicates that any industrial sound from the proposed facility (including the boiler unit) is likely to have a '**low impact**' at all of the NSRs.

7.8 It is generally considered that in order to avoid sound from a proposed facility increasing the existing background sound level at the NSRs (background creep), predicted rating sound levels should be at least 10 dB(A) below the existing background sound level. Based on the assumptions made regarding the boiler source sound levels, the difference between the rating level and background sound level (as detailed in **Table 9**) demonstrates that sound levels from the boiler would need to reduce in the region of 2 dB(A) to achieve this. It is considered highly likely that the boiler house building will provide more than 2 dB(A) sound attenuation for the boiler unit.

7.9 Sound reduction is dependent on a number of factors including the mass of the build construction and the frequency of the sound. As an indication, typically, the sound reduction index for a 0.7mm single skin steel sheet construction will provide a weighted reduction of 24 dB $R_w$[1].

### Future Barrier Considerations

7.10 The proposed buildings as part of the commercial/industrial development at 30 Sterte Avenue are 8.2m[2] and 7.1 high[3]. The terraced industrial units are to be situated directly north of dwellings on Sterte Avenue, with the larger main industrial building further to the north west, closer to dwellings on Sterte Avenue West[4]. It is considered that these buildings would act as a barrier, providing significant screening benefits for sound associated with the CHP facility. It is considered that screening could reduce sound levels at the NSRs in the region of an additional 5-10 dB(A) dependant on the degree of partial/complete removal of line of sight to the facility.

[1] https://www.tatasteelconstruction.com/static_files/Tata%20Steel/content/Tools%20&%20Resources%20articles/Download%20Zone/Colorcoat/Colorcoat_Acoustic_TechPaper_FINAL.pdf

[2] Planning application APP/17/00443/F drawing 'Proposed Elevations – Suttles Unit', dated Feb 2016

[3] Planning application APP/17/00443/F drawing 'Proposed Elevations Units 1A, 1B & 1C', dated Feb 2016

[4] Planning application APP/17/00443/F drawing 'Site and Location Plan', dated Jan 2016

# 8 Best Available Techniques (BAT)

8.1 IPPC requires installations to be operated in such a way that all appropriate preventative measures are taken against pollution, in particular through the application of BAT. BAT applied to the proposed facility include:

- *CHP to be containerised;*
- *CHP positioned within area of the container which does not directly face the direction of the NSRs;*
- *Boiler unit to be within boiler house building;*
- *Screening provided by boiler house building for some proposed sound sources;*
- *Primary and secondary silencers to be fitted to the CHP exhaust;*
- *Attenuators to be fitted to air inlet and outlet fans;*
- *Regular maintenance of the facility should be undertaken in order to avoid any sound impacts occurring due to issues such as worn bearings, imbalance, eroded or clogged silencers; and*
- *Training should be provided for site personnel in relation to the proper use and maintenance of plant to minimise sound impacts.*

# 9 Conclusion

9.1 A sound assessment has been undertaken to assess the potential impact of sound upon the nearest NSRs as a result of a natural gas fired CHP plant, located at 10-20 Sterte Avenue in Poole.

9.2 The assessment has utilised measured baseline data from a survey undertaken by NCL in August 2019 at 2No. locations representative of the NSRs. Baseline measured data has been supplemented with observations at the monitoring locations.

9.3 The measured data obtained from the sound source survey was used to construct and calibrate a noise model using LimA software. The calibrated model has been used to predict the specific sound levels at each of the NSRs due to the operation of the proposed CHP plant, assuming a typical operating scenario.

9.4 The results from the model have been compared against the measured background sound level to determine the impact at each NSRs.

9.5 It has been demonstrated that the rating level from the proposed development is deemed to have a '**low impact**' at the NSRs, based on the assumptions of this assessment. On this basis, it is considered that additional mitigation measures are unlikely to be required.

9.6 The proposed CHP plant has applied BAT where possible in order to prevent adverse sound impacts occurring at the NSRs.

9.7 It is considered that further acoustic screening benefits (in the region of 5-10 dB(A)) could be provided by the proposed commercial/industrial buildings on land which lies directly between the site and the NSRs.

# 10 Glossary

| | |
|---|---|
| **dB** | Decibel. The logarithmically scaled measurement unit of sound. |
| **A-weighting** | Frequency weighting applied to measured sound in order to account for the relative loudness perceived by the human ear. |
| **$L_{Aeq,T}$** | A-weighted equivalent continuous sound level over a given time period. It is the sound level of a steady sound that has the same energy as a fluctuating sound over the same time period. |
| **$L_{A10,T}$** | The A-weighted sound level exceeded for 10% of the measurement period. It is widely used as a descriptor of road traffic noise. |
| **$L_{A90,T}$** | The A-weighted sound level exceeded for 90% of the measurement period. Often referred to as the background sound level. |
| **$L_{Amax}$** | The A-weighted maximum recorded noise level during a measurement period. |
| **$R_w$** | The weighted Sound Reduction Index which characterises the airborne sound insulation of a building element over a range of frequencies with a single number quantity. |
| **Ambient sound level, $L_a = L_{Aeq,T}$** | The A-weighted equivalent continuous sound level of the totally encompassing sound for a given situation and time interval, T. |
| **Residual sound level** | The A-weighted equivalent continuous ambient sound level remaining when the specific sound level has decreased to a degree in which it does not contribute to the ambient sound level. |
| **Specific sound level, $L_s = L_{Aeq,Tr}$** | The A-weighted equivalent continuous sound pressure level produced by the specific sound source at the reference location over a reference time interval, T |

| | |
|---|---|
| **Rating level, $L_{Ar,Tr}$** | The specific sound level plus any adjustment for the characteristic features of the sound. |

# 11 Appendices

A1 Sound Level Meter Specifications ..... 26
A2 Site Photographs ..... 29
A3 Measured Sound Levels ..... 30
A4 Sound Source and Model Data ..... 31

# A1 Sound Level Meter Specifications

ANV MEASUREMENT SYSTEMS

**CERTIFICATE OF CALIBRATION**

UKAS CALIBRATION 0653

**Date of Issue: 11 March 2019** **Certificate Number: UCRT19/1307**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory K. Mistry

Customer: Noise Consultants Ltd, 23 Coldharbour Road, Bristol, BS6 7JT

Order No. AQC 69

Description: Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

| *Manufacturer* | *Instrument* | *Type* | *Serial No. / Version* |
|---|---|---|---|
| Rion | Sound Level Meter | NL-52 | 00687044 |
| Rion | Firmware | | 2.0 |
| Rion | Pre Amplifier | NH-25 | 87199 |
| Rion | Microphone | UC-59 | 13563 |
| Rion | Calibrator | NC-75 | 35281145 |
| | Calibrator adaptor type if applicable | | NC-75-022 |

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

*Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*

Type Approved to IEC 61672-1:2002 YES Approval Number 21.21 / 13.02

*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003*

Date Received 08 March 2019 ANV Job No. UKAS19/03163

Date Calibrated 11 March 2019

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

| Previous Certificate | *Dated* | *Certificate No.* | *Laboratory* |
|---|---|---|---|
| | Initial Calibration | | |

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

# CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

**Certificate Number** UCRT19/1307



Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

| | | |
|---|---|---|
| SLM instruction manual title | Sound Level Meter | NL-42 / NL-52 |
| SLM instruction manual ref / issue | | 11-03 |
| SLM instruction manual source | | Manufacturer |
| Internet download date if applicable | | N/A |
| Case corrections available | | Yes |
| Uncertainties of case corrections | | Yes |
| Source of case data | | Manufacturer |
| Wind screen corrections available | | Yes |
| Uncertainties of wind screen corrections | | Yes |
| Source of wind screen data | | Manufacturer |
| Mic pressure to free field corrections | | Yes |
| Uncertainties of Mic to F.F. corrections | | Yes |
| Source of Mic to F.F. corrections | | Manufacturer |
| Total expanded uncertainties within the requirements of IEC 61672-1:2002 | | Yes |
| Specified or equivalent Calibrator | | Specified |
| Customer or Lab Calibrator | | Customers Calibrator |
| Calibrator adaptor type if applicable | | NC-75-022 |
| Calibrator cal. date | | 11 March 2019 |
| Calibrator cert. number | | UCRT19/1305 |
| Calibrator cal cert issued by | | 0653 |
| Calibrator SPL @ STP | 94.01 dB | Calibration reference sound pressure level |
| Calibrator frequency | 1000.00 Hz | Calibration check frequency |
| Reference level range | 25 - 130 dB | |

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

| Environmental conditions during tests | Start | End | | |
|---|---|---|---|---|
| Temperature | 22.44 | 22.84 | ± 0.40 | °C |
| Humidity | 34.6 | 35.5 | ± 3.00 | %RH |
| Ambient Pressure | 101.18 | 101.29 | ± 0.03 | kPa |

Response to associated Calibrator at the environmental conditions above.

| | | | | | |
|---|---|---|---|---|---|
| Initial indicated level | 93.9 | dB | Adjusted indicated level | 94.0 | dB |
| The uncertainty of the associated calibrator supplied with the sound level meter ± | | | | 0.10 | dB |

Self Generated Noise — This test is currently not performed by this Lab.

| | | | | |
|---|---|---|---|---|
| Microphone installed (if requested by customer) = Less Than | N/A | dB | A Weighting | |
| Uncertainty of the microphone installed self generated noise ± | N/A | dB | | |

Microphone replaced with electrical input device - UR = Under Range indicated

| Weighting | A | | | C | | | Z | | |
|---|---|---|---|---|---|---|---|---|---|
| | 11.1 | dB | UR | 15.4 | dB | UR | 21.4 | dB | UR |
| Uncertainty of the electrical self generated noise ± | | | | | | | 0.12 | dB | |

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel R 1

Additional Comments
None

MEASUREMENT SYSTEMS

# CERTIFICATE OF CONFORMANCE

| | |
|---|---|
| **Date of Issue** | **20 March 2018** |
| **Customer** | **Noise Consultants Ltd** |
| **Certificate Number** | **CONF031811** |

| | **Manufacturer** | **Type** | **Serial** |
|---|---|---|---|
| **Sound Level Meter** | Rion | NL-52 | 01176433 |
| **Preamplifier** | Rion | NH-25 | 76452 |
| **Microphone** | Rion | UC-59 | 12382 |

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 20 March 2018

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖹 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

# A2 Site Photographs

**Figure A2.1: Monitoring Location 1**

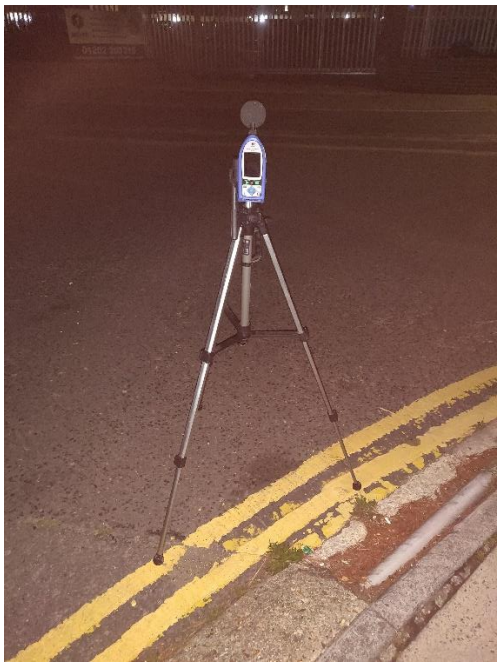
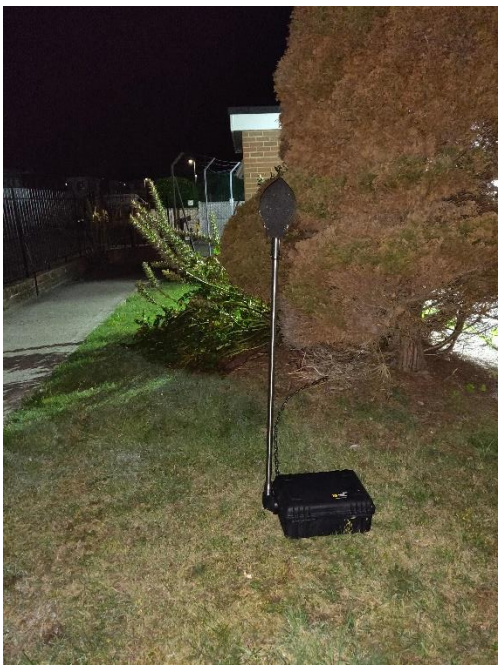


**Figure** A2.2**: Monitoring Location 2**



# A3 Measured Sound Levels

**Table A10: Measured Sound Levels at M1**

| Start Time | Measurement Duration | dB $L_{Aeq, 15min}$ | dB $L_{Amax}$ | dB $L_{A10, 15min}$ | dB $L_{A90, 15min}$ |
|---|---|---|---|---|---|
| 02/08/2019 01:49:31 | 00:15:00 | 49.5 | 53.9 | 49.9 | 49.1 |
| 02/08/2019 02:04:31 | 00:15:00 | 49.6 | 62.1 | 50 | 49.2 |
| 02/08/2019 02:19:31 | 00:15:00 | 49.3 | 53.2 | 49.7 | 48.9 |
| 02/08/2019 02:34:31 | 00:15:00 | 49.4 | 55.0 | 49.8 | 49.0 |

**Table A11: Measured Sound Levels at M2**

| Start Time | Measurement Duration | dB $L_{Aeq, 15min}$ | dB $L_{Amax}$ | dB $L_{A10, 15min}$ | dB $L_{A90, 15min}$ |
|---|---|---|---|---|---|
| 02/08/2019 01:45:00 | 00:15:00 | 45.4 | 48.2 | 45.9 | 45.0 |
| 02/08/2019 02:00:00 | 00:15:00 | 45.6 | 56.7 | 46.0 | 45.1 |
| 02/08/2019 02:15:00 | 00:15:00 | 45.6 | 56.3 | 46.1 | 45.0 |
| 02/08/2019 02:30:00 | 00:15:00 | 45.6 | 58.3 | 45.6 | 44.9 |
| 02/08/2019 02:45:00 | 00:15:00 | 46.0 | 59.2 | 46.3 | 45.2 |

# A4 Sound Source and Model Data

**Table A12: Sound Source Descriptions**

| Model Source Ref. | Description |
|---|---|
| LT Rad - Fan | Discharge Air Controller - 4 Fan Unit - Friga-bohn FC SN 08D P04 A4 – 1C – 84V |
| HT Rad Fan | Discharge Air Controller - 6 Fan Unit - Friga-bohn FCH SN 08Y P06 B2 – 1C – 100V |
| CHP Doors East | CHP Container Doors – Eastern façade |
| CHP Doors West | CHP Container Doors – Western façade |
| CHP Doors North | CHP Container Doors – Northern façade |
| CHP South | CHP Container Southern façade |
| chp east 1 | CHP Container eastern façade – south of doors |
| chp west 1 | CHP Container western façade – south of doors |
| chp west 2 | CHP Container western façade – north of doors |
| chp east 2 | CHP Container eastern façade – north of doors |
| CHP East above door | CHP Container – Section above doors on eastern façade |
| CHP west above door | CHP Container – Section above doors on western façade |
| CHP above north door | CHP Container – Section above doors on northern façade |
| CHP N - East of door | CHP Container – Northern façade, east of doors |
| CHP N - west of door | CHP Container – Northern façade, west of doors |
| Secondary silencer 1 | Exhaust gas line – section 1 |
| Secondary silencer 2 | Exhaust gas line – section 2 |

| Model Source Ref. | Description |
|---|---|
| Secondary silencer 3 | Exhaust gas line – section 3 |
| Sec silencer stack | Stack – 15m high above ground level |
| CHP Roof | CHP Container Roof |
| Air outlet | Air outlet including attenuator |
| Air inlet | Air Inlet including attenuator |

**Table A13: LimA Attribute Descriptions**

| LimA Attribute | Description | Possible Content | Content Definition |
|---|---|---|---|
| IND | Model Source Name | String | - |
| RQ | Defined the Geometry type of the industrial source | 0 | Point Source |
| | | 1 | Line Source |
| | | 2 | Area Source (on ground or roof) |
| | | 3 | Vertical Area Source on Façade |
| PD | Emission level of the industrial source | -1 | Use the octave band values from the spectral data to determine the emission level |
| | | Any number above 0 | Use as an average sound power level and adjust the octave band values from the spectral data accordingly |
| | | *x* V (where *x* is any value above 0) | Use as an average sound power level and adjust the octave band values from the spectral data accordingly |

| LimA Attribute | Description | Possible Content | Content Definition |
|---|---|---|---|
| Z | Height of source | *x* R (where *x* is the height of the source in m) | Defines the height of the source relative to the ground |
| | | *x* D (where *x* is the height of the source in m) | Defined the height of a source relative to the top of a structure (such as a building or a bridge) |
| FRK | Provides a link to the database that holds the octave band emission data. During the calculation the given spectrum will be adjusted to the total emission calculated from the PD attribute and (if applicable) any time information | String | Name of the octave band emission data within the database |

**Table A14: Sound Source Spectral Data**

| Source | Spectrum Identification (FRK) | Sound Level | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|---|---|---|
| LT Rad - Fan | LT RAD - 4 FAN UNIT | 77 dB(A) Lw | 49 | 62 | 67 | 71 | 74 | 68 | 62 | 65 |
| HT Rad Fan | HT RAD - 6 FAN UNIT | 74 dB(A) Lw | 41 | 52 | 59 | 61 | 65 | 62 | 58 | 49 |
| Secondary silencer 1 | SECONDARY SILENCER | noise reduced outlet of the secondary silencer at 10m | 40.3 | 41.1 | 33 | 12 | 0 | 0 | 33.5 | 32.7 |
| Secondary silencer 2 | SECONDARY SILENCER | noise reduced outlet of the secondary silencer at 10m | 40.3 | 41.1 | 33 | 12 | 0 | 0 | 33.5 | 32.7 |
| Secondary silencer 3 | SECONDARY SILENCER | noise reduced outlet of the secondary silencer at 10m | 40.3 | 41.1 | 33 | 12 | 0 | 0 | 33.5 | 32.7 |
| Sec silencer stack | SECONDARY SILENCER | noise reduced outlet of the secondary silencer at 10m | 40.3 | 41.1 | 33 | 12 | 0 | 0 | 33.5 | 32.7 |
| Air outlet* | AIR OUTLET | 65 dB(A) at 1m | 73 | 85 | 93 | 98 | 100 | 99 | 96 | 90 |

| Source | Spectrum Identification (FRK) | Sound Level | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Air inlet* | AIR OUTLET | 65 dB(A) at 1m | 73 | 85 | 93 | 98 | 100 | 99 | 96 | 90 |
| *Assumed spectrum is frequency band per fan within the container in the absence of an external spectrum being available | | | | | | | | | | |

**Table A15: Sound Source Spectral Data for CHP**

| Item | Octave Band Value (dB) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| Undampened engine sound pressure level (1m distance to outlet within 90 degrees plus 3dB(A) for total A-weighted level tolerance **(dB lin)** | 78.1 | 86.0 | 88.4 | 93.6 | 92.3 | 89.8 | 87.9 | 98.1 |
| Undampened engine sound level – A-weighted **(dBA)** | 51.9 | 69.9 | 79.8 | 90.4 | 92.3 | 91.0 | 88.9 | 97.0 |
| SRI of container | 23 | 18 | 30 | 40 | 38 | 46 | 44 | 44 |
| A-weighted sound pressure level at 1m (rounded to the nearest dB) **(dBA)** | 29 | 52 | 50 | 50 | 54 | 45 | 45 | 53 |
| Note: All sound sources relating to the containerised CHP have been calibrated at a distance of 1m from each façade based on the data presented within this table | | | | | | | | |

A4.1 The relevant spectrum identification for each CHP sound source is detailed in the table below for reference.

**Table A16: Spectrum Identification References for CHP Sound Sources**

| Source | Spectrum Identification (FRK) |
|---|---|
| CHP Doors East | 12V4000CHP SIDE DOOR |
| CHP Doors West | 12V4000CHP SIDE DOOR |
| CHP Doors North | 12V4000CHPNORTHDOOR |
| CHP South | 12V4000 CHP SOUTH |

| Source | Spectrum Identification (FRK) |
|---|---|
| chp east 1 | 12V4000 CHP |
| chp west 1 | 12V4000 CHP |
| chp west 2 | 12V4000 CHPSHORT |
| chp east 2 | 12V4000 CHPSHORT |
| CHP East above door | 12V4000 ABOVE DOOR |
| CHP west above door | 12V4000 ABOVE DOOR |
| CHP above north door | 12V4000 ABOVE DOOR N |
| CHP N - East of door | 12V4000 N -EAST DOOR |
| CHP N - west of door | 12V4000 N -WEST DOOR |
| CHP Roof | 12V4000 CHP ROOF |

**Table A17: Modelled Proposed Building Corner Grid References**

| Building | X (Easting) | Y (Northing) |
|---|---|---|
| CHP Container | 400887.85 | 91787.94 |
| | 400890.40 | 91789.69 |
| | 400897.08 | 91779.69 |
| | 400894.64 | 91778.00 |
| Boiler House | 400904.26 | 91787.87 |

| Building | X (Easting) | Y (Northing) |
|---|---|---|
| | 400897.57 | 91783.38 |
| | 400901.99 | 91776.80 |
| | 400908.82 | 91781.29 |

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Noise CONSULTANTS

# Technical Note:
# Revised Site Layout - Poole CHP Plant, Dorset

December 2019

Experts in noise and vibration assessment and management

## Document Control

| | | | |
|---|---|---|---|
| **Client** | Basepower Ltd | **Principal Contact** | Robin Hardy |

| | |
|---|---|
| **Job Number** | J1088 |

| | |
|---|---|
| **Report Prepared By:** | Natalie Goward (Principal Consultant) |

Document Status and Review Schedule

| Report No. | Date | Status | Reviewed by |
|---|---|---|---|
| J1088A/1/F1 | 20 December 2019 | Final | George Gibbs (Associate Director) |

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# 1 Introduction

## Background

1.1 Noise Consultants Ltd ('NCL') carried out an assessment in November 2019 (report ref. J1088A/1/F1 dated 14 November 2019) to assess the potential impact of sound upon the nearest noise sensitive receptors (NSRs) as a result of a proposed natural gas fired Combined Heat and Power (CHP) plant (the 'facility'), located at 10-20 Sterte Avenue in Poole, Dorset, BH15 2AS (the 'site').

1.2 The assessment was prepared in support of the Environmental Permit application (EPR/PP3503BZ/A001) to be submitted to the Environment Agency (EA). The site will be operated by Poole Sustainable Energy Limited as a Directly Associated Activity (DAA) to the adjacent bakery and Stationary Technical Unit (STU) (existing Permit EPR/EP3639WV).

1.3 The assessment sets out the results of a baseline sound survey and addresses the likely impacts of sound associated with the proposed development on the surrounding area during the operational phase, in accordance with BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' (BS 4142:2014+A1:2019).

1.4 The November 2019 assessment demonstrates that the rating level from the proposed development is deemed to have a '**low impact**' at the NSRs, based on the assumptions of the assessment. On this basis it was considered that additional mitigation measures are unlikely to be required.

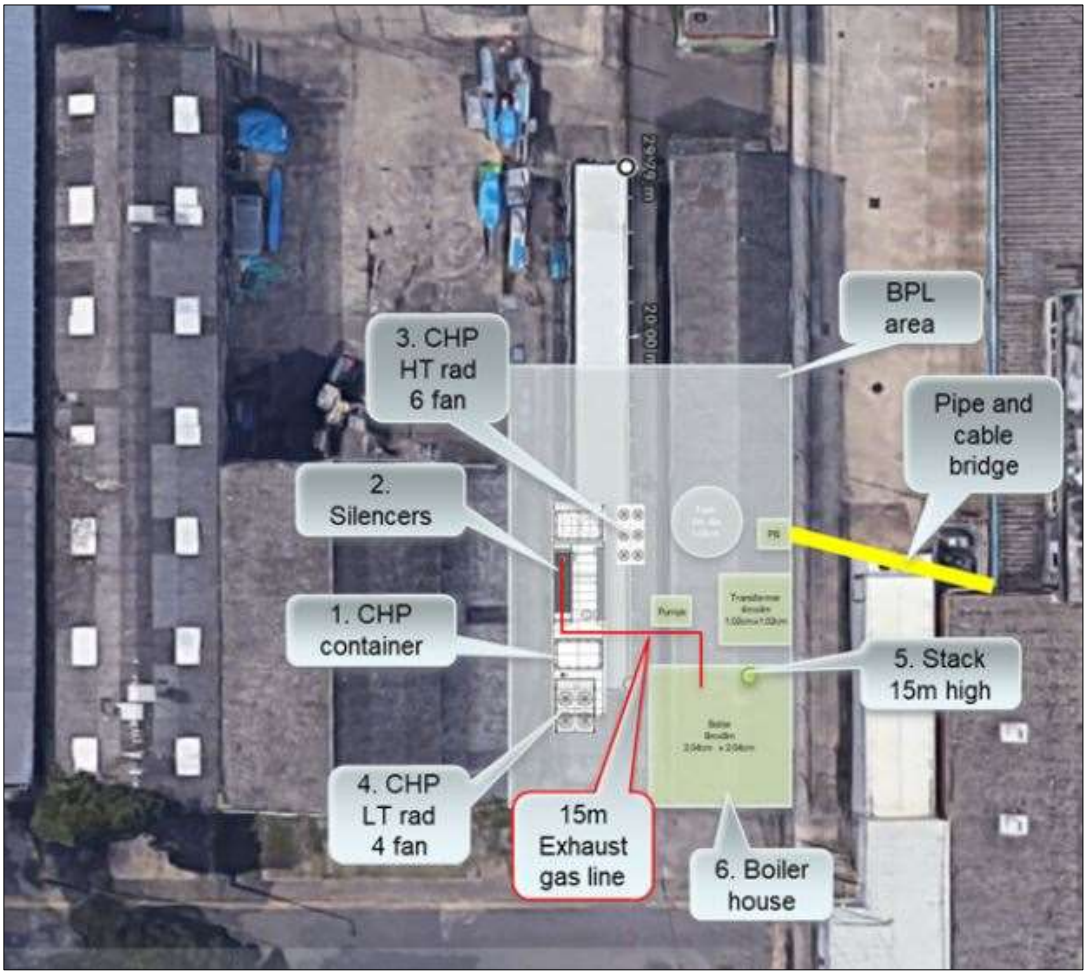
## Purpose of Technical Note

1.5 This technical note considers the likely changes to the conclusions of the November 2019 assessment due to recent revisions to the site layout.

# 2 November 2019 Site Layout

2.1 The site layout as considered in the November 2019 assessment is shown in Error! Reference source not found. for reference.

**Figure 1: November 2019 Site Layout**

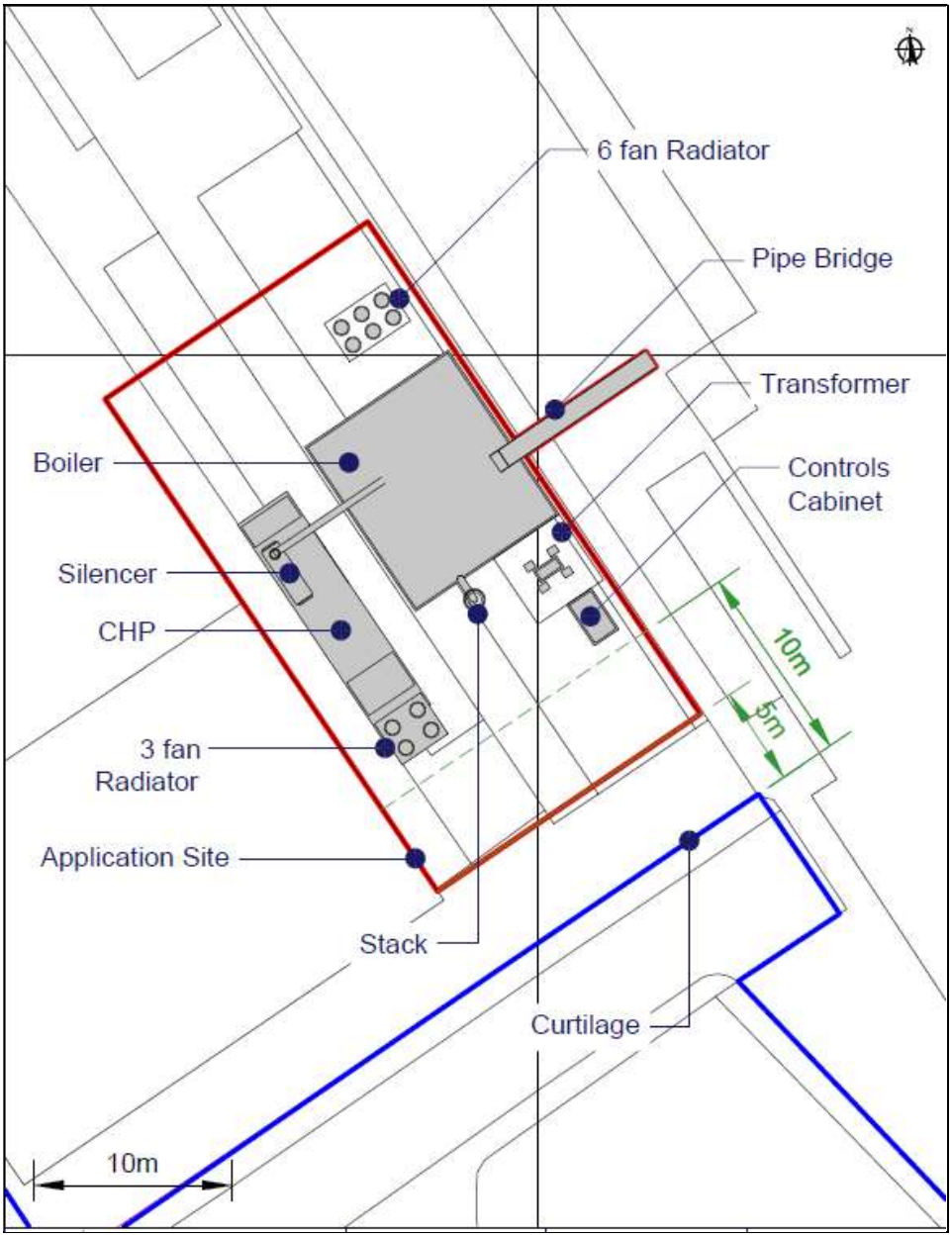


# 3 Revised Site Layout

3.1 In the revised site layout all sound sources have moved further to the north west, increasing the separation distance to the NSRs. The most notable change to the site layout is relocating the boiler house approximately 8m to the north west. The 6 fan radiator unit has moved to the north west, behind the boiler house.

3.2 The revised site layout is shown in **Figure 2**.

**Figure 2: Revised Site Layout**



# 4 Conclusions

4.1 Due to the changes in the site layout it is considered that this will result in a change to the predicted sound levels at the NSRs as previously calculated in the noise model (as shown in Section 7 of the November 2019 report). Comparing the two site layouts, it is considered likely that these changes will result in lower predicted sound levels at the NSRs. This conclusion is based on the increased separation distance between sound sources and NSRs, and due to the 6 fan radiator now being fully screened by the boiler house.

4.2 It is considered likely that the revised site layout will not change the overall conclusions of the November 2019 assessment, and that any industrial sound from the proposed facility is therefore likely to have a '**low impact**' at all NSRs. On this basis it is considered that additional mitigation measures are unlikely to be required.

# APPENDIX C – CLIMATE CHANGE RISK ASSESSMENT

## South west England river basin district: climate change risk assessment worksheet

Name (as on your part A application form): **Poole CHP Plant**

Our permit reference number (if you have one): **EPR/PP3503BZ/A001**

Your document reference number: **ECCS.115.008.R.002.A_ERA_Final**

## Risk assessment worksheet for the 2050s

South west England river basin district

You must carry out a climate change risk assessment for any new bespoke waste and installations permit applications if you expect to operate for more than 5 years. Use the user guide to complete the table. You can add in extra pages if necessary.

Consider how your operations will be affected by the changes in weather and climate described in the table. Consider any changes to average climate conditions that may impact on your operations, for example extreme rainfall.

Also consider:

- critical thresholds - where a 'tipping point' is reached, for example a specific temperature where site processes cannot operate safely
- changes to averages - for example an entire summer of higher than expected rainfall causing waterlogging
- where hazards may combine to cause more impacts

You can add in other climate variables if you wish.

If you have stated on your application form that you do not expect to be operational in 2050, you must still consider climate change risks for the time you do intend to operate. Whilst the variables are for the 2050s, this is an estimated date and you may experience these conditions before then.

This worksheet will sit in your management system. It must appear on the management system summary you submit with your application, even if you do not need to submit the whole risk assessment with your application.

If your pre-mitigation risk score (column D) is 5 or higher, you must complete columns E to H.

| **Potential changing climate variable** | **A**<br>**Impact** | **B**<br>**Likelihood** | **C**<br>**Severity** | **D**<br>**Risk**<br>(B x C) | **E**<br>**Mitigation**<br>(what will you do to mitigate this risk) | **F**<br>**Likelihood**<br>(after mitigation) | **G**<br>**Severity**<br>(after mitigation) | **H**<br>**Residual risk**<br>(F x G) |
|---|---|---|---|---|---|---|---|---|
| 1. Summer daily maximum temperature may be around 7°C higher compared to average summer temperatures now. | Potential for excess strain placed on engine cooling system. If engine gets too hot – automated emergency stop triggered - keeping any operational heat within the genset, with a possibility of Gen-set overheating and causing damage to components | 3 | 3 | 9 | SCADA system will continuously monitor operational temperature of Gen-set to ensure plant operates within safe temperature operating envelop.<br>Plant control philosophy will include Standard Stop – that will issue a stop sequence which puts the engine into cool down stop mode – the engine will run down to the configured cool setting, then shut down in a controlled manner<br>Install additional cooling system if required in future | 2 | 1 | 2 |
| 2. Winter daily maximum temperature could be 4°C more than the current average. | No negative impact expected | N/a | N/a | N/a | N/a | N/a | N/a | N/a |
| 3. The biggest rainfall events are up to 20% more intense than current extremes (peak rainfall intensity)*. | Surface water drainage system overloaded | 3 | 2 | 6 | Keep a log of extreme rainfall events.<br>Ensure drains are kept free flowing and free of debris | 2 | 2 | 4 |
| 4. Average winter rainfall may increase by 41% on today's averages. | Surface water drainage system overloaded | 3 | 2 | 6 | Keep a log of extreme rainfall events.<br>Ensure drains are kept free flowing and free of debris | 2 | 2 | 4 |
| 5. Sea level could be as much as 0.6m higher compared to today's level *. | Surface water drainage system overloaded, site and access roads flooded from rise in water levels within Poole Harbour | 3 | 3 | 9 | Keep a log of extreme rainfall events.<br>Monitor permanent change to Poole Harbour Water Levels and plan for flood defences as appropriate | 2 | 2 | 4 |
| 6. Drier summers, potentially up to 45% less rain than now. | No negative impact expected | N/a | N/a | N/a | N/a | N/a | N/a | N/a |
| 7. At its peak, the flow in watercourses could be 40% more than now, and at its lowest it could be 80% less than now. | Surface water drainage system overloaded | 3 | 2 | 6 | Keep a log of extreme rainfall events.<br>Ensure drains are kept free flowing and free of debris | 2 | 2 | 4 |

*Indicates data has come from climate change allowances as part of the spatial planning process. Evidence from your planning submission is acceptable evidence for this worksheet.

# APPENDIX D – AIR QUALITY ASSESSMENT

# Air Quality Assessment for Environmental Permit:

Poole CHP Plant, Poole

Sustainable Energy Ltd

December 2019

Experts in air quality management & assessment

## Document Control

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| **Client** | BasePower | **Principal Contact** | Robin Hardy; Lucinda Hall (EC Consultancy Services Ltd) |

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| **Job Number** | J3900 |

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| **Report Prepared By:** | Tom Richardson and Paul Outen |

Document Status and Review Schedule

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## Contents


1 Introduction ..... 2
2 Site Description ..... 4
3 Description of Process ..... 7
4 Environmental Standards for Air ..... 10
5 Baseline Conditions ..... 12
6 Modelling Methodology ..... 18
7 Assessment Approach ..... 29
8 Results ..... 30
9 Discussion ..... 36
10 Conclusions ..... 37
11 References ..... 39
12 Appendices ..... 40
A1 Engine Technical Data ..... 41
A2 Wind Roses – Bournemouth Airport ..... 43
A3 100th Percentile of 1-hour Mean PCs ..... 46
A4 ADMS-Roads Modelling Methodology ..... 47

# 1 Introduction

1.1 This report describes the air quality assessment for the Combined Heat and Power (CHP) and boiler plant at Poole Sustainable Energy Ltd. in Poole, Dorset. The assessment has been prepared to support the Bespoke Environmental Permit application for the facility, which is made in accordance with the Environmental Permitting Regulations (EPR)[1]. The assessment has been carried out by Air Quality Consultants Ltd on behalf of BasePower.

1.2 The facility comprises a combined heat and power (CHP) generator, and a backup boiler, both of which are powered by natural gas. No suitable Standard Rules Permits are available. The Environment Agency (EA) Specified Generator Screening Tool has been run, and the outcome is that a Bespoke Environmental Permit is required. The detailed modelling, which a Bespoke Environmental Permit requires, is described in this report.

1.3 The assessment focuses on nitrogen dioxide ($NO_2$) for human health, and on nitrogen oxides (NOx), nitrogen deposition and acid deposition for ecological impacts. These are the principal pollutants of concern with respect to emissions from natural-gas fired CHP plant. Natural gas-fired plant will not have significant emissions of other pollutants like particulate matter, sulphur dioxide or volatile organic compounds, and emissions of carbon monoxide are considered to be small compared to the environmental standards and not warranting assessment.

1.4 Table 1 gives the site location. Table 2 summarises the modelled scenarios and sensitivity tests that have been carried out.

1.5 The Specified Generator Screening Tool and model input files have been packaged as a zip file and sent alongside this report.

**Table 1: Site Location**

| Parameter | Entry |
|---|---|
| **Site Name** | Poole CHP Plant |
| **Site Address** | 10-20 Sterte Avenue, Poole, BH15 2AS |
| **Grid Reference (of point of release) (OS X,Y)** | 400897, 91787 |

[1] The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 Statutory Instrument 2018 No.110.

**Table 2: Summary of Model Scenarios and Sensitivity Tests**

| Parameter | Entry |
|---|---|
| **Year for Baseline Conditions** | Most recent year of available measurements/predictions – no improvement assumed into the future (see Section 5) |
| **Operating Hours** | CHP is assumed to operate for 8,760 hours per year (i.e. continuous use); boiler is assumed to run at full capacity. The dispersion model has been run assuming continuous operation. Short-term outputs have assumed constant operation and are thus worst-case (see Paragraphs 6.23 and 6.24) |
| **Meteorological Conditions** | Five years of meteorological data used. Each modelled separately. Receptor-specific maxima out of the five years are reported (see Section 6) |
| **Building Wake Effects** | Model run with and without nearby buildings. Receptor-specific maxima from the two tests are reported (see Section 6) |

# 2 Site Description

## Nearby Sensitive Features

2.1 The facility is located in Sterte, approximately 1.2 km north of Poole town centre. Figure 1 shows the site location, and 2 km and 10 km distance lines from the site. It also shows the model domain (which is described further in Section 6). The local authority Air Quality Management Areas (AQMAs) and designated ecological sites are also shown. Table 3 summarises the proximity of nearby sensitive features.

2.2 Based on publicly-available information, there are no known permitted Specified Generator arrays operating within 1 km of the site.

**Table 3: Summary of Nearby Sensitive Features**

| Feature | Description | Distance from Stack |
|---|---|---|
| **Nearest roadside human receptor** | Residential property on B3093 Wimborne Road | 735 m |
| **Nearest non-roadside human receptor** | Residential property at 75 Sterte Avenue West | 85 m |
| **Nearest SAC, SPA, Ramsar site or SSSI** | Poole Harbour SSSI / Ramsar / SPA | 285 m |
| **Receptors within the downwash cavity length from the nearest edge/side of the building?** | There are no receptors downwind of the building within the region of potential downwash effects (26 m) | N/A |
| **Sensitive receptor setting** | Suburban | N/A |
| **Sensitive receptors near an A road or motorway network?** | Yes (ecological receptors only) | 285 m |
| **Sensitive receptors within an AQMA declared for $NO_2$?** | No | N/A |

## Topography and Terrain

2.3 Figure 2 describes the terrain across the modelled study area using Ordnance Survey (OS) Terrain data. The area immediately surrounding the site is broadly flat, such that the base of the stack is approximately at the same elevation as the base of the on-site buildings and nearest human health receptors.

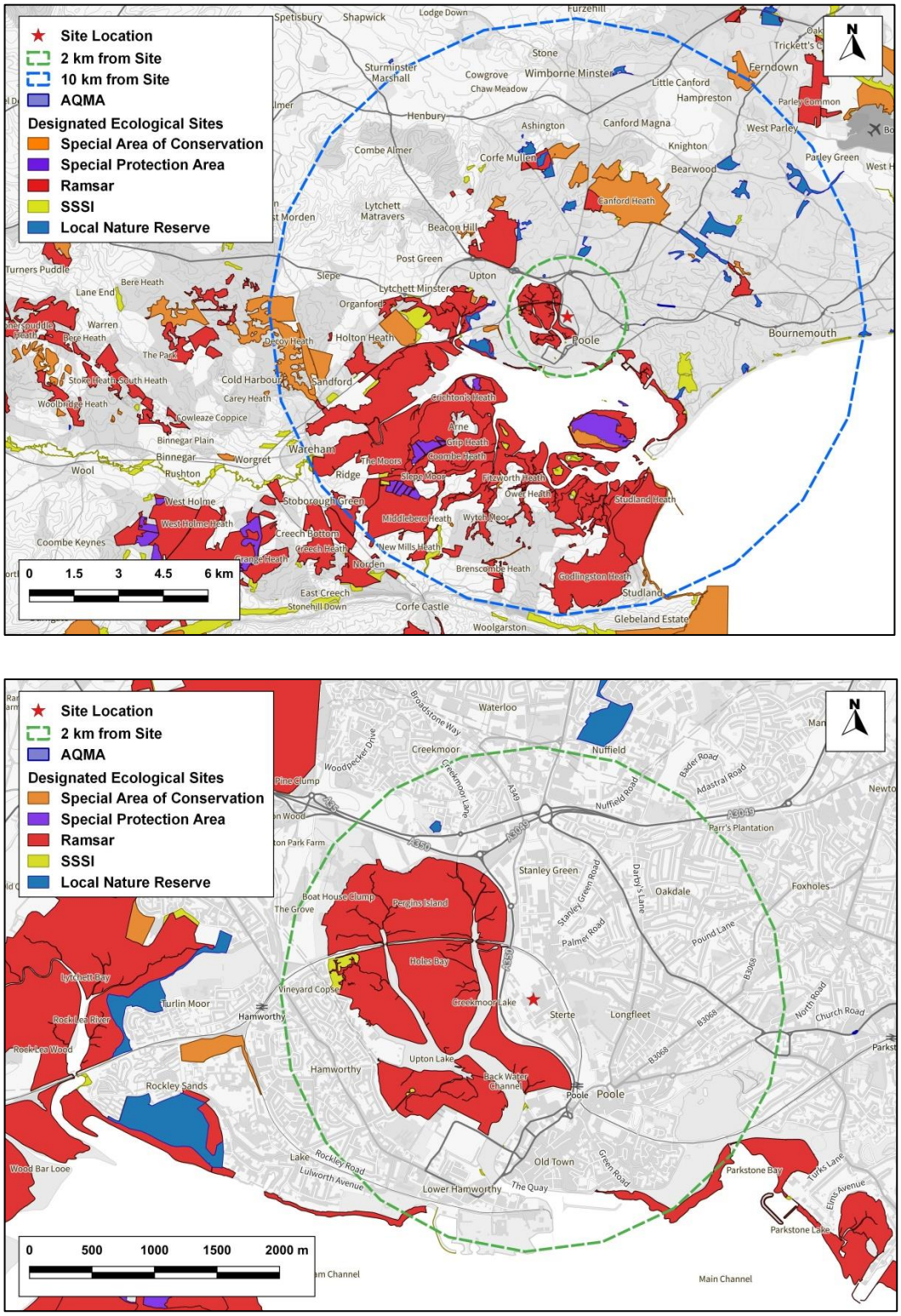


**Figure 1: Site Location, AQMAs and Designated Ecological Sites: Top) Wider Area; Bottom) Area Close to Application Site**

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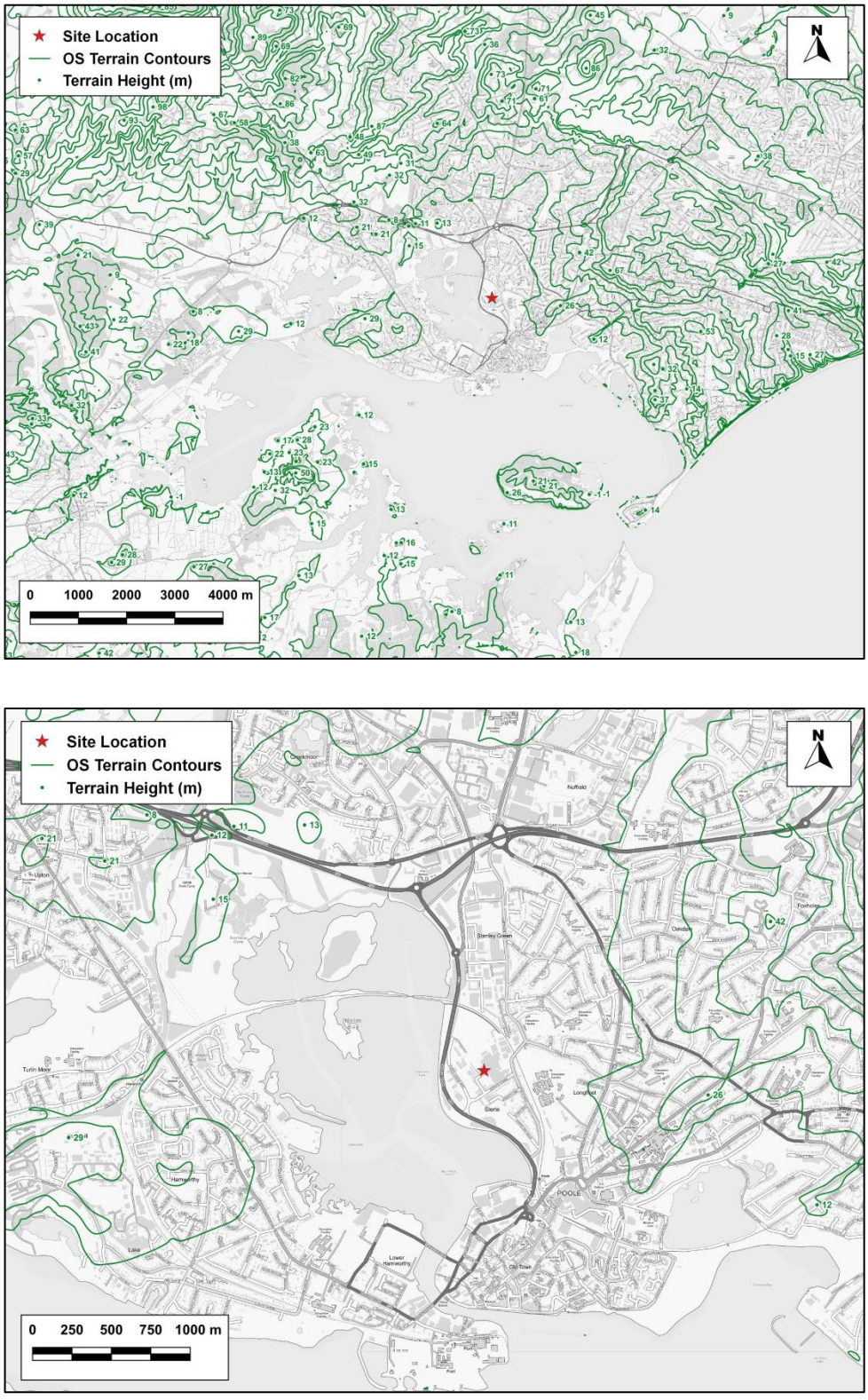


**Figure 2: Terrain Contours: Top) Wider Area; Bottom) Area Close to Application Site**

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# 3 Description of Process

## Overview of Plant Requiring Permit

3.1 The facility comprises one Onsite Energy MTU 12V4000 GS CHP generator and one Yorkshireman Low NOx boiler, both powered by natural gas. The combustion gases will be exhausted from individual, vertical flues for each engine. The stacks are 15 m high.

3.2 The CHP is assumed to operate for up to 8,760 hours per year, and has a net thermal input capacity of ~3,175 $kW_{th}$ (~3,517 $kW_{th}$ gross thermal input, ~1,285 $kW_e$ electrical power output). The boiler is assumed to operate at its maximum output at 100% load, and has a net thermal input capacity of ~2,334 $kW_{th}$ (~2,585 $kW_{th}$ gross thermal input). Figure 3 shows the site plan and layout. Plant details are given in Table 4 and Table 5.

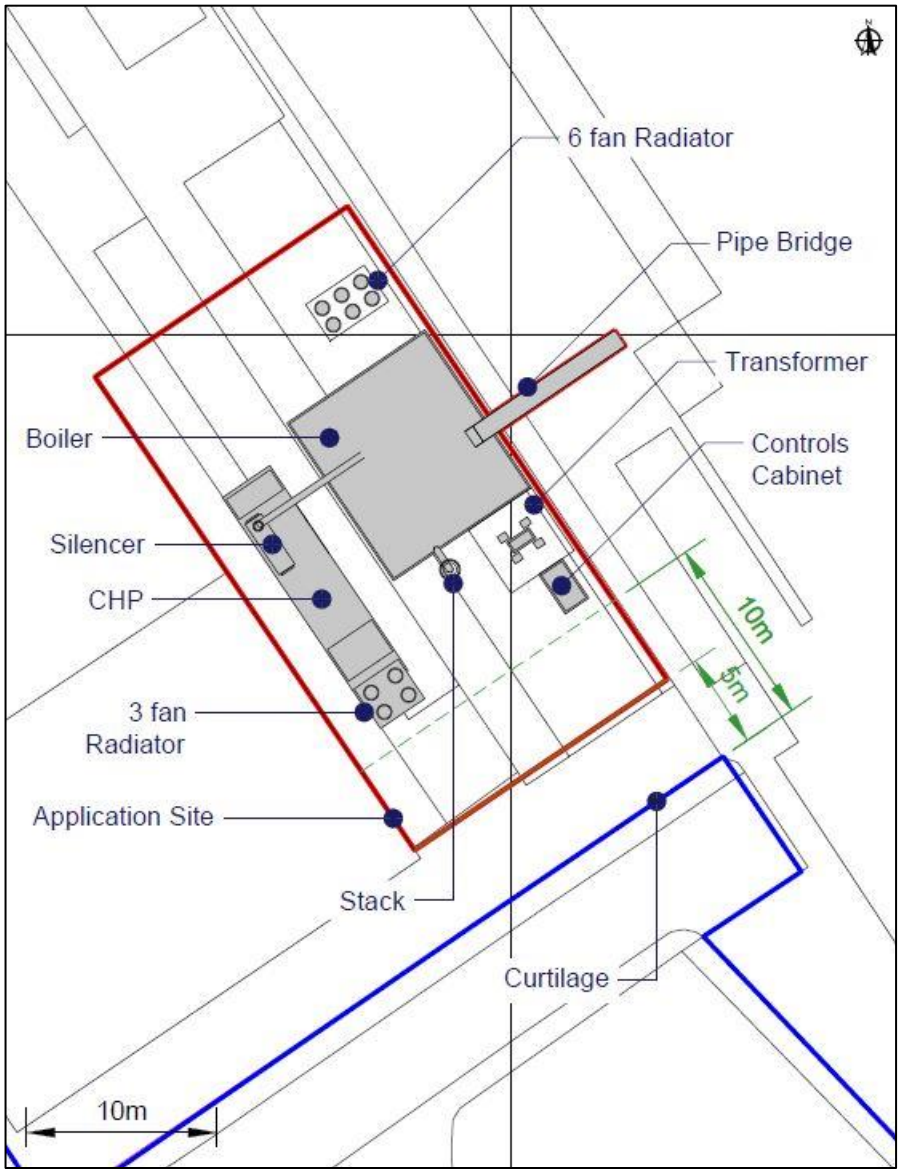


**Figure 3: Site Layout**

Contains data from Castellum Consulting, drawing B1-13-19-03v3 Site Layout Plan.

**Table 4: Plant Information**

| Parameter | CHP | Boiler |
|---|---|---|
| **Specified generator usage type category** | CHP | N/A |
| **Mixed Tranche A and B Specified Generator site?** | No | |
| **Specified generators aggregated rated thermal input** | 5,509 | |
| **Operational hours per year** | 8,760 | |
| **If 'Peaking' or 'Balancing', is rolling average flexibility required?** | No | |

| | | |
|---|---|---|
| **Existing or new medium combustion plant generators?** | New | |
| **Do the generators have secondary abatement fitted?** | No | |
| **Emission Limit Value (273 K, dry)** | 95 mg/Nm$^3$ [a] | 100 mg/Nm$^3$ [b] |

[a] At 15% $O_2$.

[b] At 3% $O_2$.

**Table 5: Stack and Building Information**

| Parameter | CHP | Boiler |
|---|---|---|
| **Stack height** | 15 m | |
| **Internal flue diameter at point of release** | 0.4 m | 0.34 m |
| **Is there one or more buildings within 5L and with heights more than 40% of the stack height?** | Yes | |
| **Height of tallest building within 5L** | 7 m | |
| **Length of tallest building within 5L** | 170 m | |
| **Width of tallest building within 5L** | 80 m | |

## Additional Details

3.3 Natural gas will be supplied to the site through mains supply. There are no other on-site combustion plant.

## Operating Conditions

3.4 The CHP plant operates up to 8,760 hours per year for the purposes of electricity, heat and steam generation. Heat from the engine is captured from both the engine jacket and exhaust; the jacket heat is captured in the form of hot water which is stored in a hot water buffer vessel; and the exhaust heat is used to generate steam. The heat and hot water are utilised across several parts of the adjacent Poole Bakery site, before returning to the energy plant cooler. Electricity from the engine is used to power the Poole Bakery site, with an additional connection to the National Grid for surplus.

3.5 The boiler plant operates when demand for heat cannot be met by the CHP alone, for example due to planned downtime or maintenance, which is expected to be limited to only a few hours a year. The initial information from the applicant suggests that the boiler will need to service a total annual heat demand equivalent to 3.5% of its potential total annual thermal output. However, for the purposes of this application, the modelling set out in this assessment assumes the boiler will operate at 100% of its total annual thermal output capacity at full load (i.e. for 8,760 hours per year at full load).

# 4 Environmental Standards for Air

4.1 The relevant Air Quality Standards (AQS) for human health impacts are set out in Table 6 (EA, 2018b). Table 7 sets out the relevant critical levels and critical loads for the designated ecological sites in the study area, as taken from the Air Pollution Information System (APIS) website (APIS, 2019).

**Table 6: AQS for Human Health**

| Pollutant | Averaging Period | AQS (µg/m$^3$) | Acceptable Exceedance Criteria |
|---|---|---|---|
| $NO_2$ | Annual Mean | 40 | Zero exceedances |
| | 1-hour | 200 | Not to be exceeded more than 18 times a year |

**Table 7: AQS for Designated Ecological Sites**

| Site | Maximum 24-hour Mean NOx | Annual Mean | | |
|---|---|---|---|---|
| | | NOx | Nutrient Nitrogen Deposition | Acid Deposition [a] |
| Poole Harbour (SPA/Ramsar) | 75 µg/m$^3$ | 30 µg/m$^3$ | 8 kgN/ha/yr | 0.586 keq/ha/yr [b] |
| Poole Harbour (SSSI) | | | 10 kgN/ha/yr [b] | 0.558 keq/ha/yr |
| Dorset Heathlands (SPA/Ramsar) | | | 5 kgN/ha/yr | 0.842 keq/ha/yr |
| Dorset Heaths (SAC) | | | 10 kgN/ha/yr | 0.553 keq/ha/yr |
| Dorset Heaths (Purbeck and Wareham) and Studland Dunes (SAC) | | | 5 kgN/ha/yr | 0.558 keq/ha/yr |
| Millfields Pond (Local Nature Reserve) | | | 10 kgN/ha/yr | - [c] |

[a] MinCLMaxN

[b] For the purposes of this assessment, the more stringent critical load values for Poole Harbour have been used regardless of designation.

[b] No relevant critical load.

4.2 The AQS for $NO_2$ are defined as UK objectives within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002). The same numerical values are also set as European Limit values (The European Parliament and the Council of the European Union, 2008).

4.3 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2018). The

annual mean objectives are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values and specific monitor- and receptor-siting requirements apply. Neither the objectives nor limit values apply in places of work where members of the public have no free access and where relevant provisions concerning health and safety at work apply (AQC, 2016).

4.4 The AQS for designated ecological sites apply within the boundary of each designated site.

# 5 Baseline Conditions

## Human Health

5.1 Figure 4 sets out the background annual mean $NO_2$ concentrations in the study area taken from Defra's published maps for 2019 (Defra, 2019a). It also shows the $NO_2$ diffusion tube monitoring locations operated by the Borough of Poole. Measurements for the year 2018, the most recent year available, are tabulated in Table 8. These include mostly roadside and kerbside sites, and one background site; measurements at the roadside and kerbside sites are higher than those at the background site.

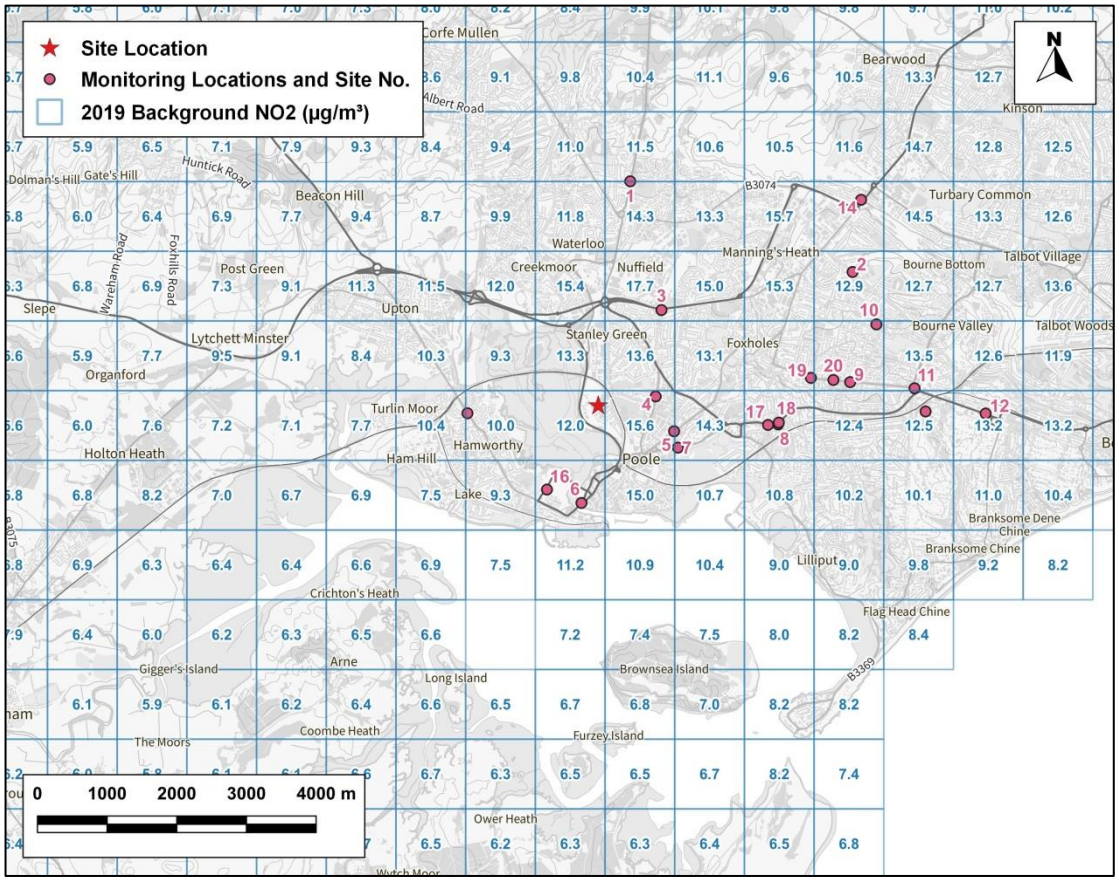


**Figure 4: Defra's Predicted $NO_2$ Background Concentrations, and Measured Annual Mean $NO_2$ Concentrations in the Area Surrounding the Site (µg/m$^3$)**

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**Table 8: Summary of $NO_2$ Monitoring (2014-2018) [a]**

| Site No. | Site Type | Location | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| **Diffusion Tubes - Annual Mean (µg/m$^3$) [b]** | | | | | | | |
| **1** | Kerbside | Gravel Hill | 33.7 | 26.4 | 27.6 | 25.9 | 26.3 |
| **2** | Kerbside | Herbert Avenue | 25.1 | 21.6 | 23.3 | 21.5 | 22.1 |
| **3** | Roadside | Dorset Way | 35.2 | 35.0 | **40.1** | 32.2 | 32.4 |
| **4** | Roadside | Wimborne Road | 22.6 | 19.3 | 21.5 | 19.4 | 20.1 |
| **5** | Kerbside | Longfleet Road | 37.3 | 35.5 | 35.2 | 30.7 | 28.3 |
| **6** | Kerbside | West Quay Road | 23.9 | 20.9 | 22.5 | 22.2 | 20.8 |
| **7** | Roadside | Parkstone Roundabout | 33.7 | 30.4 | 35.7 | 27.5 | 25.0 |
| **8** | Roadside | Commercial Road | **43.7** | 36.4 | **41.3** | 35.8 | 34.5 |
| **9** | Kerbside | Ashley Road | **42.2** | 39.2 | **42.3** | **40.9** | 33.6 |
| **10** | Urban Background | Fortescue Road | 13.7 | 13.6 | 15.7 | 13.7 | 16.6 |
| **11** | Kerbside | Pottery Junction | 37.8 | 35.1 | 38.1 | 35.1 | 31.8 |
| **12** | Kerbside | Poole Road | 35.7 | 30.5 | 32.1 | 29.7 | 27.7 |
| **13** | Kerbside | Lindsay Road | 37.2 | 35.0 | 35.8 | 30.8 | 31.2 |
| **14** | Kerbside | Dolberry Road North | 26.2 | 22.8 | 24.4 | 23.1 | 22.6 |
| **15** | Kerbside | Blandford Road | 23.6 | 19.6 | 22.7 | 20.4 | 21.9 |
| **16** | Kerbside | Twin Sails | 19.0 | 15.6 | 18.7 | 22.1 | 17.4 |
| **17** | Roadside | CR Lamppost 416 | **42.1** | 37.8 | 38.9 | 36.1 | 32.3 |
| **18** | Roadside | CR Lamppost 421 | **49.3** | **44.8** | **47.9** | **41.2** | **40.3** |
| **19** | Roadside | AR Lamppost 35 | 39.6 | 31.9 | 35.7 | 31.6 | 28.3 |
| **20** | Kerbside | AR Lamppost 28 | **42.2** | 39.2 | **42.5** | 33.6 | 31.8 |
| **Objective** | | | **40** | | | | |

[a] Data downloaded from the Borough of Poole 2019 Air Quality Annual Status Report (Borough of Poole, 2019).

[b] Diffusion tubes prepared and analysed by Gradko (using the 50% TEA in acetone method) and adjusted for bias.

5.2 Defra's maps (Defra, 2019a) of roadside concentrations for the baseline year 2017 can also be used to determine approximate concentrations at the roadside. Figure 5 shows the roads in Poole that are included in Defra's Pollution Climate Mapping (PCM) model, labelled with the annual mean $NO_2$ concentrations, equivalent to a concentration at 4 m from the kerbside and 2 m height, along these roads in 2017. The highest predicted roadside concentration in the study area is 43.6 µg/m$^3$. This is along the busy A35/A3049, approximately 1.6 km to the northeast, which carries an annual average daily traffic (AADT) flow of around 50,000 vehicles. Concentrations along main roads

closer to the site are lower; 27.3 µg/m$^3$ along the A350 Holes Bay Road to the west of the site, and 27.7 µg/m$^3$ along the A35 Fernside Road/Wimborne Road to the east.

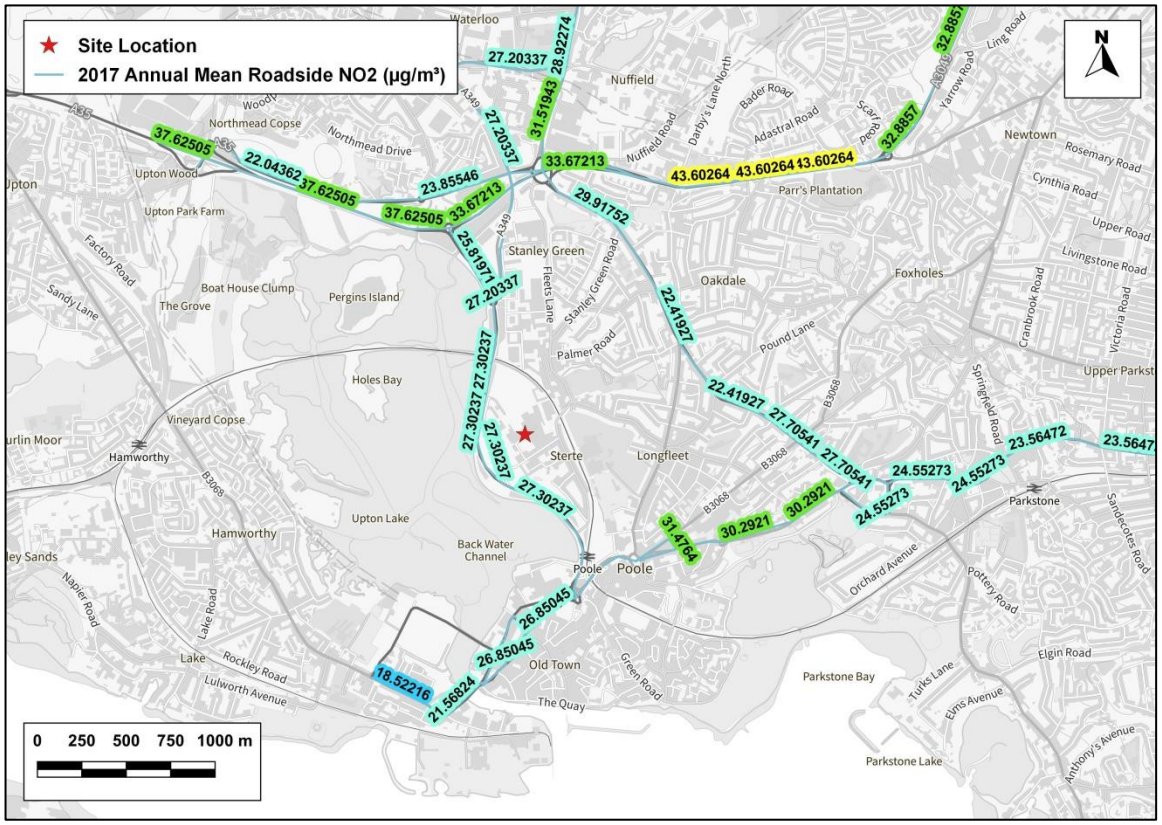


**Figure 5: PCM Mapped Roadside Annual Mean $NO_2$ Concentrations**

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### *Summary of Baseline $NO_2$ Concentrations*

5.3 For all human health receptors close to roads, the assumed annual mean baseline $NO_2$ concentration is the highest of all measured or PCM mapped roadside concentrations for representative conditions. For receptors away from roads, the highest mapped background $NO_2$ concentration will be used to calculate PECs.

5.4 Table 9 sets out the baseline $NO_2$ concentrations used in this assessment.

**Table 9: Baseline $NO_2$ Concentrations Used in Assessment**

| Location | Value (µg/m$^3$) | Derivation |
|---|---|---|
| **Annual Mean Concentrations** | | |
| **All Receptors Close to Roads** | 27.7 | Highest concentration across all of the roadside PCM predictions close to the facility. |
| **All Receptors Away from Roads** | 17.7 | Highest concentration across all of the background measurements and all of the mapped background concentrations within the study area. |
| **1-hour Mean Concentrations** | | |
| **All Receptors Close to Roads** | 55.4 | 2 x the annual mean |
| **All Receptors Away from Roads** | 35.4 | |

## Designated Ecological Sites

5.5 The estimated annual mean background NOx concentrations at the designated ecological sites within the study area have been derived using Defra's background maps (Defra, 2019a). The baseline nutrient nitrogen and acid deposition fluxes have been defined using APIS (APIS, 2019) and are 5 km x 5 km grid square averages based on the three year mean between 2015 and 2017. The results are presented in Table 10. The NOx concentrations are well below the critical level of 30 µg/m$^3$. Maximum baseline nutrient nitrogen and acid deposition fluxes at all sites are above the critical loads, which is the case for very many designated ecological sites across the UK.

**Table 10: Background NOx Concentrations and Deposition Fluxes at Designated Ecological Sites**

| | NOx (µg/m$^3$) | Nutrient Nitrogen Deposition (kgN/ha/yr) | Acid Deposition (keq/ha/yr) |
|---|---|---|---|
| **Dorset Heathlands (SPA/Ramsar)** | 7.9 – 21.2 | 11.3 – 34.2 | 0.8 – 2.4 |
| **Dorset Heaths (SAC)** | 8.7 – 21.2 | 8.4 – 34.2 | 0.6 – 2.4 |
| **Dorset Heaths (Purbeck and Wareham) and Studland Dunes (SAC)** | 7.9 – 10.9 | 11.2 – 21.8 | 0.8 – 1.6 |
| **Poole Harbour (SPA/Ramsar/SSSI)** | 7.9 – 22.1 | 11.6 – 15.8 | 0.8 – 1.1 |
| **Millfields Pond (Local Nature Reserve)** | 22.0 | 15.8 | 1.1 |

5.6 Baseline NOx concentrations and deposition at the Poole Harbour SPA/Ramsar/SSSI may be elevated from the background due to the proximity of the A350 Holes Bay Road dual carriageway, which is located 12 m from Poole Harbour at its closest point. The approach to estimating roadside $NO_2$ concentrations has been to rely upon local measurements and Defra's PCM outputs (see paragraphs 5.1 and 5.2). However, there are limitations to this approach for estimating NOx concentrations along the A350 Holes Bay Road because there is no local monitoring adjacent to

this road, and PCM represents a relatively basic model output at locations 4 m from the kerb, which will likely overestimate concentrations at Poole Harbour, which is a minimum of 12 m from the road. Therefore, in order to accurately predict baseline concentrations at the Poole Harbour SPA/RAMSAR adjacent to Holes Bay Road, NOx contributions from the road traffic emissions have been modelled using the ADMS-Roads dispersion model and added to the local background NOx concentrations from Defra's background pollutant maps. This approach has also been used for estimating baseline nitrogen deposition and acid deposition rates. Further details of this modelling methodology are presented in Appendix A4.

5.7 Table 11 sets out the baseline values used in this assessment.

**Table 11: Baseline NOx Concentrations and Deposition Fluxes Used in Assessment**

| Pollutant and Averaging Period | Value | Derivation |
|---|---|---|
| **Poole Harbour (SPA/Ramsar/SSSI)** | | |
| **Annual Mean NOx (µg/m$^3$)** | 28.0 | Maximum from Table 10 + Maximum contribution from roads obtained from ADMS-Roads modelling (see Appendix A4) |
| **Maximum 24-hour Mean NOx (µg/m$^3$)** | 56.0 | 2 x the annual mean |
| **Nutrient Nitrogen Deposition (kgN/ha/yr)** | 16.2 | Maximum from Table 10 + Maximum contribution from roads obtained from ADMS-Roads modelling (see Appendix A4) |
| **Acid Deposition (keq/ha/yr)** | 1.1 | Maximum from Table 10 + Maximum contribution from roads (see Appendix A4) |
| **Dorset Heathlands (SPA/Ramsar)** | | |
| **Annual Mean NOx (µg/m$^3$)** | 21.2 | Maximum from Table 10 |
| **Maximum 24-hour Mean NOx (µg/m$^3$)** | 42.4 | 2 x the annual mean |
| **Nutrient Nitrogen Deposition (kgN/ha/yr)** | 34.2 | Maximum from Table 10 |
| **Acid Deposition (keq/ha/yr)** | 2.4 | Maximum from Table 10 |
| **Dorset Heaths (SAC)** | | |
| **Annual Mean NOx (µg/m$^3$)** | 21.2 | Maximum from Table 10 |
| **Maximum 24-hour Mean NOx (µg/m$^3$)** | 42.4 | 2 x the annual mean |
| **Nutrient Nitrogen Deposition (kgN/ha/yr)** | 34.2 | Maximum from Table 10 |
| **Acid Deposition (keq/ha/yr)** | 2.4 | Maximum from Table 10 |
| **Dorset Heaths (Purbeck and Wareham) and Studland Dunes (SAC)** | | |
| **Annual Mean NOx (µg/m$^3$)** | 10.9 | Maximum from Table 10 |
| **Maximum 24-hour Mean NOx (µg/m$^3$)** | 21.8 | 2 x the annual mean |
| **Nutrient Nitrogen Deposition (kgN/ha/yr)** | 21.8 | Maximum from Table 10 |
| **Acid Deposition (keq/ha/yr)** | 1.6 | Maximum from Table 10 |
| **Millfields Pond (Local Nature Reserve)** | | |
| **Annual Mean NOx (µg/m$^3$)** | 22.0 | Table 10 |
| **Maximum 24-hour Mean NOx (µg/m$^3$)** | 44.0 | 2 x the annual mean |

| | | |
|---|---|---|
| **Nutrient Nitrogen Deposition (kgN/ha/yr)** | 15.8 | Table 10 |
| **Acid Deposition (keq/ha/yr)** | 1.1 | Table 10 |

# 6 Modelling Methodology

6.1 Modelling has been carried out in line with EA documents: *"Air emissions risk assessment for your environmental permit"* (EA, 2018b); and "*Emissions from specified generators. Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators Version 1*" (EA, 2018a).

## Dispersion Model

6.2 Impacts have been predicted using the ADMS-5.2 dispersion model developed by Cambridge Environmental Research Consultants (CERC). ADMS-5.2 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. ADMS is widely used for assessments of this type and has been extensively validated[2]. It is considered suitable for the current assessment.

## Emission Parameters

### *Release Conditions*

6.3 Operational parameters for exhaust temperature, net fuel consumption and exhaust mass flow rate have been determined from the product specification datasheets (see Appendix A1). These have been used as the basis for the combustion, exhaust and emission calculations. The stack diameter and stack height has been provided by BasePower.

6.4 The combustion parameters have been calculated for natural gas with a composition as defined in Table 12. The specified parameters are based on the complete combustion of the fuel used.

6.5 The volume of combustion air for the CHP has been calculated to ensure the exhaust gas mass flow rate (kg/h) of the combustion products matches the amount stated in the technical data sheet in Appendix A1 when 3,175 kW of fuel is consumed (the net fuel consumption for the engines at full load).

6.6 The volume of combustion air for the boiler has been calculated to ensure the exhaust gas mass flow rate (kg/h) of the combustion products matches the amount provided by the boiler manufacturer (see Appendix A1), when 2,334 kW of fuel is consumed (the net fuel consumption at full load).

[2] https://www.cerc.co.uk/environmental-software/model-validation.html

**Table 12: Typical Fuel Gas Composition**

| Parameter | Value |
|---|---|
| **Methane** | 90.76% |
| **Ethane** | 4.64% |
| **Propane** | 1.22% |
| **Carbon Dioxide** | 1.07% |
| **Nitrogen** | 2.32% |
| **Net Calorific Value (LHV) (MJ/kg)** | 46.5 |
| **Gross Calorific Value (HHV) (MJ/kg)** | 51.5 |
| **HHV/LHV** | 1.11 |
| **Molecular Mass (g/mol)** | 17.61 |

6.7 There will be a very small proportion of other components in the fuel, however, the main components (components with >0.1%) are included in the above. Based on this fuel, and assuming complete combustion, the plant parameters are shown in Table 13.

**Table 13: Emissions and Release Conditions for the Combustion Plant**

| Parameter | CHP | Boiler |
|---|---|---|
| **Net Input Fuel Rate ($kW_{in}$)** | 3,175 | 2,334 |
| **Gross Input Fuel Rate ($kW_{in}$)** | 3,517 | 2,585 |
| **Combustion $Air_{in}$ (kg/h, dry)** | 6,683 | 3,242 |
| **Excess Air (%)** | 70.0 | 12.2 |
| **Exhaust Temperature (ºC)** | 160 | 134 |
| **Exhaust Flow (kg/h) for Actual Flow** | 6,698 | 3,442 |
| **Molar Flow Rate (mol/s) for Actual Flow** | 68.71 | 34.34 |
| **Molecular Mass (g/mol) for Actual Flow** | 28.17 | 27.84 |
| **Calculated Exhaust $O_2$ Content (%)** | 8.0 | 2.1 |
| **Calculated Exhaust $H_2O$ Content (%)** | 12.2 | 17.5 |
| **Exhaust Flow ($Am^3/s$) [a, b] for Actual Flow** | 2.442 | 1.147 |
| **Molar Flow Rate (mol/s) for Normalised Flow** | 33.95 | 24.96 |
| **Exhaust Flow ($Nm^3/s$) [c, d] for Normalised Flow** | 0.761 | 0.559 |
| **Effective Flue Diameter (m)** | 0.4 | 0.34 |
| **Exhaust Velocity (Am/s) for Actual Flow** | 19.43 | 12.64 |

[a] Actual flow conditions in the exhaust assumed to be at the calculated exhaust $O_2$ and $H_2O$ contents.

[b] Calculated from molar flow rate x 8.3145 x (T+273.13) / 101,325, where T is the temperature in ºC.

[c] Calculated from normalised molar flow rate x 8.3145 x (273.13) / 101325.

[d] Normalised to 0 ºC, 101.325 kPa, 0% oxygen, dry.

### *Emissions Data*

6.8 The CHP has an Emissions Limit Value (ELV) of 95 mg/$Nm^3$ NOx (at 15% $O_2$ in dry gas at 0 °C, and 101.325 kPa), whilst the boiler has an ELV of 100 mg/$Nm^3$ NOx (at 3% $O_2$ in dry gas at 0 °C, and 101.325 kPa). These emission concentrations have been used for the purposed of modelling in the absence of further emissions information. Table 14 presents the emission concentrations for the CHP and boiler.

**Table 14: Operational NOx Emissions at Varying $O_2$ Levels**

| Parameter | Value (mg/Nm$^3$) [a] |
|---|---|
| **CHP** | |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 0% $O_2$, Dry)** | 336 |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 5% $O_2$, Dry)** | 256 |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 15% $O_2$, Dry)** | **95** |
| **Boiler** | |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 0% $O_2$, Dry)** | 117 |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 3% $O_2$, Dry)** | **100** |
| **NOx Emission Concentration (at 0 °C, 101.325 kPa, 5% $O_2$, Dry)** | 89 |

[a] Emissions under relevant conditions as defined in the MCPD are highlighted in bold.

## *Modelled Parameters*

6.9 The physical emission parameters and corresponding emission rates used in the modelling are outlined in Table 15. The stacks have been modelled as two individual point sources.

**Table 15: Modelled Physical Release Emission Parameters for the Facility**

| Parameter | Modelled Release Emission Parameters | |
|---|---|---|
| | CHP | Boiler |
| **Source Type** | Point | |
| **X-Coordinate** | 400897 | 91788 |
| **Y-Coordinate** | 400897 | 91787 |
| **Height (m)** | 15 | |
| **Release Temperature (°C)** | 160 | 134 |
| **Molecular Mass (g/mol) [a]** | 28.17 | 27.84 |
| **Actual Exhaust Velocity (Am/s)** | 19.43 | 12.64 |
| **Flue Diameter (m)** | 0.4 | 0.34 |
| **Flow rate (Am$^3$/s)** | 2.442 | 1.147 |
| **Normalised Exhaust Flow (Nm$^3$/s) [b]** | 0.761 | 0.559 |
| **NOx Emission Rate (mg/Nm$^3$)** | 95.0 [b] | 100.0 [c] |
| **NOx Emission Rate (g/s)** | 0.256 | 0.065 |

[a] Calculated assuming the ideal combustion of the specified mixture of natural gas and combustion air.

[b] Normalised to 0 ºC, 101.325 kPa, 15% oxygen, dry.

[c] Normalised to 0 ºC, 101.325 kPa, 3% oxygen, dry.

## Receptors and Study Area

6.10 Human health impacts have been predicted over a 10 km x 10 km model domain, with the discharging flues at the centre. Concentrations have been predicted over this area using nested Cartesian grids (see Figure 6). These grids have a spacing of 5 m x 5 m within 200 m of the facility, 25 m x 25 m within 400 m of the facility, 50 m x 50 m within 1,000 m of the facility, 250 m x 250 m within 2,000 m of the facility and 500 m x 500 m within 5,000 m of the facility. This grid is considered to provide a sufficiently high resolution to enable the identification of worst-case impacts throughout the study area. The receptor grid has been modelled at a height of 1.5 m above ground level.

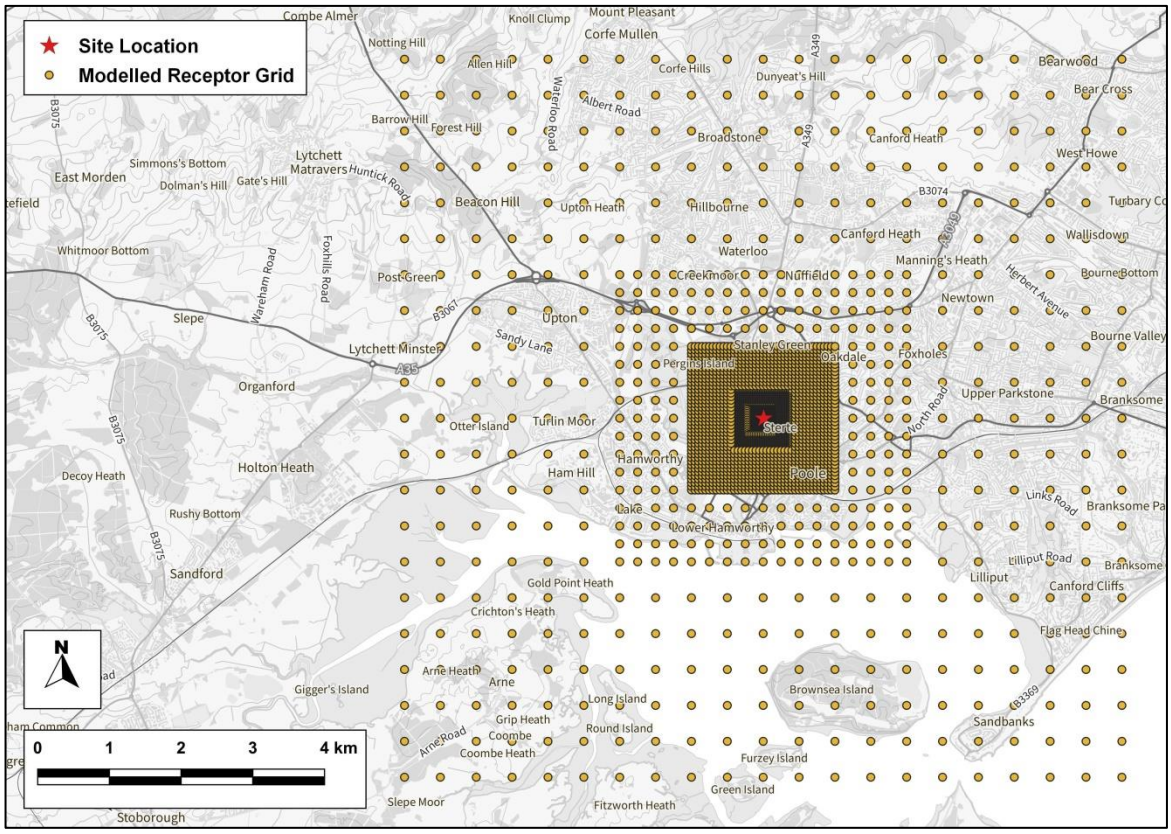


**Figure 6: Modelled Receptors (Nested Grid)**

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6.11 Designated ecological sites have been assessed using the Cartesian grid point closest to the boundary of the site. Receptors have been modelled at 1.5 m above ground level to be consistent with Defra's national modelling of ecosystem impacts. The grid references for these specific locations are presented in Table 16.

**Table 16: Specific Ecological Receptor Coordinates**

| Designated Ecological Site | X Coordinate | Y Coordinate |
|---|---|---|
| **Dorset Heathlands SPA/Ramsar Dorset Heaths SAC** | 398896 | 91036 |
| **Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC** | 397896 | 89286 |
| **Poole Harbour SPA/Ramsar/SSSI** | 400621 | 91586 |
| | 400596 | 91736 |
| **Millfields Pond LNR** | 400146 | 93036 |

## Meteorological Data

6.12 In order to allow for uncertainties in local and future-year conditions, the dispersion model has been run five times, with each run using a different full year of hour-by-hour meteorological data from the nearest appropriate meteorological site. For each individual receptor point on the nested Cartesian grids, the maximum predicted concentration across any of the five meteorological datasets has then been determined. It is these maxima which are presented.

6.13 Hourly sequential meteorological data from Bournemouth have been used for the years 2013 to 2017 inclusive. The Bournemouth Airport meteorological monitoring station is located approximately 12 km to the northeast of the site. It is deemed to be the nearest monitoring station representative of meteorological conditions at the site. The meteorological data were provided by ADM Ltd.

6.14 The meteorological parameters entered into the model are shown in Table 17. Wind roses for each year are presented in Appendix A2.

**Table 17: Meteorological Parameters Entered into the ADMS Model**

| Parameter | Modelled Receptors (including Cartesian Grids) | Meteorological Site |
|---|---|---|
| **Surface Roughness** | Variable Surface Roughness File | 0.5 m |
| **Minimum MO length** | 30 m | 30 m |
| **Surface Albedo** | 0.23 [a] | 0.23 [a] |
| **Priestly-Taylor Parameter** | 1 [a] | 1 [a] |

[a] Model default value

### *Variable Surface Roughness File*

6.15 The study area encompasses a range of land types. A variable surface roughness file has been used to represent the spatial variation of the surface roughness over each land type as shown in Figure 7. The following parameters have been used regarding surface roughness and land type:

- forest – 1 m;
- built-up area – 0.5 m;
- grassland – 0.2 m; and
- water – 0.0001 m.

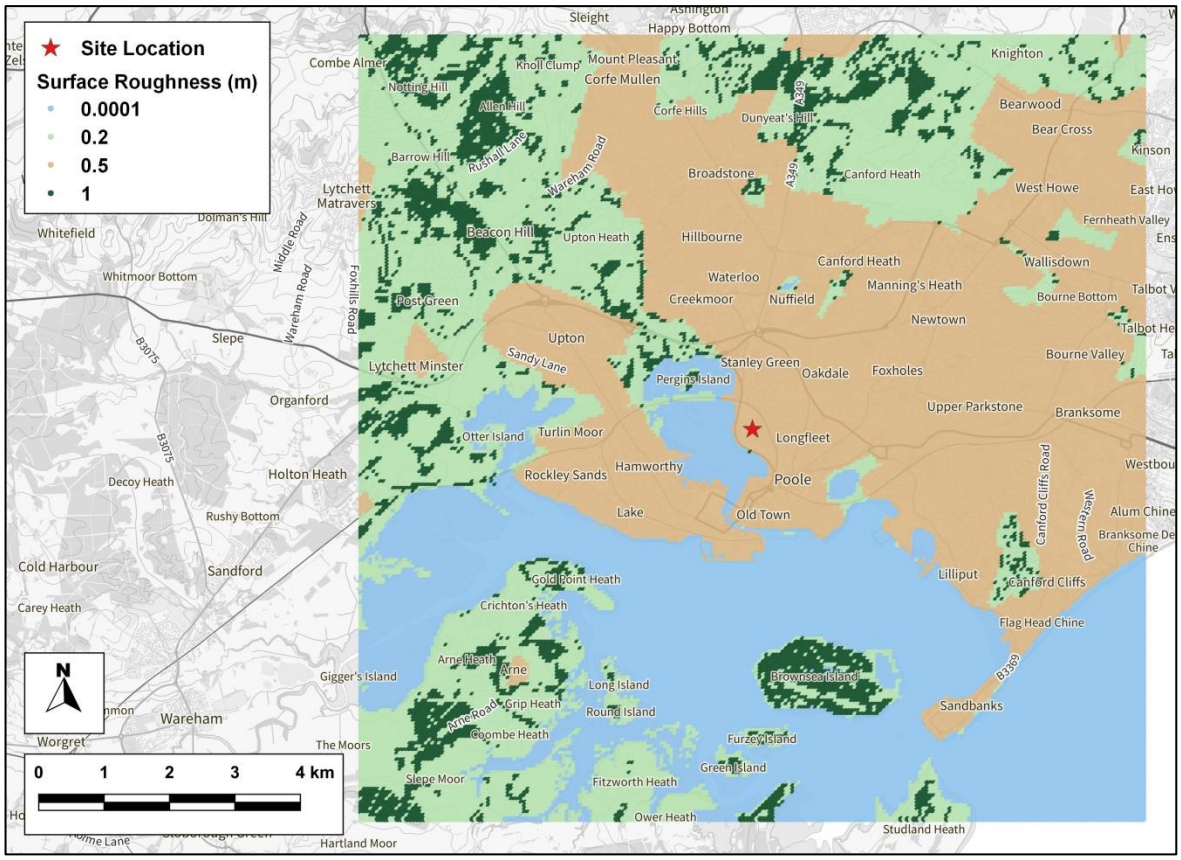


**Figure 7: Surface Roughness across Modelled Area**

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## Buildings

6.16 Where buildings are a significant height relative to the stack height, building downwash effects may occur. The downwash effects should be accounted for within modelling where the stack is less than 2.5 times the height of the buildings within a distance which is five times the minimum of the stack height and the maximum projected width of the building.

6.17 The model has been run once with the adjacent buildings included, and once without, for each meteorological year. The maximum predicted concentration of either building scenario and any

meteorological year has then been determined and presented. Modelled buildings are shown in Figure 8, and the dimensions of all buildings are given in Table 18.

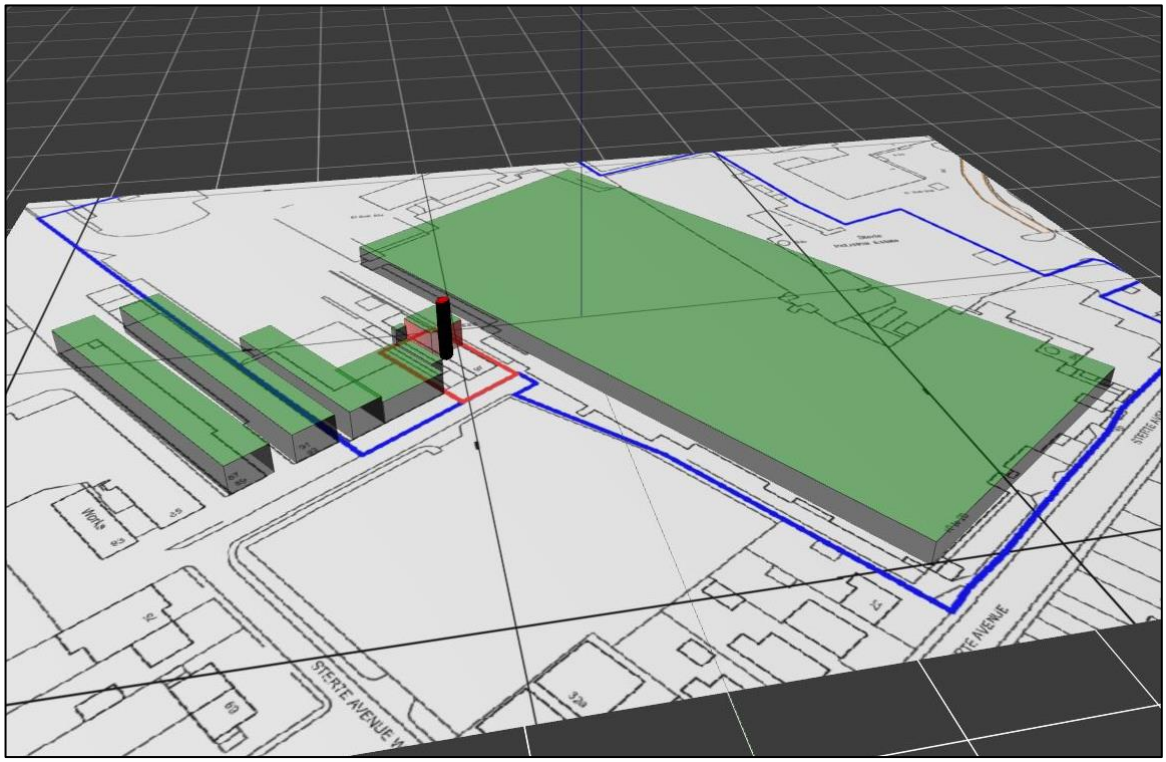


**Figure 8: Buildings Included in the Model (Green); Modelled Flues (Red Cylinders)**

Contains data from Poole Sustainable Energy Ltd Lease and Ownership Plan.

**Table 18: Modelled Building Dimensions**

| Building | Height (m) | Length / Diameter (m) | Width (m) | Rotation (º) |
|---|---|---|---|---|
| **Boiler** | 7 | 10 | 9 | 326° |
| **CHP** | 3.5 | 13 | 3 | 326° |
| **CHP Vent** | 7 | 1.6 | 3 | 326° |
| **Building on Sterte Avenue W** | 5.5 | 18 | 16 | 326° |
| **Building on Sterte Avenue W** | 7 | 43 | 8 | 326° |
| **93 Sterte Ave W** | 7 | 75 | 10 | 326° |
| **89 Sterte Ave W** | 7 | 75 | 10 | 325° |
| **Warehouse to East** | 5.5 | 170 | 80 | 326° |

## Terrain Effects

6.18 Local terrain has been included within the model based on OS Terrain 50 data, as shown in Figure 9.

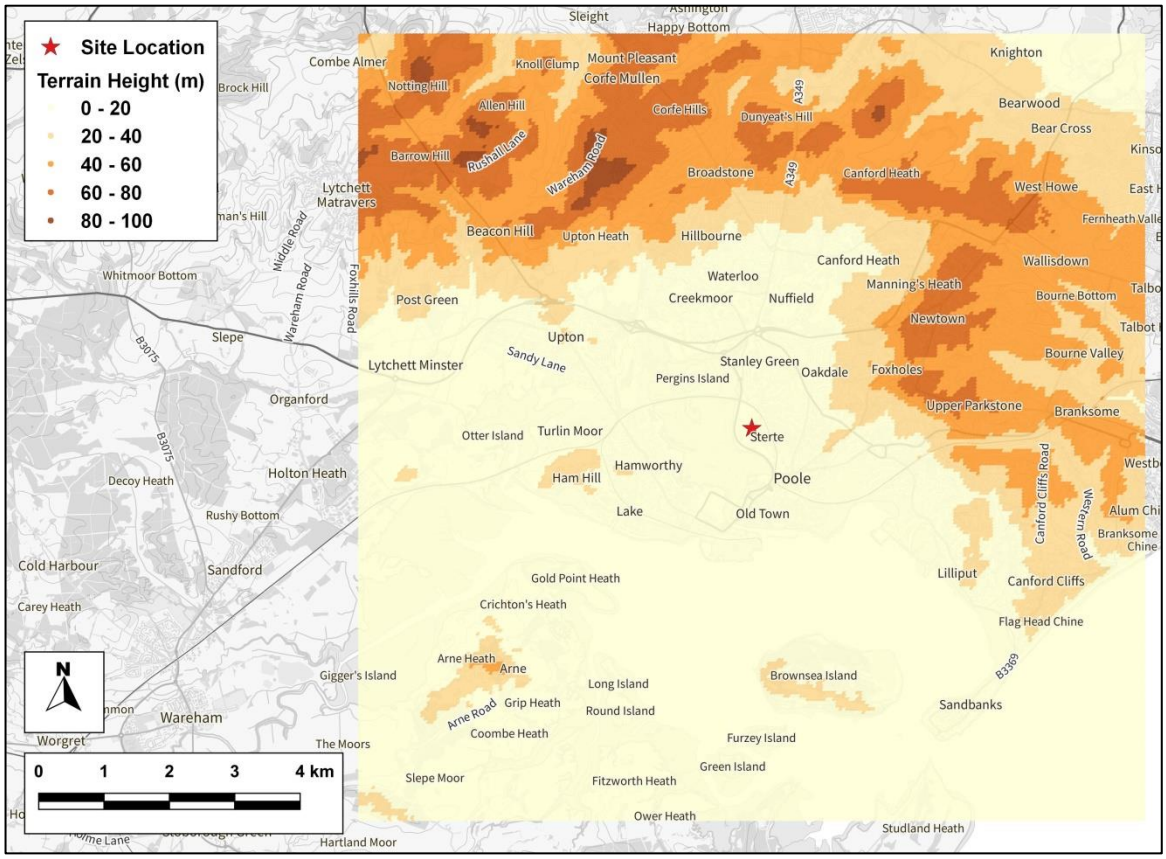


**Figure 9: Terrain across Modelled Area**

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## $NO_X$ to $NO_2$ Conversion

6.19 NOx emissions will be in the form of nitric oxide (NO) and primary $NO_2$. The primary $NO_2$ from natural gas-fuelled generators is likely to be in the region of 5-12% of the total NOx. Over time, the NO emissions will react with available ozone ($O_3$) to form $NO_2$. In close proximity to the source, the ratio will be similar to the primary $NO_2$ proportion; with increasing distance from the source the ratio will increase, depending on the availability of $O_3$.

6.20 The EA (2018b) recommends that, as a conservative approach:

- 70% of the NOx emitted from the generators converts to $NO_2$ for the annual mean average concentrations; and
- 35% of the 1-hour mean NOx emitted from the generators converts to $NO_2$ for the 1-hour mean average concentrations.

6.21 The EA Guidance on dispersion modelling for oxides of nitrogen assessment from specified generators Version 1 (EA, 2018a) states: "*For primary $NO_2$ to NOx ratios of 10% or less, worst case NOx to $NO_2$ conversion ratios of 35% for short term assessment and 70% for long term assessment can be used as a conservative approach in the modelling study*."

6.22 Given the size of the CHP plant and boiler and the fuel (natural gas), it is likely that the primary $NO_2$:NOx ratio will be 10% or less; therefore, the 70% (long-term) and 35% (short-term) conversion ratios used represent a conservative approach.

## Model Post-Processing

### Annual Mean PCs

6.23 The model has been run assuming constant operation of both the CHP and boilers, therefore no post-processing of predicted annual mean concentrations is required.

### Short-term PCs

6.24 The AQS for 1-hour mean $NO_2$ is based on the number of hours (18) that a threshold concentration (200 µg/m$^3$) can be exceeded in a year. The 1-hour mean AQS has been assessed by assuming constant operation, and considering the 99.79$^{th}$ percentile of 1-hour mean concentrations, which represents the 19$^{th}$ highest hour from a full year (8,760 hours). This provides a worst-case assessment.

### Deposition

6.25 Deposition of $NO_2$ has not been included within the dispersion model because $NO_2$ has been calculated from NOx outside of the model. Instead, deposition has been calculated from the predicted ambient concentrations using the deposition velocity set out in Table 19. This means that depletion effects are ignored, resulting in a worst-case assessment. Deposition velocities refer to a height above ground, typically 1 or 2 m, although in practice the precise height makes little difference and here they have been applied to concentrations predicted at a height of 1.5 m above ground, which is the average height of the monitors which underpin the Concentration Based Estimated Deposition (CBED) model which generates predictions used by UK Government. The velocities are applied simply by multiplying a concentration (µg/m$^3$) by the velocity (m/s) to predict a deposition flux (µg/m$^2$/s). Subsequent calculations required to present the data as kg/ha/yr of nitrogen as keq/ha/yr for acidity follow basic chemical and mathematical rules[3].

[3] i.e. 1 kg N/ha/yr = 0.071 keq/ha/yr

**Table 19: Deposition Velocities Used in This Assessment**

| Pollutant | Deposition Velocity (m/s) | Reference |
|---|---|---|
| **Nitrogen Dioxide** | 0.0015 m/s (Grassland) | AQTAG06 (2011) |

6.26 Wet deposition of emissions from the facility has been discounted. Wet deposition of the emitted pollutants this close to the emission source will be restricted to wash-out, or below cloud scavenging. For this to occur, rain droplets must come into contact with the gas molecules before they hit the ground. Falling raindrops displace the air around them, effectively pushing gasses away. The low solubility of $NO_2$ means that any scavenging of this gas will be a negligible factor.

### *Uncertainty*

6.27 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which are both variable and uncertain. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. Where these parameters have been estimated the approach has been to use reasonable worst-case assumptions.

6.28 On balance, when taking into account the assumed continuous operation of both the CHP and boiler, the approach taken to meteorological conditions and the sensitivity testing for building downwash, the assessment can be expected to over-predict the impacts of the facility. The approach has been designed to provide a robust and conservative assessment.

# 7 Assessment Approach

7.1 The EA (2019) states that, following detailed modelling, PCs are insignificant where they are less than:

- 10% of a short-term environmental standard; or
- 1% of a long-term environmental standard.

7.2 This is the case regardless of the total concentration or deposition flux (i.e. the PC + the local baseline, or the Predicted Environmental Concentration 'PEC').

7.3 For local nature conservation sites, the EA (2018b) states that PCs are insignificant where they are less than 100% of either a long-term or short-term standard.

7.4 Where these criteria are not met following detailed modelling, the EA does not provide any specific assessment criteria but instead requires a judgement of significance based on the site-specific circumstances, taking into account the PCs and PECs.

7.5 For human health receptors, the approach has been to provide contour plots which highlight the area within which insignificant PCs cannot be determined using the criteria above. Consideration is also given to the maximum PCs at locations with relevant exposure to the AQS, and to the PECs. A judgement of significance has then been reached based on the potential for the facility to cause an exceedance of the AQS.

7.6 For the designated ecological sites, the assessment has focused on the maximum PCs within the designated sites. Where the PC cannot be screened out as insignificant, the PEC has been determined. A judgement of significance has then been reached based on the potential for the facility to cause an exceedance of the AQS.

# 8 Results

## Human Health Receptors

8.1 Figure 10 presents the area where the annual mean PC is greater than 0.4 µg/m$^3$ (1% of the AQS). This covers an area which extends up to approximately 485 m from the exhaust flues and encompasses up to approximately 200 residential properties and apartments on Sterte Avenue West, Sterte Avenue, Sterte Close, Sterte Road, Tatnam Road and Well Lane, as well as an area of Poole High School to the east of the railway line.

8.2 There are a number of receptors to the east and northeast which fall into the 0.4 µg/m$^3$ contour, and lie adjacent to through roads (Sterte Road and Tatnam Road). However, traffic volumes on these roads are below 10,000 AADT and baseline $NO_2$ concentrations are not likely to be substantially elevated above background. Therefore, no properties within the 0.4 µg/m$^3$ contour are considered to be roadside receptors.

8.3 Figure 11 presents the area where the PC to the 99.79$^{th}$ percentile of 1-hour mean $NO_2$ concentrations is greater than 20 µg/m$^3$ (10% of the AQS). This covers a very small area 90 – 120 m from the exhaust flues, and encompasses two residential properties on Sterte Avenue West, and small areas of the industrial units and associated car parks to the west of the facility.

8.4 Figure 10 also shows the locations where the maximum annual mean PCs are predicted anywhere on the nested Cartesian grids, and at any location with relevant exposure to the annual mean AQS. Figure 11 shows the maximum 99.79$^{th}$ percentile PC at any location on the grids (which is also a location of relevant exposure).

8.5 The predicted PCs and PECs at these worst-case locations are set out in Table 20.

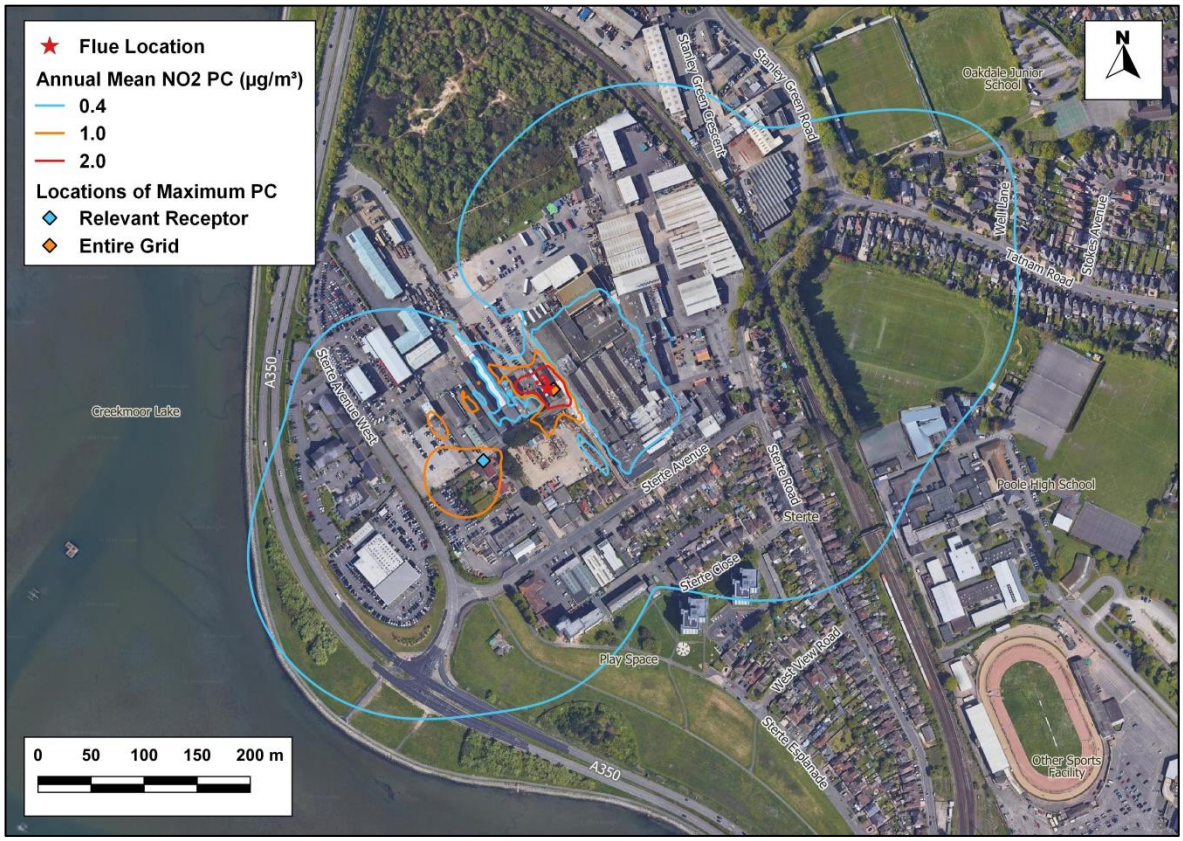


**Figure 10: Areas Where the PC to Annual Mean $NO_2$ Concentrations Exceeds 0.4 µg/m$^3$ (and 1.0 and 2.0 µg/m$^3$ for Information); Also showing the Stack Locations and Locations of Maxima: on Entire Grid, and at Relevant Receptor**

Imagery © 2019 Google.

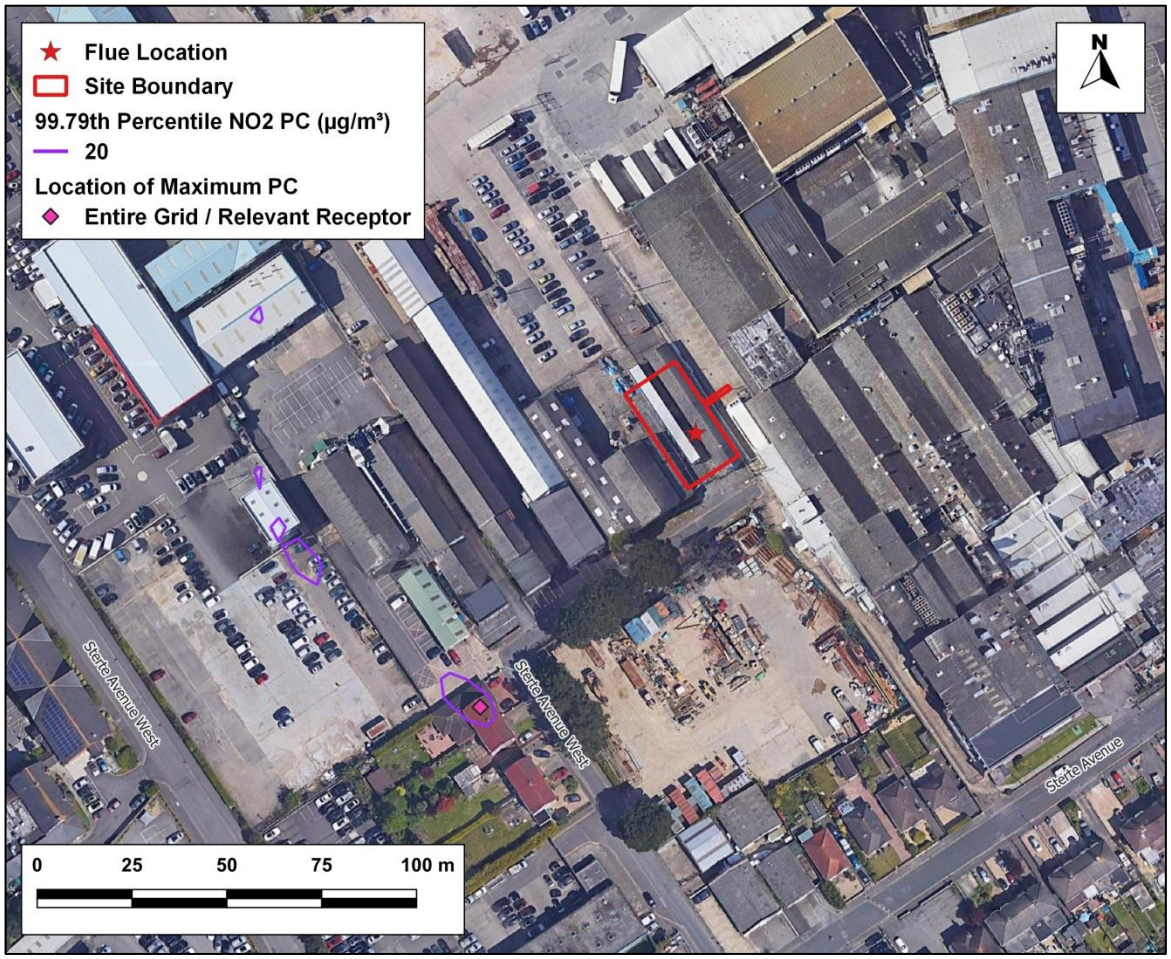


**Figure 11: Areas Where the PC of the 99.79th Percentile of 1-hour $NO_2$ Concentrations Exceeds 20 µg/m$^3$. Also showing the Stack Locations, Site Boundary, and Location of Maximum on Entire Grid and at Relevant Receptor**

Imagery © 2019 Google.

**Table 20: Maximum PCs and PECs Relevant for Human Health**

| | X Coordinate | Y Coordinate | PC (µg/m$^3$) | PC (% of AQS) [a] | PEC (µg/m$^3$) [b] | PEC (% of AQS) |
|---|---|---|---|---|---|---|
| **Annual Mean $NO_2$ AQS (40 µg/m$^3$)** | | | | | | |
| **Max on Grid** [c] | 400901 | 91781 | 6.3 | 15.8% | 24.0 | 60.1% |
| **Max at Relevant Receptor** | 400836 | 91721 | 1.4 | 3.5% | 19.1 | 47.8% |
| **1-hour Mean AQS (200 µg/m$^3$)** [d] | | | | | | |
| **Max on Grid** | 400841 | 91716 | 30.5 | 15.3% | 65.9 | 33.0% |
| **Max at Relevant Receptor** | 400841 | 91716 | 30.5 | 15.3% | 65.9 | 33.0% |

[a] Based on unrounded numbers.

[b] After adding the relevant baseline concentrations from Table 9.

[c] This row has been greyed out as the AQS do not apply at this location.

[d] 99.79$^{th}$ percentile of 1-hour means. PCs for the 100$^{th}$ percentile of 1-hour mean concentrations are provided in Appendix A3.

## Designated Ecological Sites

### *Process Contributions*

8.6 Table 21 presents the maximum PCs at any of the designated ecological sites, and whether they can be screened as insignificant.

8.7 All maximum PCs to designated ecological sites are screened as insignificant, except for annual mean NOx PCs in Poole Harbour SPA/Ramsar/SSSI.

**Table 21: Maximum PCs at Designated Ecological Sites**

| Pollutant and Averaging Period | | X Coord. | Y Coord. | PC (% of AQS) [a] | Screening Criterion | Screening Outcome |
|---|---|---|---|---|---|---|
| **Poole Harbour SPA/Ramsar/SSSI** | | | | | | |
| **NOx (µg/m$^3$)** | **Annual Mean** | 400621 | 91586 | **0.57 (1.90%)** | **0.3 (1%)** | **Not screened** |
| | **24-hour** | 400596 | 91736 | 7.34 (9.79%) | 7.5 (10%) | Insignificant |
| **Nutrient Nitrogen (kgN/ha/yr)** | **Annual Mean** | 400621 | 91586 | 0.058 (0.73%) | 0.08 (1%) | Insignificant |
| **Acid Nitrogen (keq/ha/yr)** | **Annual Mean** | 400621 | 91586 | 0.004 (0.72%) | 0.00558 (1%) | Insignificant |
| **Dorset Heathlands SPA/Ramsar** | | | | | | |
| **NOx (µg/m$^3$)** | **Annual Mean** | 398896 | 91036 | 0.03 (0.11%) | 0.3 (1%) | Insignificant |
| | **24-hour** | 398896 | 91036 | 0.47 (0.63%) | 7.5 (10%) | Insignificant |
| **Nutrient Nitrogen (kgN/ha/yr)** | **Annual Mean** | 398896 | 91036 | 0.003 (0.06%) | 0.05 (1%) | Insignificant |
| **Acid Nitrogen (keq/ha/yr)** | **Annual Mean** | 398896 | 91036 | 0.0002 (0.02%) | 0.00845 (1%) | Insignificant |
| **Dorset Heaths SAC** | | | | | | |
| **NOx (µg/m$^3$)** | **Annual Mean** | 398896 | 91036 | 0.03 (0.11%) | 0.3 (1%) | Insignificant |
| | **24-hour** | 398896 | 91036 | 0.47 (0.63%) | 7.5 (10%) | Insignificant |
| **Nutrient Nitrogen (kgN/ha/yr)** | **Annual Mean** | 398896 | 91036 | 0.003 (0.03%) | 0.1 (1%) | Insignificant |
| **Acid Nitrogen (keq/ha/yr)** | **Annual Mean** | 398896 | 91036 | 0.0002 (0.04%) | 0.00553 (1%) | Insignificant |
| **Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC** | | | | | | |
| **NOx (µg/m$^3$)** | **Annual Mean** | 397896 | 89286 | 0.02 (0.05%) | 0.3 (1%) | Insignificant |
| | **24-hour** | 397896 | 89286 | 0.21 (0.28%) | 7.5 (10%) | Insignificant |
| **Nutrient Nitrogen (kgN/ha/yr)** | **Annual Mean** | 397896 | 89286 | 0.002 (0.03%) | 0.05 (1%) | Insignificant |
| **Acid Nitrogen (keq/ha/yr)** | **Annual Mean** | 397896 | 89286 | 0.0001 (<0.01%) | 0.00558 (1%) | Insignificant |
| **Millfields Pond LNR** | | | | | | |
| **NOx (µg/m$^3$)** | **Annual Mean** | 400146 | 93036 | 0.04 (0.13%) | 30 (100%) | Insignificant |
| | **24-hour** | 400146 | 93036 | 0.63 (0.84%) | 75 (100%) | Insignificant |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Nutrient Nitrogen (kgN/ha/yr)** | **Annual Mean** | 400146 | 93036 | 0.004 (0.04%) | 10 (100%) | Insignificant |
| **Acid Nitrogen (keq/ha/yr)** | **Annual Mean** | 400146 | 93036 | 0.0003 | - | - |

[a] After adding the relevant baseline values from Table 11.

### *Predicted Environmental Concentrations*

8.8 Figure 12 presents the contours of the PCs to annual mean NOx at Poole Harbour, including areas greater than 0.3 µg/m$^3$ (1% of the AQS). This covers an area which extends up to approximately 570 m from the exhaust flues and covers approximately 125,000 m$^2$ of the designated site.

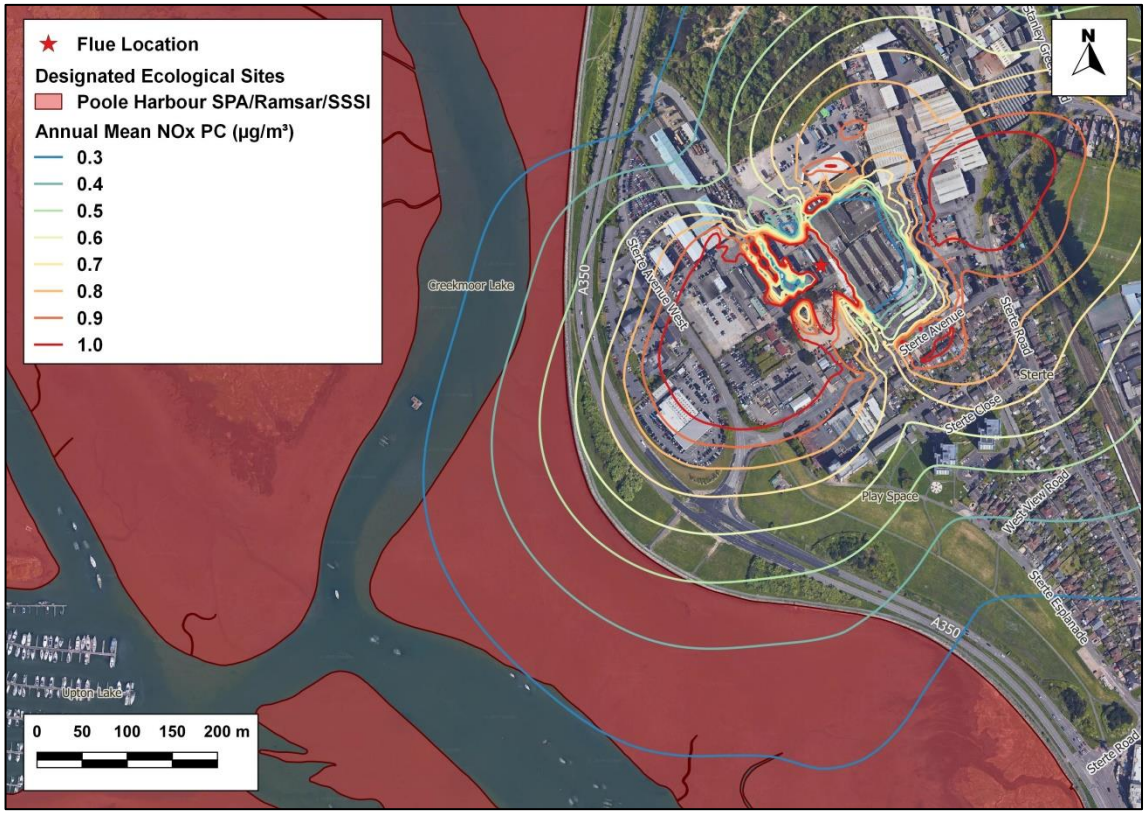


**Figure 12: Contours of PCs to Annual Mean NOx Concentrations across Poole Harbour; and Stack Location**

8.9 The maximum baseline annual mean NOx concentration at the designated site (Table 11) is 28.0 µg/m$^3$. This includes both background NOx (Table 10) and contribution from the A350 Holes Bay Road as modelled using ADMS-Roads (see Appendix A4).

8.10 The maximum contribution from the facility at any location across the habitat is 0.58 µg/m$^3$. The maximum PEC at the habitat is therefore 28.6 µg/m$^3$ (95% of the AQS).

# 9 Discussion

## Human Health Receptors

### *Annual Mean AQS*

9.1 Table 20 shows that the PC exceeds 1% of the long-term AQS at approximately 200 residential properties and a part of Poole High School, within 485 m of the exhaust flues. However, the AQS is not exceeded at any of these sensitive receptors, nor is it exceeded at any location on the grid, even very close to the flues. The maximum PEC at any location with relevant exposure to the AQS is well below the AQS, thus there is no risk that the AQS will be exceeded as a result of emissions from the facility.

### *1-hour Mean AQS*

9.2 Table 20 shows that the PC exceeds 10% of the short-term AQS in only a very small area, in encompassing two residential properties on Sterte Avenue West. However, the AQS is not exceeded at these locations, and the maximum PEC is well below the AQS. There is thus no risk that the AQS will be exceeded as a result of the facility.

## Designated Ecological Sites

9.3 The EA guidance is thus that PCs are insignificant regardless of the PEC where the maximum PC is less than 1% of the long-term AQS, and less than 10% of the short-term AQS. Table 21 shows that the maximum PCs are insignificant at all designated ecological sites, except for at Poole Harbour where the maximum annual mean NOx PC exceeds 1%.

9.4 The maximum baseline concentration of annual mean NOx across the ecological site is 28.0 µg/m$^3$. This is the addition of the maximum background annual mean NOx concentration (22.1 µg/m$^3$) and the maximum contribution to annual mean NOx from the A350 Holes Bay Road (5.9 µg/m$^3$). In reality, the baseline concentrations across Poole Harbour will likely be closer to the background concentration, as only a small section of the habitat will have elevated levels of NOx due to close proximity to the A350 Holes Bay Road dual carriageway. The baseline concentration of 28.0 µg/m$^3$ can therefore be considered applicable to only a small area of the habitat, and is thus conservative.

9.5 To this effect, the maximum PEC of annual mean NOx is 28.6 µg/m$^3$, which is below the critical level for annual mean NOx of 30 µg/m$^3$. There is thus no risk that the AQS will be exceeded at any designated ecological site as a result of emissions from the facility.

# 10 Conclusions

10.1 There is no risk that the annual mean $NO_2$ AQS will be exceeded as a result of the facility. On this basis, the impacts are judged to be not significant.

10.2 There is no risk that the 1-hour mean $NO_2$ AQS will be exceeded as a result of the facility. On this basis, the impacts are judged to be not significant.

10.3 In terms of 24-hour mean NOx and annual mean nutrient nitrogen and acid nitrogen deposition, the PCs at designated ecological sites will all be less than 1% of the long-term AQS and less than 10% of the short-term AQS. The EA guidance is thus that these PCs are not significant.

10.4 For annual mean NOx, it has been shown that the PCs at all designated ecological sites, except for Poole Harbour SPA/Ramsar/SSSI, are less than 1% of the long-term AQS, and these are thus insignificant. At Poole Harbour, it has been shown that the total PEC (baseline + PC) will be below the long-term environmental standard. The impact of the facility is therefore judged to be not significant.

10.5 The assessment is based on operation of the CHP for 8,760 hours per year and the boiler at 100% of its total annual capacity, and includes a number of conservative assumptions. It also takes account of the maximum predicted impacts across several sensitivity tests. In particular:

- the assessment of short-term impacts assumes constant operation of both the CHP and boiler;
- the results presented are the maxima from modelling with five separate years of meteorological data;
- the results presented are the maxima from modelling both with and without including surrounding buildings within the dispersion model;
- depletion has not been included in the model. This will cause a tendency for impacts to be over-predicted; and
- a conservative approach has been taken to calculating $NO_2$ concentrations from modelled NOx concentrations.

10.6 It is thus concluded that the air quality impacts of the proposed facility will be not significant.

**Table 22: EA Checklist for Dispersion Modelling Report for Installations**

| Item | Included | Comment |
|---|---|---|
| Location map | ✓ | See Figure 1 |
| Site plan | ✓ | See Figure 3 |
| List of emissions modelled | ✓ | See Paragraph 1.3 |
| Details of modelled scenarios | ✓ | See Table 2 and Section 6 |
| Details of relevant ambient concentrations used | ✓ | See Section 5 |
| Model description and justification | ✓ | See Paragraph 6.2 |
| Special model treatments used | ✓ | See Section 6 |
| Table of emission parameters used | ✓ | See Table 15 |
| Details of modelled domain receptors | ✓ | See Figure 1 and Paragraph 6.10 |
| Details of meteorological data used (including origin) and justification | ✓ | See Paragraphs 6.12 to 6.14 |
| Details of terrain treatment | ✓ | See Paragraph 6.18 |
| Details of building treatment | ✓ | See Paragraphs 6.16 and 6.17 |
| Sensitivity analysis | ✓ | See Table 2 and Section 6 |
| Assessment of impacts | ✓ | See Sections 9 and 10 |
| Model input files | ✓ | Sent electronically |

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# 12 Appendices

A1 Engine Technical Data ..... 41
A2 Wind Roses ..... 43
A3 100th Percentile of 1-hour Mean PCs ..... 46
A4 ADMS-Roads Modelling Methodology ..... 47

# A1 Engine Technical Data

| Technical Data Sheet | MTU 12V4000 GS | | | |
|---|---|---|---|---|
| 93800050400_V07_en_GB | GG12V4000A1 | | | |
| **Voltage / Frequency** | V / Hz | 400 | / | 50 |
| **Cooling water temperature (in / out)** | °C | | 78 / 90 | |
| **NOx emissions (dry, 5 % $O_2$)** | mg/m³ i.N. | | < 250 | |
| **Mixture cooler 1st stage water temperature (in)** | °C | | | |
| **Mixture cooler 2nd stage water temperature (in)** | °C | | 40 | |
| **Exhaust gas temperature** | °C | | 440 | |
| **Catalytic converter** | | | not included | |
| **Special equipment** | | | | |
| **Elevation above sea level** | m / mbar | 100 | / | 1000 |
| **Combustion air temperature** | °C | | 25 | |
| **Relative combustion air humidity** | % | | 30 | |
| **Standard specifications and regulations** | | | | |

| **Energy balance** | % | 100 | 75 | 50 |
|---|---|---|---|---|
| Electrical Power [2) 3)] | kW | 1287 | 965 | 644 |
| Energy input [4) 5)] | kW | 3054 | 2359 | 1685 |
| Thermal output total [6)] | kW | 690 | 514 | 371 |
| Thermal output engine (block, lube oil, 1st stage mixture cooler) [6)] | kW | 690 | 514 | 371 |
| Thermal output mixture cooler 1st stage [6)] | kW | | | |
| Thermal output mixture cooler 2nd stage [6)] | kW | 91 | 68 | 51 |
| Exhaust heat ( 120 °C ) [6)] | kW | ( 687 ) | ( 579 ) | ( 440 ) |
| Engine power ISO 3046-1 [2)] | kW | 1320 | 991 | 666 |
| Generator efficiency at power factor = 1 | % | 97.5 | 97.4 | 96.7 |
| Electrical efficiency [4)] | % | 42.1 | 40.9 | 38.2 |
| Total efficiency | % | 87.2 | 87.2 | 86.4 |
| Power consumption [7)] | kW | | | |
| **Combustion air / Exhaust gas** | | | | |
| Combustion air volume flow [1)] | m³ i.N./h | 5221 | 3953 | 2753 |
| Combustion air mass flow | kg/h | 6743 | 5105 | 3555 |
| Exhaust gas volume flow, wet [1)] | m³ i.N./h | 5391 | 4086 | 2849 |
| Exhaust gas volume flow, dry [1)] | m³ i.N./h | 4990 | 3774 | 2624 |
| Exhaust gas mass flow, wet | kg/h | 6969 | 5280 | 3679 |
| Exhaust temperature after turbocharger | °C | 440 | 475 | 502 |
| **Reference fuel [8)]** | | | | |
| Natural gas | | | $CH_4$ >95 Vol.% | |
| Sewage gas | | | not applicable | |
| Biogas | | | not applicable | |
| Landfill gas | | | not applicable | |
| **Fuel requirements [9)]** | | | | |
| Minimum methane number | MN | | 80 | |
| Range of heating value: design / operation range without power derating | kWh/m³ i.N. | | 10.0 - 10.5 / 9.2 - 11.0 | |
| **Exhaust gas emissions [5) 6)]** | | | | |
| NOx, stated as $NO_2$ (dry, 5 % $O_2$) | mg/m³ i.N. | < 250 | | |
| CO (dry, 5 % $O_2$) | mg/m³ i.N. | < 1000 | | |
| HCHO (dry, 5 % $O_2$) | mg/m³ i.N. | | | |
| VOC (dry, 5 % $O_2$) | mg/m³ i.N. | | | |

| YORKSHIREMAN LOW NOX MODEL | | | YSLN | 3500 | IE |
|---|---|---|---|---|---|
| Boiler working pressure | barg | 7.5 | 108.75 | psig | |
| Saturation Temperature | degC | 172.9 | | | |
| Ambient Air Temp | degC | 21 | | | |

| REQUIRED BOILER DUTY 3500 | | | 100 | 75 | 50 | 25 |
|---|---|---|---|---|---|---|
| | Percentage Load | % | | | | |
| | Heat Output | kw | 2194.7 | 1646 | 1097.4 | 548.68 |
| | F&A 100DegC | kg/h | 3500 | 2625 | 1750 | 875 |
| | | lb/h | 7717.5 | 5788.1 | 3858.8 | 1929.4 |
| Actual Boiler Output with Feed Water Temperature of 85 degC | | kg/hr | 3271.1 | 2453.3 | 1635.5 | 817.8 |
| | | lb/hr | 7212.7 | 5409.5 | 3606.4 | 1803.2 |

**FUEL HEATING VALUES**

| Natural Gas | | |
|---|---|---|
| GCV | 52.97 Mj/kg | 40.5 MJ/Ncu mtre |
| NCV | 47.75 Mj/kg | 36.6 MJ/Ncu mtre |
| **ClassA2 and D-Fuel Oil** | | |
| GCV | 46.89 Mj/kg | |
| NCV | 43.98 Mj/kg | |

| BOILER PERFORMANCE | | ClassA2 and D-Fuel Oil | | | | Natural Gas | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentage Load | % | 100 | 75 | 50 | 25 | 100 | 75 | 50 | 25 | |
| Nett Heat Release | $mw/m^3$ | 1.15 | 0.91 | 0.61 | 0.31 | 1.15 | 0.95 | 0.64 | 0.32 | |
| Nett Heat Input | mw | 2.33 | 1.86 | 1.24 | 0.63 | 2.35 | 1.94 | 1.30 | 0.66 | |
| Gross Heat Release Rate | $mw/m^3$ | 1.21 | | | | 1.27 | | | | |
| Front Smoke BoxTemperature | deg C | 365 | 337 | 302 | 256 | 389 | 358 | 320 | 269 | |
| Boiler Outlet Temperature | deg C | 209 | 201 | 192 | 182 | 213 | 204 | 195 | 184 | |
| ECONOMISER FITTED TO BOILER ROWS 6 | | | | | | | | | | |
| Economiser Gas Outlet Temperature | degC | 128 | 125 | 122 | 121 | 130 | 126 | 122 | 121 | |
| Econ Feed Water Outlet Temperature | degC | 107 | 107 | 106 | 105 | 108 | 107 | 107 | 106 | |
| Economiser Duty | kW | 90 | 66 | 43 | 20 | 90 | 66 | 43 | 20 | |
| Total Gas Weight | kg/h | 3494 | 2725 | 1895 | 999 | 3435 | 2696 | 1908 | 1038 | |
| Max $CO_2$ Emissions | kg/hr | 597 | | | | 467 | | | | |
| Boiler Efficiency on GCV with Econ | % | 88.73 | 88.54 | 88.19 | 87.05 | 85.06 | 84.86 | 84.46 | 83.23 | BS845 |
| Boiler Efficiency on NCV with Econ | % | 94.14 | 93.93 | 93.56 | 92.34 | 93.60 | 93.37 | 92.93 | 91.56 | BS845 |
| Boiler Efficiency on GCV with Econ | % | 90.44 | 90.33 | 90.07 | 89.27 | 87.72 | 87.65 | 87.39 | 86.69 | EN12953 |
| Boiler Efficiency on NCV with Econ | % | 94.95 | 94.79 | 94.45 | 93.40 | 94.81 | 94.64 | 94.26 | 93.13 | EN12953 |
| Total Draught Loss | inchwg | 4.30 | 2.38 | 1.14 | 0.32 | 4.25 | 2.46 | 1.21 | 0.36 | |
| | mbar | 10.77 | 5.95 | 2.85 | 0.79 | 10.63 | 6.15 | 3.04 | 0.89 | |
| Combustion air volume | $Sm^3/s$ | 0.75 | 0.58 | 0.41 | 0.22 | 0.74 | 0.58 | 0.41 | 0.23 | |
| Exit Gas Volume from Economiser | $Am^3/s$ | 1.10 | 0.85 | 0.59 | 0.31 | 1.09 | 0.85 | 0.59 | 0.32 | |
| Fuel consumption | kg/h | 189.93 | 142.76 | 95.55 | 48.40 | 175.38 | 131.85 | 88.31 | 44.81 | kg/h |
| | litre/h | 221.22 | 166.28 | 111.30 | 56.38 | 241.84 | 181.81 | 121.78 | 61.79 | $Sm^3/h$ |
| | | | | | | 229.14 | 172.26 | 115.38 | 58.55 | $Nm^3/h$ |
| | kWhr Gross | 2474.1 | 1859.7 | 1244.7 | 630.5 | 2580.9 | 1940.3 | 1299.6 | 659.5 | kWhr Gross |

**TYPICAL FUEL COSTS**

**Annual Boiler Loading**

| | | |
|---|---|---|
| Average boiler Load | | kg/hr |
| No. Hours/Day | | hr |
| No days /week | | days |
| No weeks | | wks |

**ClassA2 and D-Fuel Oil** p/litre

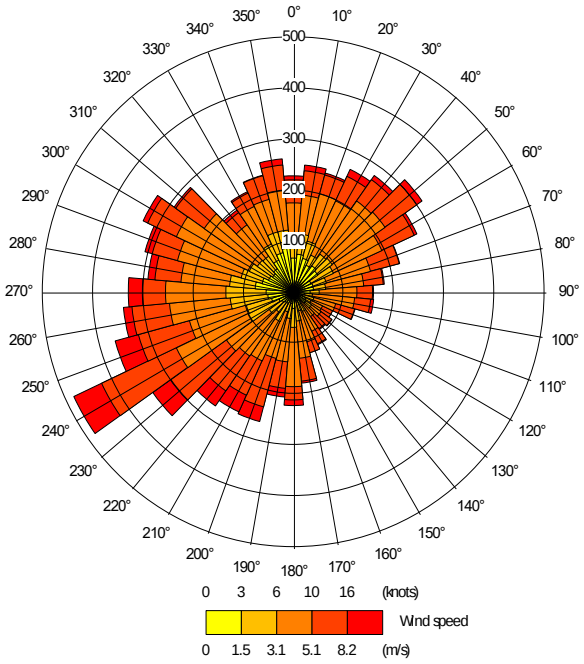
| | |
|---|---|
| Cost per day | £ #N/A |
| Cost per Week | £ #N/A |
| Cost per Year | £ #N/A |
| **Cost per tonne of Steam** | **£#N/A** |

**Natural Gas** p/kWh

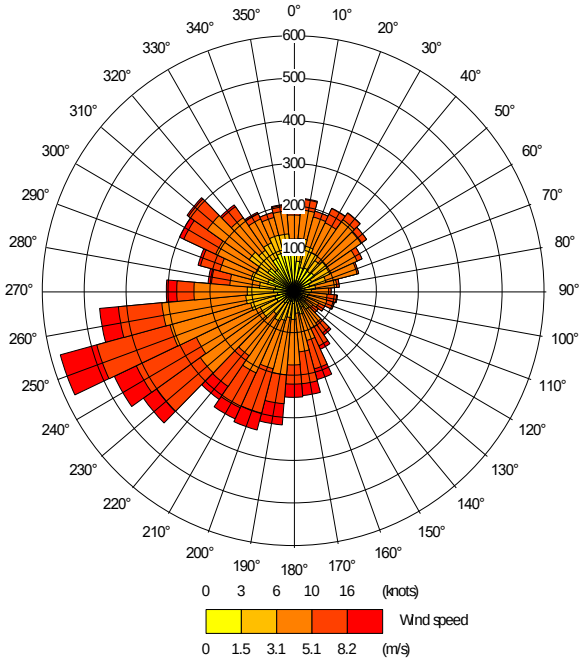
| | |
|---|---|
| Cost per day | £ #N/A |
| Cost per Week | £ #N/A |
| Cost per Year | £ #N/A |
| **Cost per tonne of Steam** | **£#N/A** |

# A2 Wind Roses – Bournemouth Airport

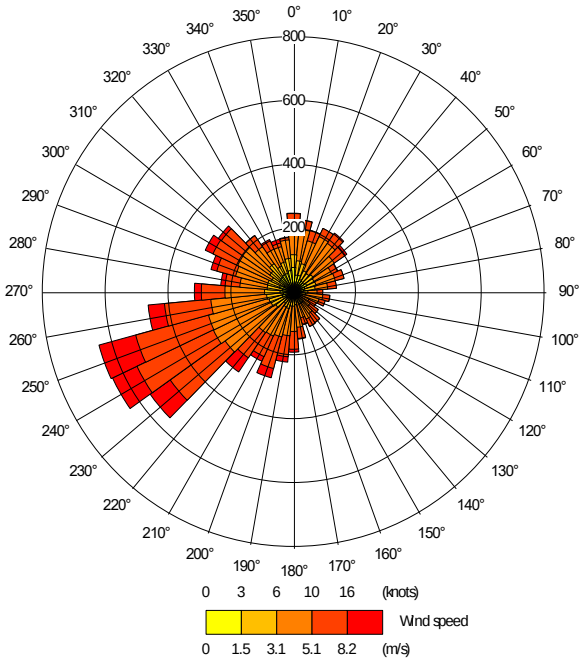
## 2013




## 2014



## 2015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230°
240°
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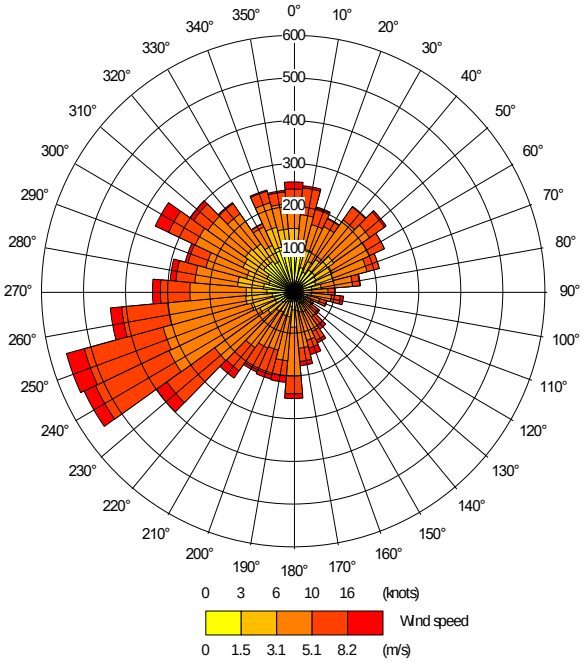
260°
270°
280°
290°
300°
310°
320°
330°
340°
350°
800
600
400
200
0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

## 2016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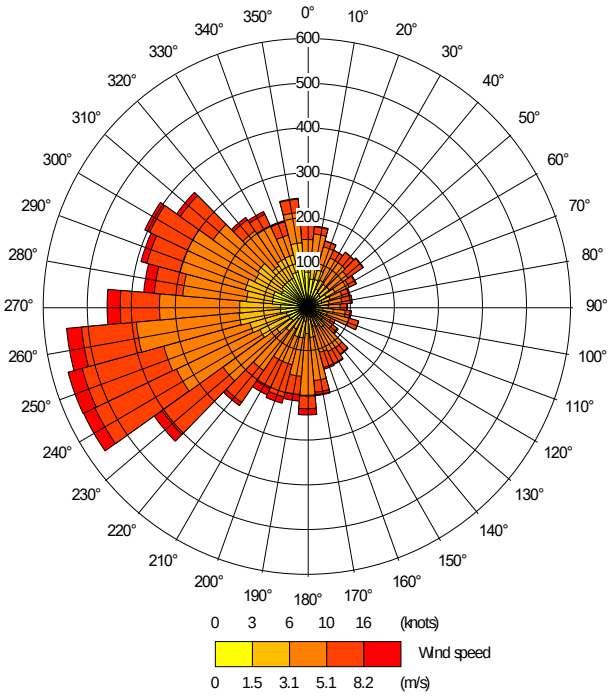
330°
340°
350°
600
500
400
300
200
100
0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

## 2017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500
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200
100
0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

# A3 100th Percentile of 1-hour Mean PCs

12.1 The AQS for 1-hour mean $NO_2$ concentrations allows 18 exceedances of 200 µg/m$^3$ in each calendar year. The 100$^{th}$ percentile of 1-hour means (i.e. the maximum in any hour of the year) is thus not directly comparable with the AQS. Results are provided here for information only.

**Table 23: Maximum 100$^{th}$ Percentile of 1-hour Mean $NO_2$ Concentrations**

| | X Coordinate | Y Coordinate | PC (µg/m$^3$) | PC (% of AQS) |
|---|---|---|---|---|
| **Max on Grid** | 400851 | 91711 | 118.0 | 59.0% |
| **Max at Relevant Receptor** | 400841 | 91716 | 101.3 | 50.7% |

# A4 ADMS-Roads Modelling Methodology

## Model Inputs

A4.1 Predictions of PCs from the A350 Holes Bay Road to Poole Harbour have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics, including road width. Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 9.0) published by Defra (2019b).

A4.2 The model has been run five times using five years of meteorological data from Bournemouth Airport, for the years 2013 and 2017, as per the ADMS-5 dispersion model. The maximum concentrations from all of these years has been used.

A4.3 AADT flows and the proportions of HDVs have been determined from the interactive web-based map provided by DfT (2019a). Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A4.1. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2019b).

**Table A4.1: Summary of Traffic Data used in the Assessment (AADT Flows)**

| Road Link | AADT | % Car | % LGV | % Rigid HGV | % Artic HGV | % Bus/ Coach | % Motor Cycle |
|---|---|---|---|---|---|---|---|
| **A350 Northbound** | 13,825 | 84.0 | 11.9 | 1.6 | 0.9 | 0.5 | 1.0 |
| **A350 Southbound** | 15,818 | 84.9 | 11.8 | 1.4 | 0.7 | 0.4 | 0.9 |

A4.4 Figure A4.1 shows the road network included within the model, along with the speed at which each link was modelled.

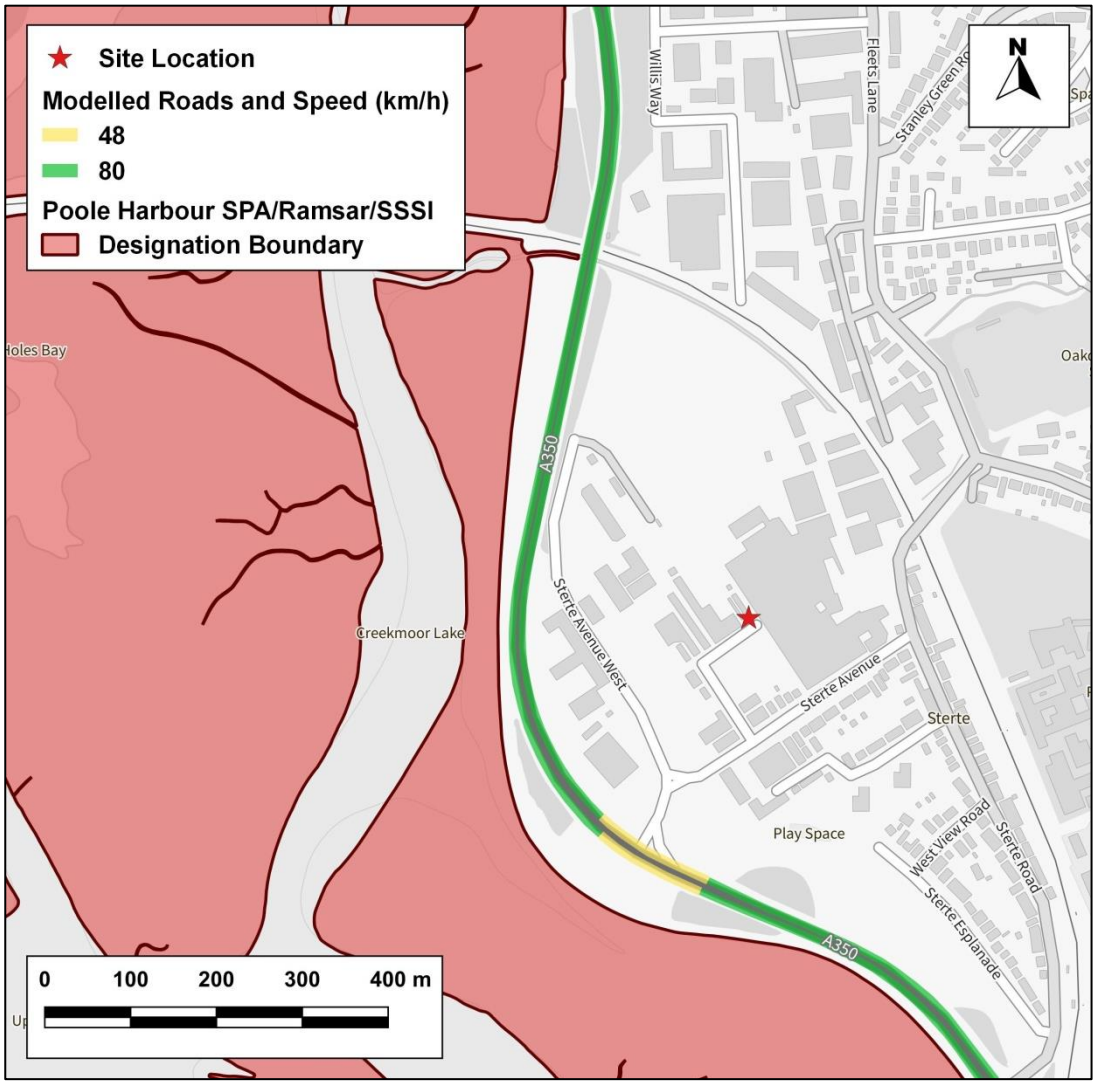


**Figure A4.1: Modelled Road Network & Speed**

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# APPENDIX E – NATURE & HERITAGE SCREENING REPORT

# Nature and Heritage Conservation

## Screening Report: Bespoke installations

| | |
|---|---|
| Reference | **EPR/PP3503BZ/A001** |
| NGR | **SZ0089391779** |
| Buffer (m) | **20** |
| Date report produced | **20/08/2019** |
| Number of maps enclosed | **8** |

### The nature conservation sites identified in the table below must be considered in your application.

| Nature and heritage conservation sites | Screening distance (km) | Further information |
|---|---|---|
| Special Areas of Conservation (cSAC or SAC) | 10 | Joint Nature Conservation Committee |
| **Dorset Heaths (SAC)** | | |
| **Isle of Portland to Studland Cliffs (SAC)** | | |
| **Dorset Heaths (Purbeck & Wareham) & Studland Dunes (SAC)** | | |
| Special Protection Area (pSPA or SPA) | 10 | Joint Nature Conservation Committee |
| **Solent and Dorset Coast (PSPA)** | | |
| **Dorset Heathlands (SPA)** | | |
| **Poole Harbour (SPA)** | | |
| Ramsar | 10 | Joint Nature Conservation Committee |
| **Poole Harbour (Ramsar)** | | |

| | | |
|---|---|---|
| **Dorset Heathlands (Ramsar)** | | |
| Sites of Special Scientific Interest (SSSI) | 2 | Natural England |
| **Poole Harbour (SSSI)** | | |
| Local Nature Reserve (LNR) | 2 | Natural England |
| **Millfield Pond (LNR)** | | |
| Local Wildlife Sites (LWS) | 2 | Appropriate Local Record Centre (LRC) |
| **Hole's Bay Relief Road** | | |
| **Creekmoor Ponds** | | |

| Protected Species | Screening distance (m) | Further Information |
|---|---|---|
| **European eel Anguilla anguilla migratory route** | up to 500m | Environment Agency. Dial 03708 506 506 for your local Fisheries and Biodiversity team |
| **Twaite shad Alosa fallax migratory route** | | |
| **Allis shad Alosa alosa migratory route** | | |
| **River lamprey Lampetra fluviatilis migratory route** | | |

| Protected Habitats | Screening distance (m) | Further Information |
|---|---|---|
| **Mudflats** | up to 500m | Natural England |

Where protected species are present, a licence may be required from Natural England or the Welsh Government to handle the species or undertake the proposed works.

The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

**Please note** we have screened this application for protected and priority sites, habitats and species for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

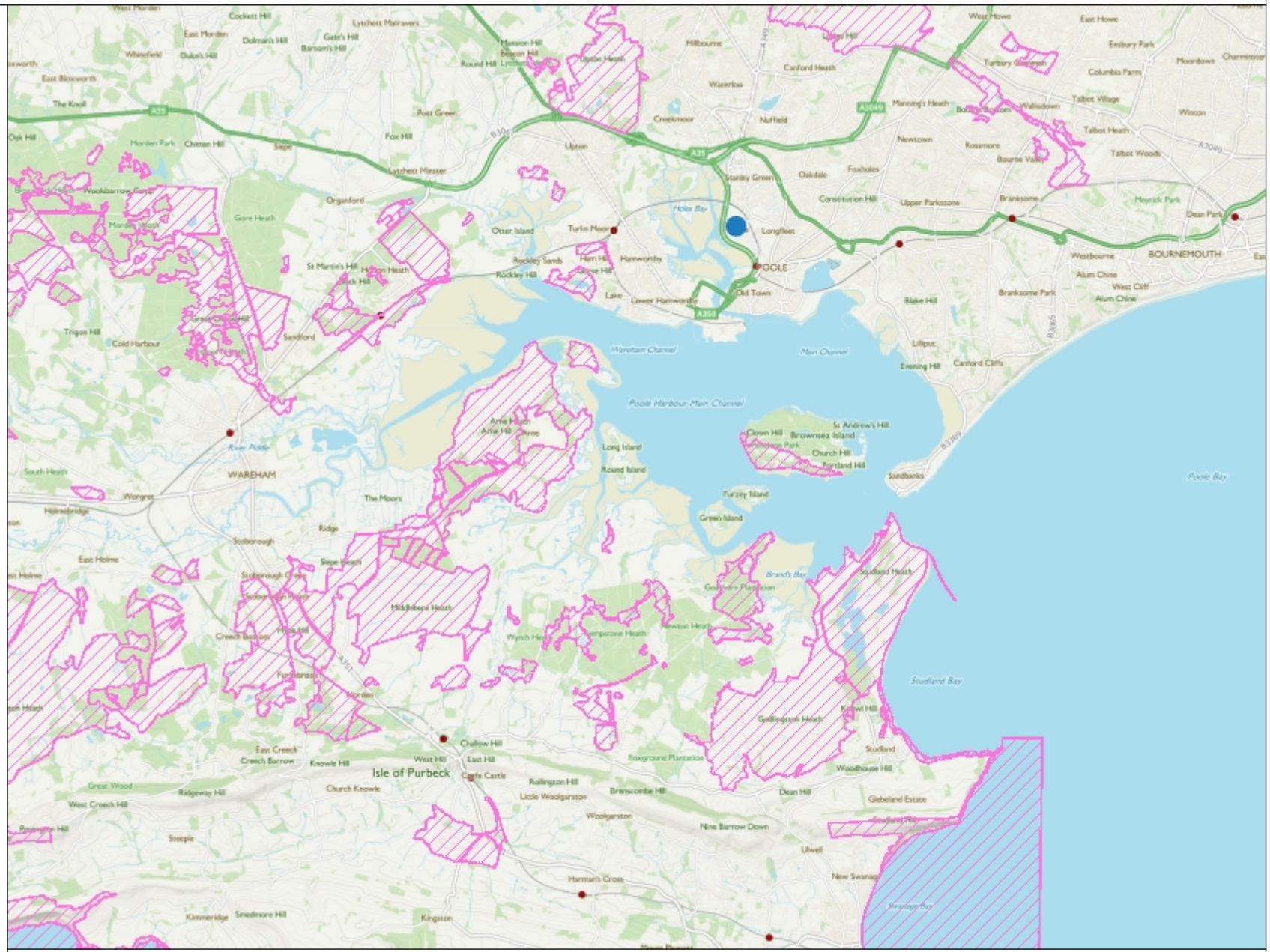
**Please note**, the enclosed pre-application map(s) is valid for a period of **6 months**. If you plan to submit your application more than 6 months after the map(s) was generated, you must request that the screen is re-run. This will ensure that you have used the most current information on heritage and nature conservation interests in your application.

# Special Areas of Conservation

Environment Agency

Legend

- SAC (England)
- SAC (Wales)




0 1,000 2,000 3,000

Metres

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W E
S

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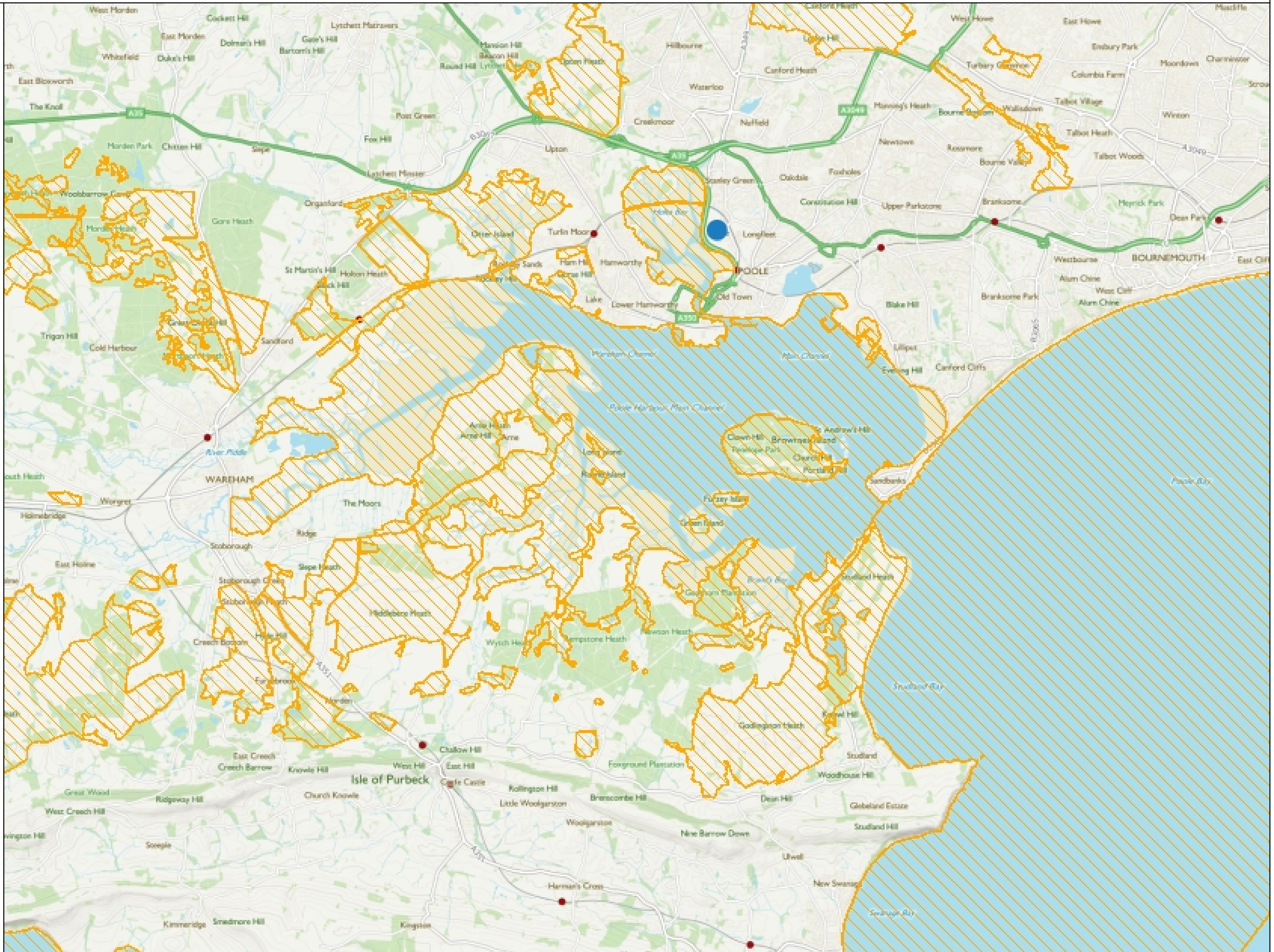
# Special Protection Area

Environment Agency

Legend

- SPA (England)
- SPA (Wales)

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Metres

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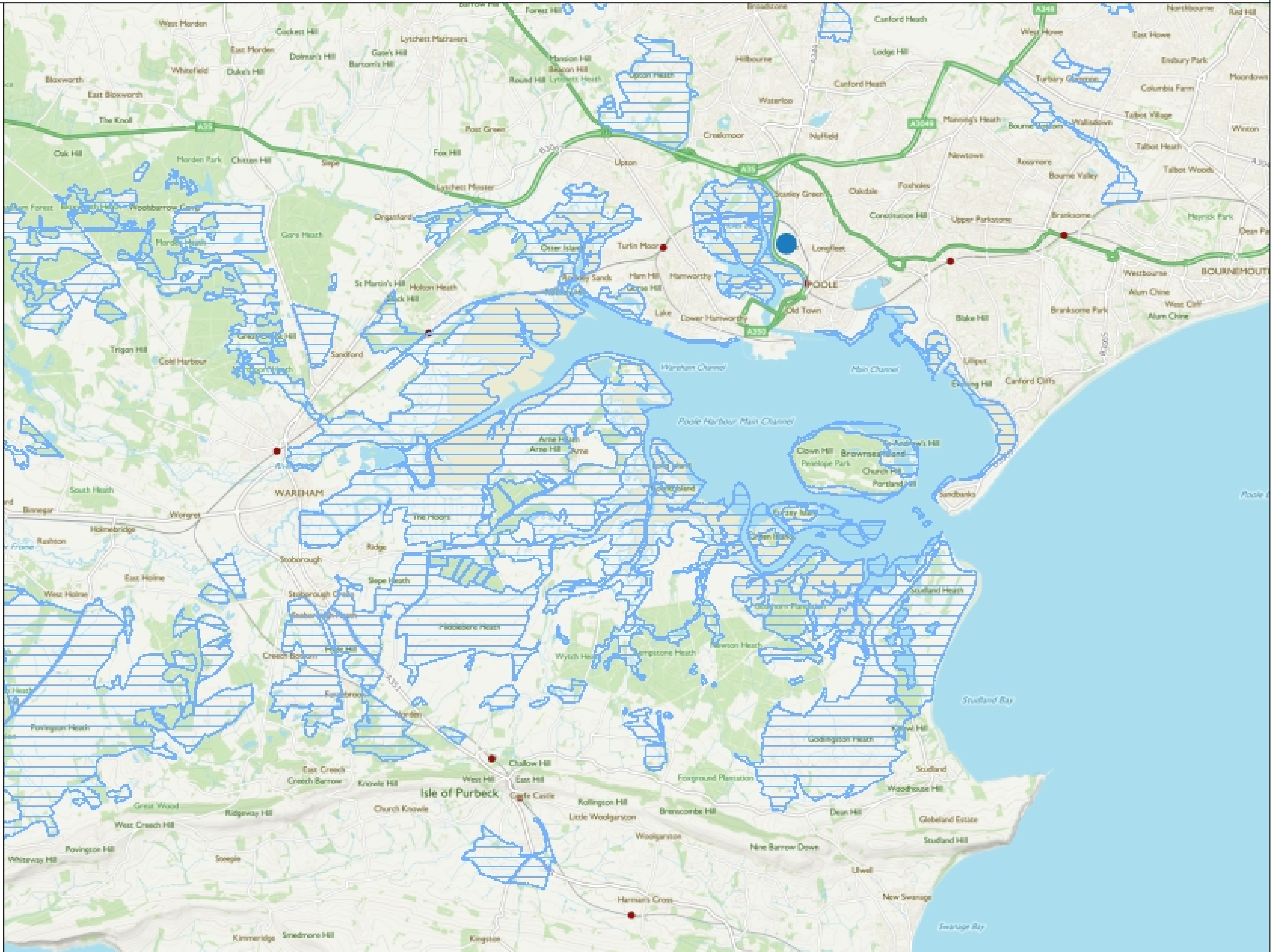
# Ramsar

Legend

- Ramsar (England)
- Ramsar (Wales)

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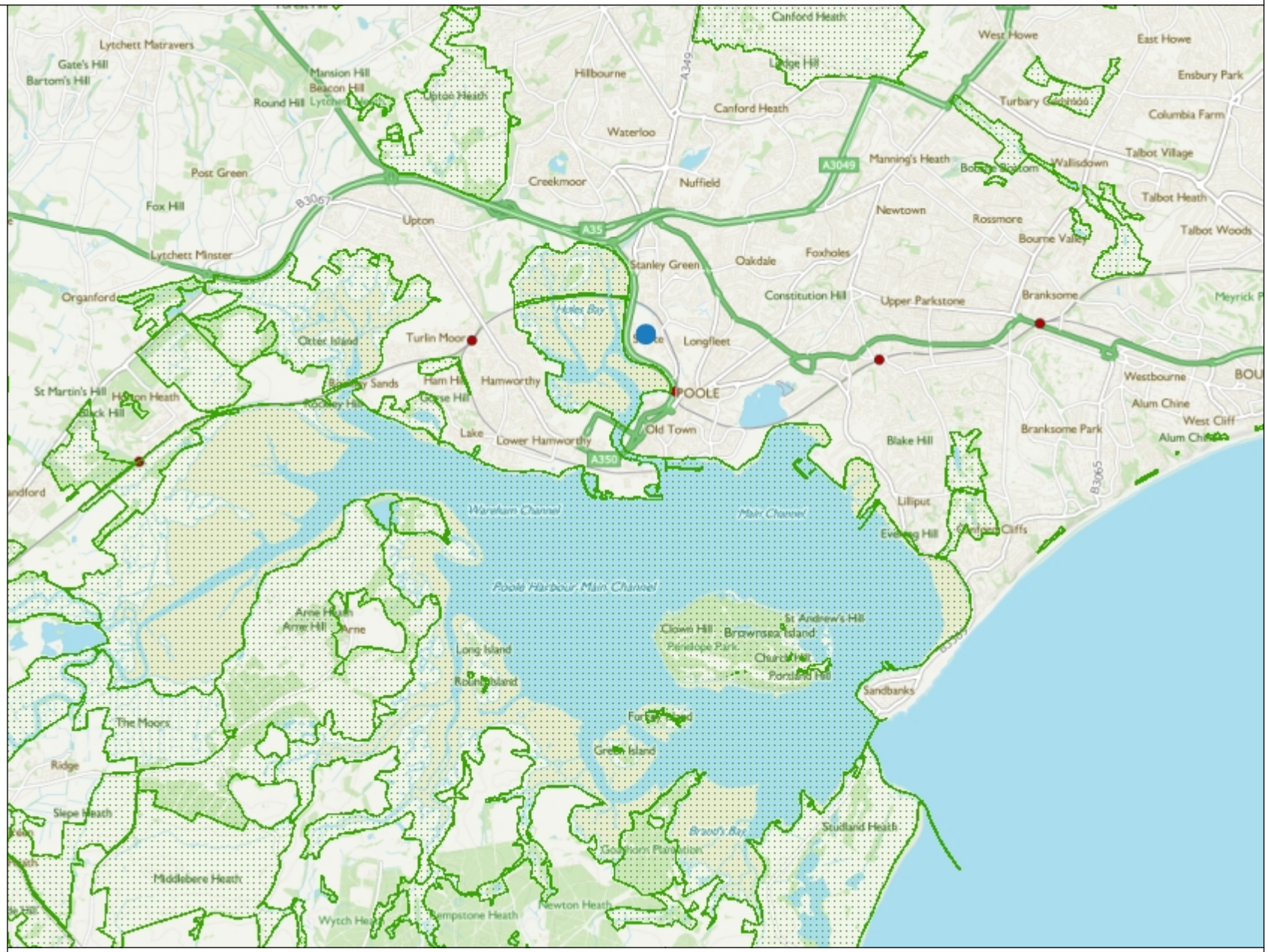
# SSSI

Environment Agency

## Legend

- SSSI (England)
- SSSI (Wales)




0 700 1,400 2,100

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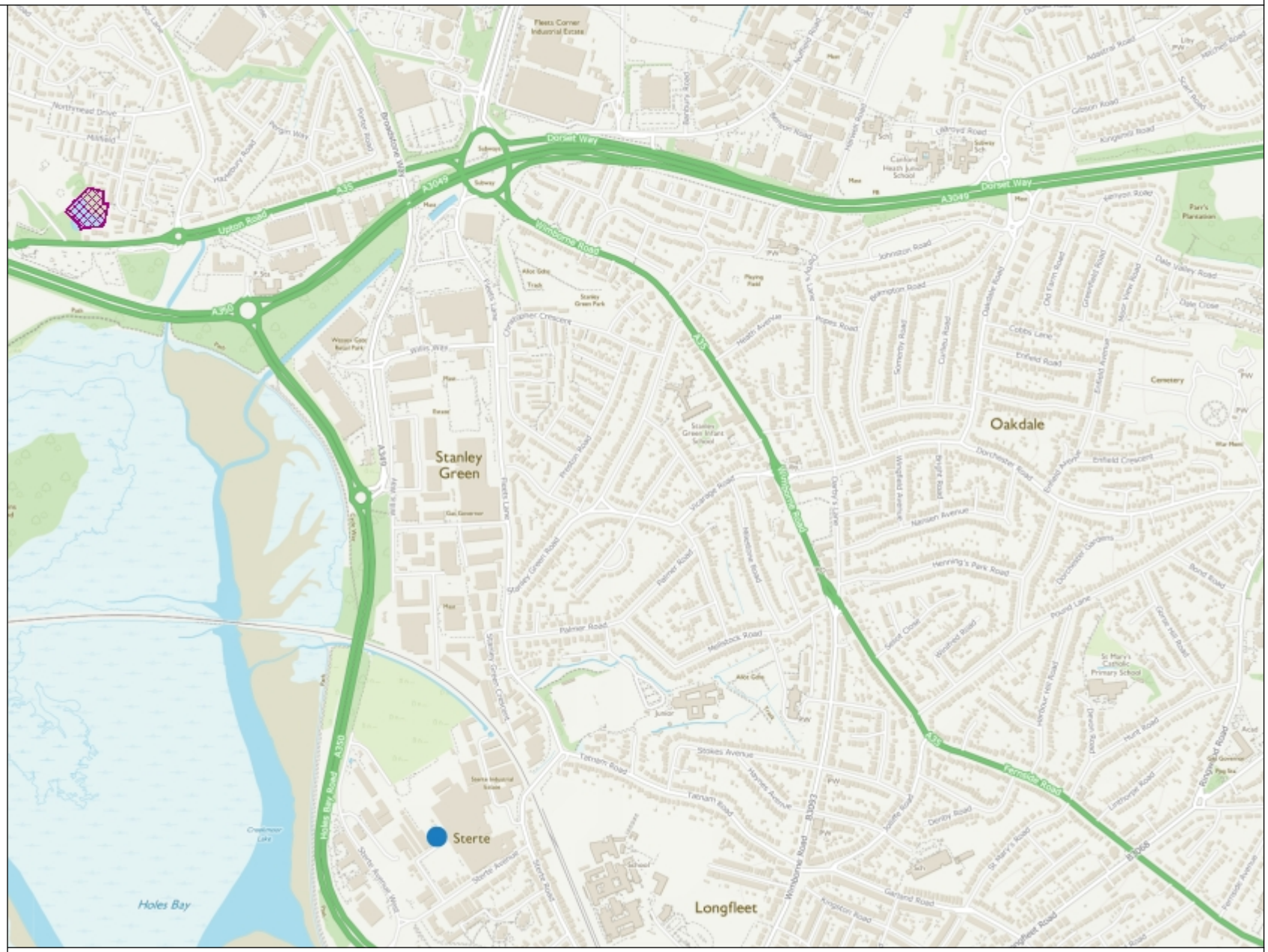
# Local Nature Reserve

Environment Agency

Legend

- LNR (England)
- LNR (Wales)

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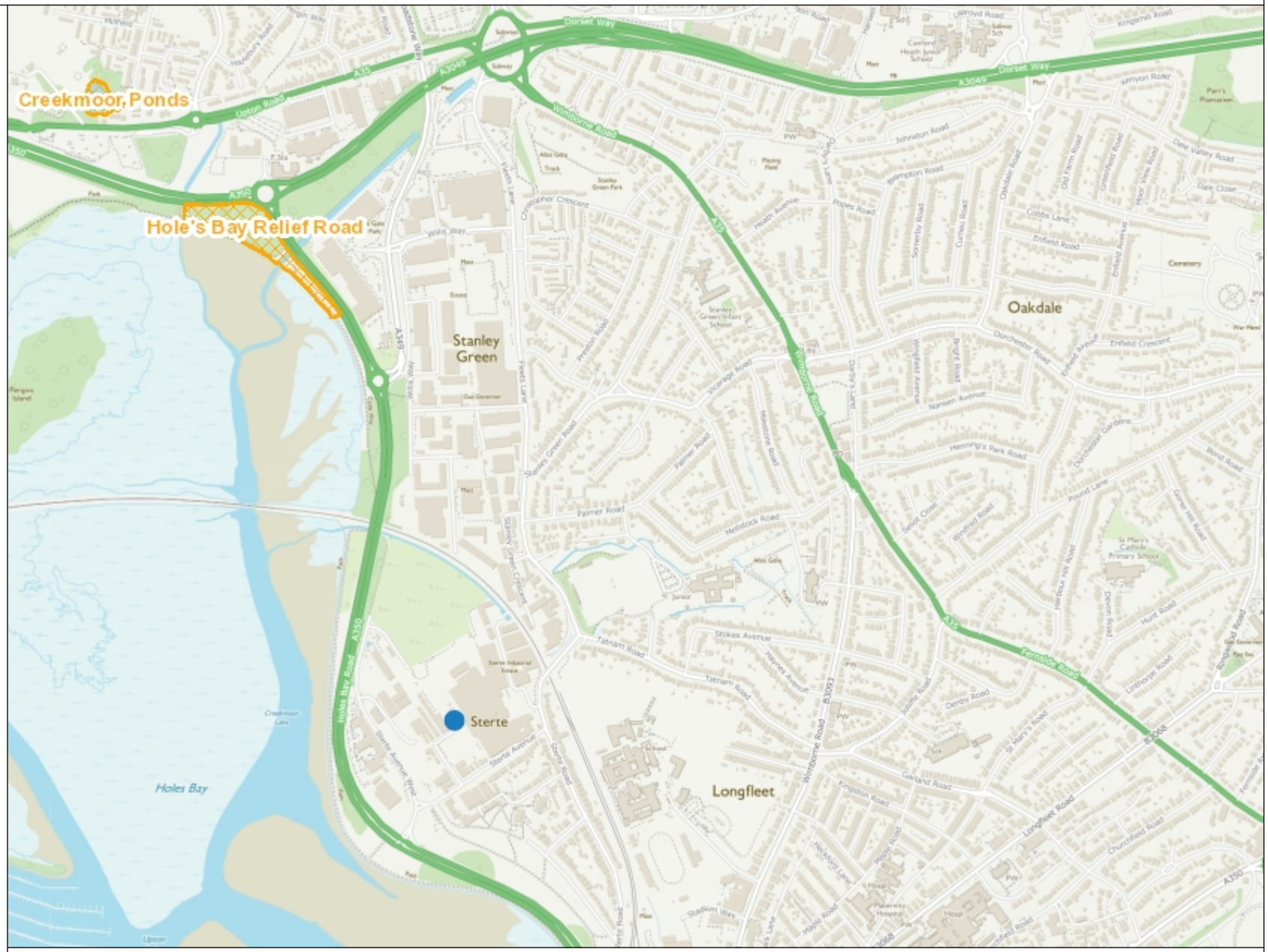
# Local Wildlife Sites

Environment Agency

Legend

Local Wildlife Sites




0 125 250 375

Metres

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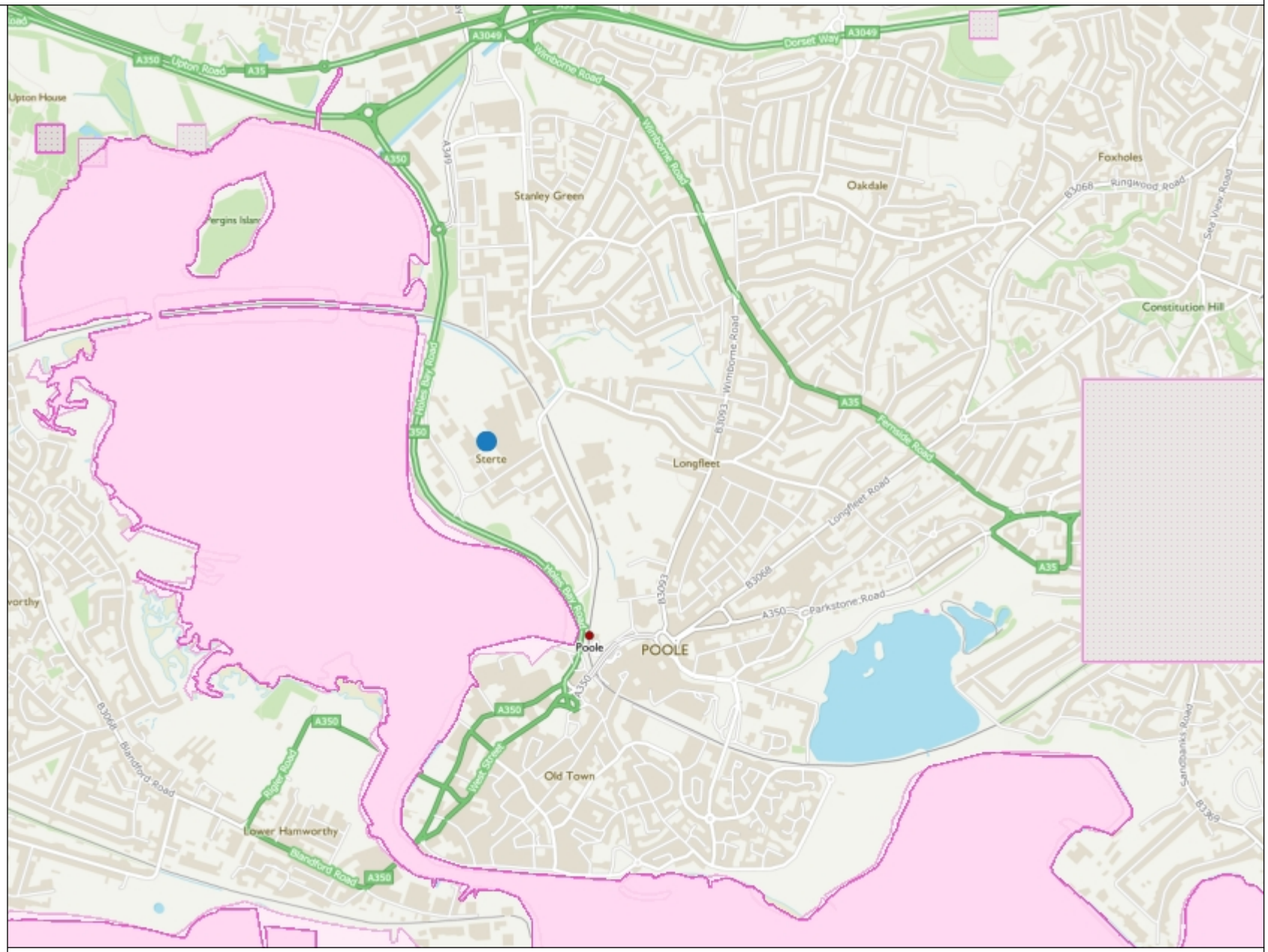
# Protected Species

Environment Agency

## Legend

Protected species screened for Env Permits - complete set

- Protected species, non fish
- Protected fish
- Protected fish migratory route

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Metres

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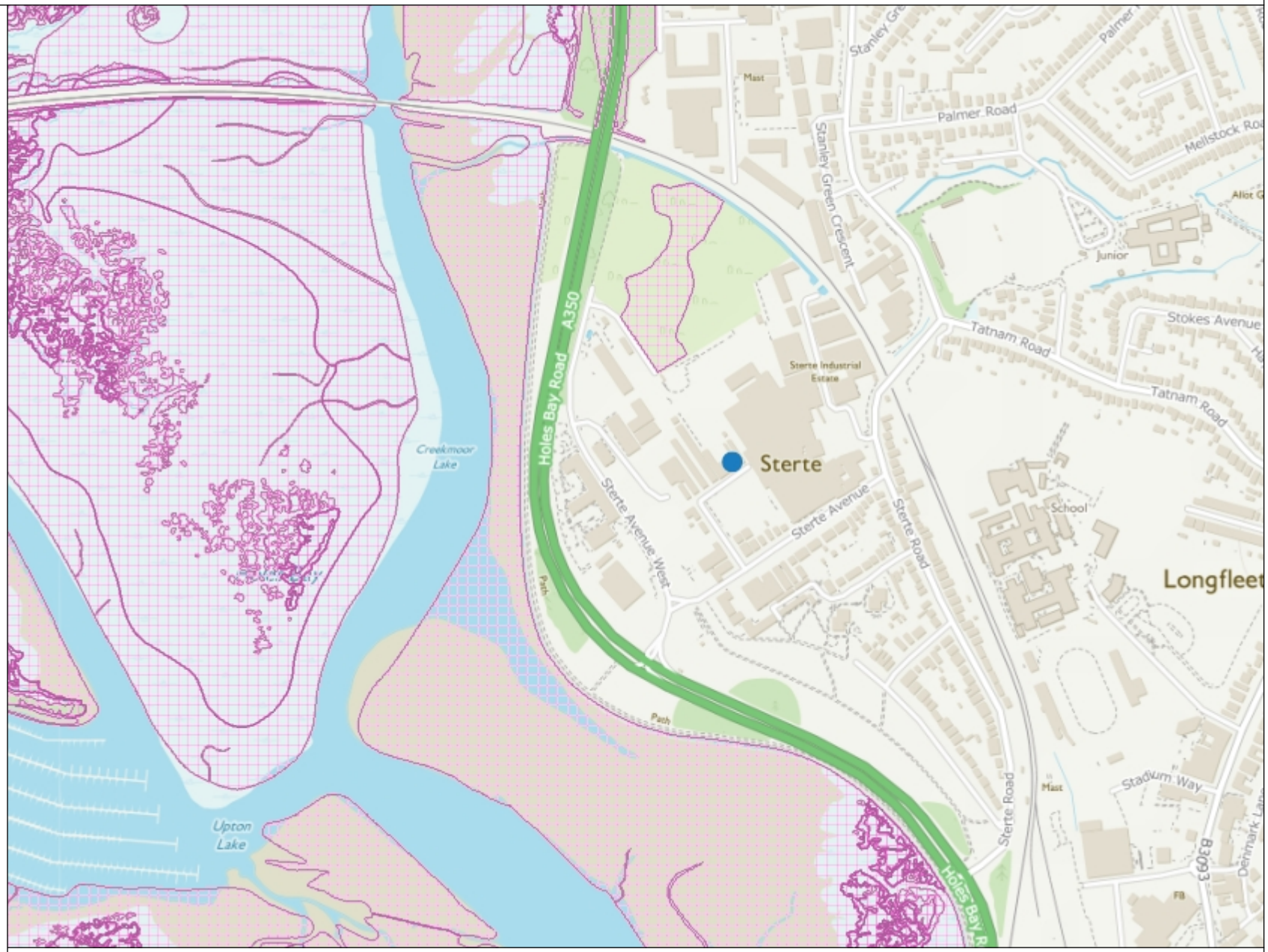
# Protected Habitats

Environment Agency

Legend

Protected Habitats screened for Env Permits

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Metres

N W E S

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