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Consulting Engineers Limited



Chirk Particleboard Facility

Kronospan

Dispersion Modelling Assessment

ENGINEERING CONSULTING

Document approval

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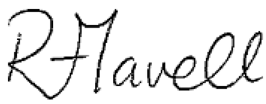
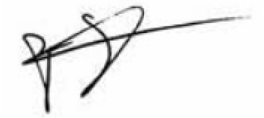
Prepared by:	Rosalind Flavell		Senior Environmental Consultant	02/03/2023
Checked by:	James Sturman		Lead Environmental Consultant	02/03/2023

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Contents

1 Introduction

1.1 Background

Kronospan Limited (Kronospan) operates a panel board manufacturing facility at its site in Chirk, North Wales (the Facility). This is regulated by Natural Resource Wales (NRW) under the terms of an Environmental Permit (EP) (reference EPR/BW999IG) issued in October 2022.

Through the Operator Review process Kronospan has advised NRW that it may not be able to comply with the oxides of nitrogen (NOx) emission limit value (ELV) on the emission point A33 (WESP 21).

Within the Facility, the resin plant manufactures formaldehyde-based resins in four reactors. The emissions from the reactors are abated via a wet scrubber; emission source A5. A5 also abates emissions from two paper impregnation lines with A6 (a smaller wet scrubber) abating emissions from the third paper impregnation line. Although, the Wet Scrubbers are functioning as designed and compliant when tested against the relevant standards and conditions within the EP, they require much frequent preventative maintenance and as such Kronospan is proposing to replace them. Therefore, Kronospan is proposing to re-duct the emissions from the resin reactors and paper impregnation lines to the WESP 32, which will then be used as the abatement for these emissions instead of the wet scrubbers, which are to be removed.

As such Kronospan is submitting this variation application to:

- change the NOx ELV from A33 (WESP 21) from the permitted 100 mg/Nm^3 to 200 mg/Nm^3; and
- to duct the emissions from A5 and A6 to A28 (WESP 32).

This dispersion modelling assessment has been produced to demonstrate that the impacts associated with the proposed changes would not have a significant effect, alone or in combination, on human health or ecology.

Emission points A5, A6 and WESP 32 only include emission limits on total dust, total volatile organic compounds (TVOC) and formaldehyde (CH_2O), and the changes to WESP 21 are related to the ELV for NOx. Therefore, this assessment only considers those impacts which are affected by the variation, namely:

- Impacts on human health from emissions of:
  - Oxides of nitrogen (NOx);
  - Particulate matter (PM);
  - TVOCs; and
  - CH_2O.
- Impacts on ecology from emissions of NOx and the resultant effects on:
  - Nitrogen deposition; and
  - Acid deposition.

It is noted that nitrogen and acid deposition impacts are calculated from a combination of emissions from NOx, ammonia (NH_3), sulphur dioxide (SO_2) and hydrogen chloride (HCl). Therefore, emissions of these substances have also been considered, where appropriate.

Impacts have been calculated for the following scenarios:

- Existing - total impact of the Facility operating as set out in the existing EP; and
- Proposed – the Facility as proposed.

1.2 Structure of the report

This report has the following structure:

- A description of the emission points to atmosphere is provided in Section 2.
- A description of the operating and emissions scenarios to be considered in this dispersion modelling assessment is provided in Section 3.
- National and international air quality legislation and guidance, and local planning policies which relate to air quality, are considered in Section 4.
- The residential properties and ecological receptors in the vicinity of the Facility sensitive to changes in air quality associated with the proposals are highlighted in Section 5.
- The current levels of ambient air quality are described in Section 6.
- The inputs used for the dispersion model are contained within Section 7.
- The results of the dispersion modelling are presented and discussed in Section 8 to Section 9.
- The conclusions are presented in Section 10.
- All figures, model input data, and results tables are provided in the Appendices.

2 Emission Points to Atmosphere

For the purpose of this report, emissions to atmosphere have been split into two groups.

1. combustion plants which provide heat and power to the manufacturing process; and
2. emission sources directly related to the panel board manufacturing process.

The combustion plants are set out in Table 1, and the panel board manufacturing process plant in Table 2. These tables set out the use of each combustion plant, and where the emissions are released to atmosphere.

As shown in Table 1, there are a number of combustion plants at the Facility. Under normal operations, the hot exhaust gases from the combustion plants are used as a source of heat within the driers and released to atmosphere via the cyclones.

Table 1: Combustion Sources

Combustion plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to atmosphere via
Natural Gas Heaters					
K1	Gas	2.25	Primary heat source	Kronoplus single daylight press plus space heating.	Dedicated stack only
K5	Gas	14.1	Standby for K7	Rawboard thermal oil to contiroll presses.	Dedicated stack only
K6	Gas	16.5	Standby for K7 & K8	Rawboard thermal oil to contiroll presses.	Dedicated stack only
Biomass Boilers					
K7	Biomass Gas	38	Primary heat source	Grate based combustion system producing steam and heating thermal oil for the Particle Board and MDF processes. Residual heat from the stack fed into MDF Drier 2.	MDF 1 or MDF 2 cyclone or dedicated stack
K8	Biomass	32	Primary heat source	Grate based combustion system producing steam and heating thermal oil for the Particle Board and MDF processes. Residual heat from the stack fed into the MDF Drier 1.	MDF 1 or MDF 2 cyclone or dedicated stack
Gas Engines					
Engine 1	Gas	21.28	Primary electricity, heat and steam source for the manufacturing process.	Electricity supplied to the Site. Steam production for MDF 1 & 2 process. Heat to the MDF Driers (MDF 1 and MDF 2).	MDF 1 or MDF 2 cyclone or dedicated stack
Engine 2	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack
Engine 3	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack

Combustion plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to atmosphere via
Engine 4	Gas	21.28	Not currently installed.		MDF 1 or MDF 2 cyclone or dedicated stack
Engine 5	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack
Gas Turbines					
GT1	Gas	20.5	Standby in the event that a gas engine is offline.	Heat to MDF1 drier during gas engine maintenance. Back-up electricity supply to site.	MDF 1 cyclone or dedicated stack
GT2	Gas	20.5	Standby in the event that a gas engine is offline.	Heat to MDF2 drier during gas engine maintenance. Back-up electricity supply to site.	MDF 2 cyclone or dedicated stack
Process driers – combustion plant					
MDF1	Gas	15	Standby for K8/GT1	MDF1 drier. Direct drier. Back-up.	MDF 1 cyclone only
MDF2	Gas	32	Standby for K7/GT2	MDF2 drier. Direct drier. Back-up.	MDF 2 cyclone only
Chip dryer	Wood Dust/Gas	45	Primary heat source	Chip drier. Direct drier.	WESP 21

Table 2: Process Plant

Unit	Use	Vents to atmosphere via
A1 Formalin ECS	Exhaust from the emissions control – formaldehyde plant	Dedicated stack only
A5 Resin / VITS wet scrubber	Exhaust from the wet scrubber on the Resin VITS 2,3 and 5 paper impregnation lines	Currently dedicated stack but proposed to vent via WESP 32
A6 VITS wet scrubber	Exhaust from the wet scrubber on the Resin VITS 4 paper impregnation line	Currently dedicated stack but proposed to vent via WESP 32
A30 MDF1 cyclone	Abatement for emissions from the MDF 1 drier	MDF 1 Cyclone
A29 MDF2 cyclone	Abatement for emissions from the MDF 1 drier	MDF 2 Cyclone
A28 WESP 32	Currently only emissions from press abatement system and water is not used so not functioning as a WESP. However, it is proposed to use as a WESP for emissions from A5 and A6 combined with emissions from the press abatement system post the wet scrubber on this line.	WESP 32
A31 Press abatement system (existing)	Press abatement system on the MDF 1, MDF 2 and particleboard Contiroll (3 lines)	WESP 32
A33 Chip dryer	Chip dryer fuelled by gas and dust	WESP 21

3 Operating Scenarios

All of the combustion plants at the Facility are configured with full redundancy. Therefore, in the event that a particular combustion plant is not available, other combustion plants can provide the heat and power required to maintain the operation of the board manufacturing process. For all other sources, it has been assumed that these are in continuous operation. The operating scenarios and associated emission sources in both normal operations, and in the event that certain board manufacturing plant or combustion plant is offline, are presented in sections 3.1 and 3.2 and represent the full suite of operating scenarios considered within this assessment.

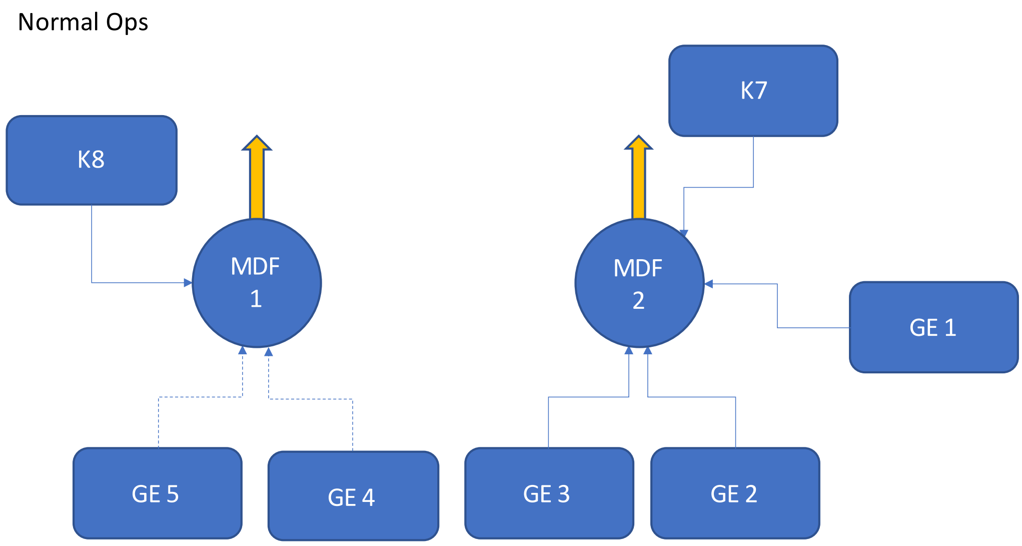
3.1 Normal operations

Under normal operating conditions point source emissions to atmosphere from the Facility are from the following sources:

1. K1 boiler;
2. MDF 1 and MDF 2 cyclones;
3. WESP 32;
4. WESP 21;
5. emissions control system from the Formalin Plant (A1);
6. wet scrubbers on the resin and paper impregnation plant (A5 and A6); and
7. the dust filter units.

The arrangements for the release of emissions from the MDF 1 and MDF 2 cyclones is presented in Figure 1, and the point sources are explained in more detail in sections 3.1.1 to 3.1.7.

Figure 1: Normal Operations



3.1.1 K1 boiler

K1 is a 2.25MWth gas heater providing heating. The reference conditions for the boiler the ELV are expressed as mg/Nm^3 (273.15 K, 101.3 kPa, dry air, 3 % oxygen content by volume).

3.1.2 MDF 1 cyclones

MDF 1 cyclones are fed from the MDF 1 drier which is a direct heat drier. The EP includes ELVs from the MDF 1 cyclones for NOx, carbon monoxide (CO), total dust (PM), total volatile organic compounds (TVOCs) and formaldehyde (CH_2O). The ELVs for the MDF 1 cyclones are expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content.

Under normal operations, emissions from the MDF 1 cyclones consist of exhaust gases from the K8 biomass plant and up to two gas engines. The EP includes ELVs from K8 for the full suite of pollutants listed in Annex VI of the IED for co-incineration plants, and ELVs for the gas engines for NOx. This includes half-hourly ELVs for certain pollutants.

For modelling purposes when determining the impact of pollutants other than those for which an ELV has not been set for the MDF 1 cyclones, it has been assumed that the release rate from the K8 biomass plant vents to atmosphere via the MDF 1 cyclones under normal operations. The emission rate from K8 biomass plant has been divided by two to reflect that the emissions would be split across the two cyclones.

3.1.3 MDF 2 cyclones

MDF 2 cyclones are fed from the MDF 2 drier which is a direct heat drier. The EP includes ELVs from the MDF 2 cyclone for NOx, CO, PM, TVOC, CH_2O, hydrogen chloride (HCl), and hydrogen fluoride (HF). The ELVs for the MDF 2 cyclones are expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content.

Under normal operations, emissions from the MDF 2 cyclones consist of exhaust gases from the K7 biomass plant and up to three gas engines. The EP includes ELVs for the K7 biomass plant for NOx, CO, PM and SO_2 prior to the MDF 2 drier. For modelling purposes, it has been assumed that the release rate of SO_2 from the K7 biomass plant vents to atmosphere via the MDF 2 cyclones under normal operations. The emission rate from K7 biomass plant has been divided by four to reflect that the emissions would be split across the four cyclones.

3.1.4 WESP 32

In the existing configuration the WESP 32 includes emissions from three existing presses (the MDF 1 and 2 presses and the Particleboard Press) after the press abatement system (emission point A28). The EP includes ELVs to air for PM, TVOCs, and CH_2O, for the three existing presses combined. The ELVs are expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content. WESP 32 is not used as a wet electrostatic precipitator but just to vent the emissions from the press abatement system at a greater height.

It is proposed that the emissions from emission points A5 and A6 would be ducted to the WESP 32 and this would be used for the abatement of emissions from the paper impregnation and resin plants rather than the existing wet scrubbers. In this scenario the volumetric flow rate and emission rate has been increased to allow for the additional flow and emissions from each source.

3.1.5 Resin reactors and paper impregnation plant

The resin reactors and paper impregnation plant includes two wet scrubbers (A5 and A6). The EP includes ELVs for PM, CH_2O and TVOCs. These ELVs are expressed at 273.15 K, 101.3 kPa, dry gas, with no correction for oxygen content.

Modelling has been carried out based on the emissions directly from emission points A5 and A6 as set out in the existing EP and as proposed as part of the EP variation i.e. via the WESP 32.

3.1.6 Formalin plant

The Formalin Plant includes an emission control system, which vents to atmosphere via a dedicated stack (A1). The EP includes an ELV for CH_2O. The ELV is expressed at 273.15 K, 101.3 kPa, dry gas, with no correction for oxygen content.

3.1.7 WESP 21

WESP 21 is used to abate the emissions from the directly heated drier. This includes a single drier fan. For compliance purposes, monitoring is carried out after the drier fan close to the top of WESP 21. Monitoring can only be undertaken on WESP 21 when the drier / drier fan is near to full load (min 80% loading). The flue gas parameters have been determined based on the monitoring of the operation of WESP 21. The EP includes emission limits for PM, TVOC and CH_2O at the upper end of the BAT AEL range within the BREF. However, the limit for NOx is the lower end of the range. As set out in section 1.1, this application is seeking to vary the NOx ELV on the WESP 21 to be 200 mg/Nm^3. The ELVs for WESP 21 are expressed at 273.15 K, 101.3 kPa, dry gas, 18% oxygen content by volume.

Modelling has been carried out based on operation at the ELV in the EP and that proposed as part of this EP variation.

3.2 Non-standard operating scenarios

3.2.1 WESP 32 or WESP 21 Offline

In the event of a malfunction on WESP 32 or WESP 21 unit the operations are to be terminated as soon as is reasonably practicable, but within a period not exceeding 1-hour, until such time as normal operations of the units can be restored. Kronospan is required to notify NRW in the event of this occurring, and has a record of all these events occurring historically on WESP 32 when it was used to discharge emissions from the BAB driers. The reports show that, in most cases, WESP 32 recovered and that discharge to the chip drier emergency stack only lasts for a short period with the drier still operational. Therefore, releasing the exhaust gases from the chip drier emergency stack is considered to be an emergency scenario if the WESP 21 is offline.

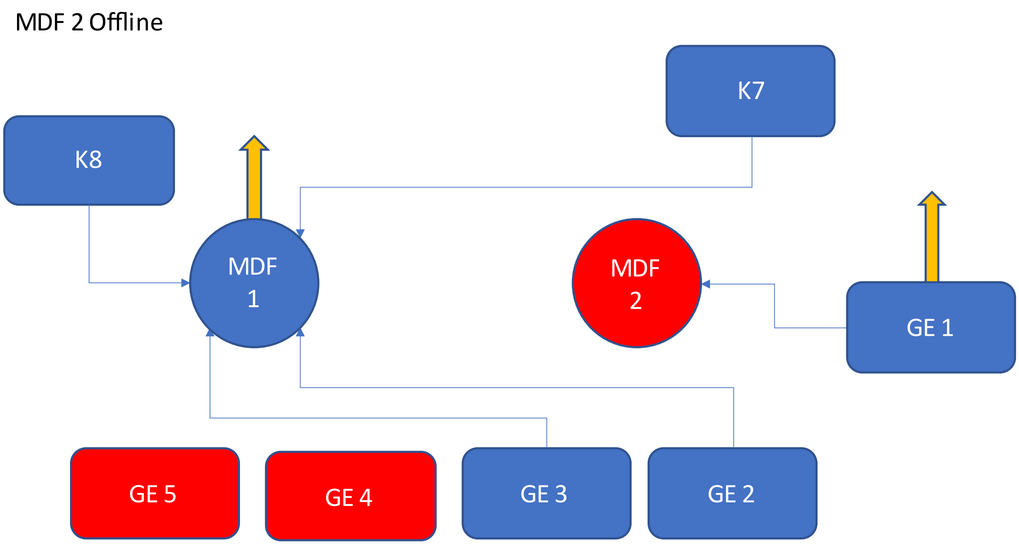
WESP 32 is currently not used for the abatement of emissions from the press abatement system but is used to allow emission to be released at height to assist with dispersion of emissions. However, as part of the EP variation application it is proposed to use WESP 32 as abatement for the emissions from the paper impregnation and resin production processes (currently emission points A5 and A6). If there was a loss of power to the WESP this would no longer work as an electrostatic field (for PM abatement) but would still act as a wet scrubber for the abatement of the VOCs.

3.2.2 MDF 1 or MDF 2 Cyclone offline

The MDF 1 and 2 driers are fed by exhaust gases from a mixture of the K7 biomass plant, the K8 biomass plant, gas engines, and gas turbines (if the gas engines are unavailable).

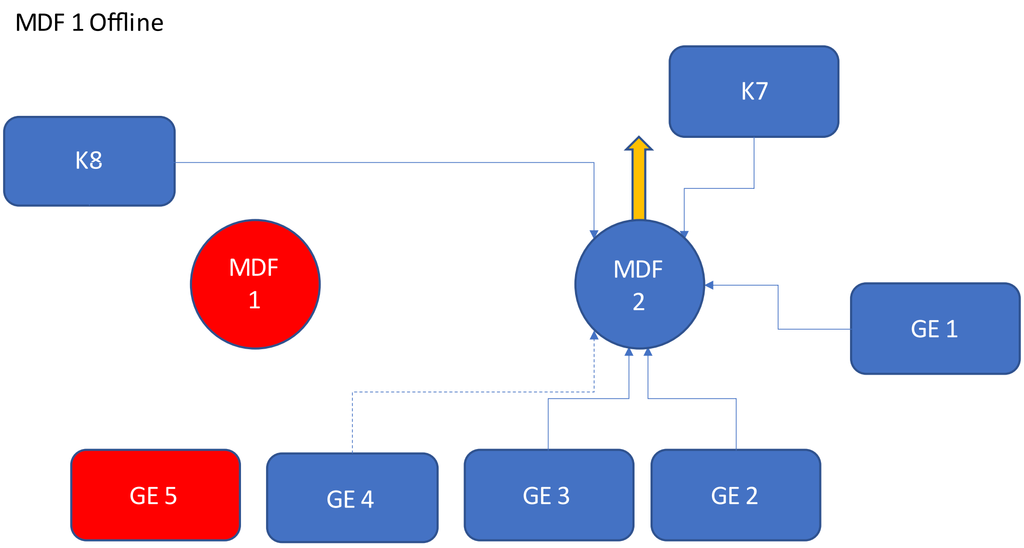
MDF 1 drier normally takes the exhaust gases from K8 biomass plant and up to two gas engines. However, if MDF 2 cyclone is offline MDF 1 drier can take the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to two gas engines. If the MDF 2 cyclone is offline the electricity demand for the site is reduced and only three gas engines would be needed. In this instance the exhaust gases from two gas engines will be used in the MDF 1 drier, but one of the gas engines will need to exhaust via its own dedicated stack. This is presented in a graphical format in Figure 2.

Figure 2: Emissions Sources - MDF 2 Offline



MDF 2 drier is the larger drier and normally takes the exhaust gases from the K7 biomass plant and up to three gas engines. However, if MDF 1 cyclone is offline, MDF 2 drier can take the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to four gas engines. If the MDF 1 cyclone is offline the electricity demand for the site is reduced. In this instance the exhaust gases from all the operating gas engines can be used in the MDF 2 drier. This is presented in a graphical format in Figure 3.

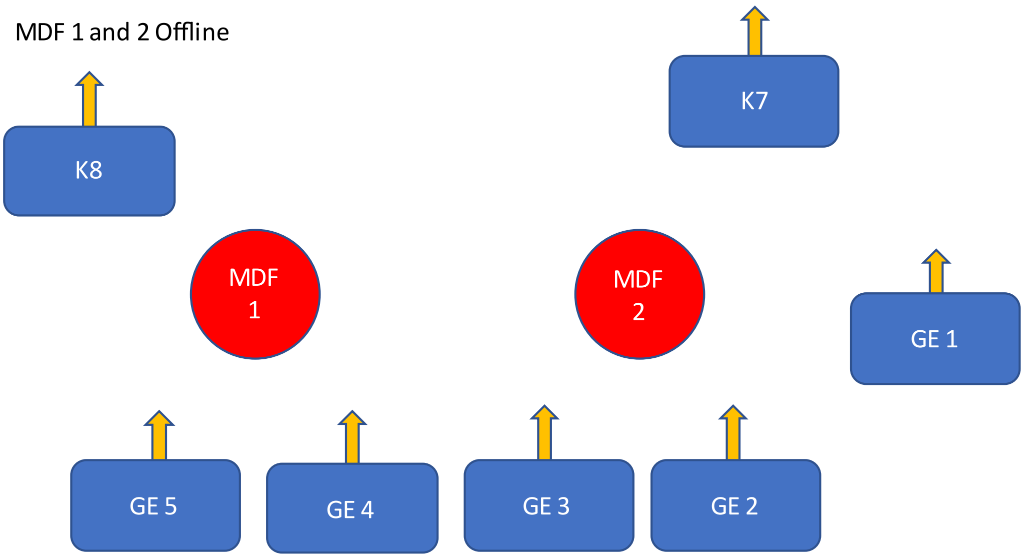
Figure 3: Emissions Sources - MDF 1 Offline



3.2.3 MDF 1 and 2 Cyclone offline

If MDF 1 and 2 cyclones are offline for a short period, the sources feeding the drier are required to release to atmosphere via their own dedicated stacks. This would only occur for extremely short and rare periods as the electricity and heat generated would not be able to be used by the manufacturing process. In this scenario, emissions from both the K7 and K8 biomass plants and up to five gas engines would vent to atmosphere via their dedicated stacks. In this scenario there would not be any releases from the MDF 1 or MDF 2 cyclones. This is presented in a graphical format in Figure 4.

Figure 4: Emissions Sources - MDF 1 and 2 Offline



3.2.4 K7 or K8 Biomass Plant offline

The K7 and K8 biomass plant provide steam for the MDF manufacturing process; heat to the thermal oil for the contiroll presses; and residual heat from the exhaust gases is used in the MDF driers. If either K7 or K8 biomass plant are offline, the heat for the driers will be provided by the burners in the driers and gas heaters K5 and / or K6 will be used to heat the oil for the contiroll presses. In this scenario the MDF 1 and MDF 2 cyclones would still be operating together with either K5 or K6, which will always vent to atmosphere via their dedicated stacks.

For dispersion modelling purposes, if the K7 and K8 biomass plants are offline, it has been assumed that the MDF driers continue to operate but K5 and K6 will also operate to supply heat to the thermal oil for the contiroll presses.

3.2.5 Gas engine unavailable

Back-up to the gas engines is provided by gas turbines. Gas Turbine 1 is ducted to MDF 1 drier, and Gas Turbine 2 is ducted to MDF 2 drier. This will not change the emissions from the driers. Kronospan is committed to decommissioning the turbines when the two new gas engines (4 and 5) are installed. The only time the gas turbines would vent via their own stack would be to carry out quarterly emissions monitoring.

Table 3: Operating Scenarios – Combustion Sources

Source	Normal Ops	MDF 1 Only Offline	MDF 2 Only Offline	WESP 32 Only Offline	MDF 1 and MDF 2 Offline[(1)]	MDF 1, MDF 2 and WESP 32 Offline[(1)]	K7 and K8 offline
K1	K1	K1	K1	K1	K1	K1	K1
K5	-	-	-	-	-	-	K5
K6	-	-	-	-	-	-	K6
K7	MDF 2	MDF 2	MDF 1	MDF 2	K7	K7	-
K8	MDF 1	MDF 2	MDF 1	MDF 1	K8	K8	-
Chip drier	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21
Gas Engine 1	MDF 1	-	MDF 1	MDF 1	Gas Engine Stack	Gas Engine Stack	MDF 1
Gas Engine 2	MDF 1	MDF 2	MDF 1	MDF 1	Gas Engine Stack	Gas Engine Stack	MDF 1
Gas Engine 3	MDF 2	MDF 2	Gas Engine Stack	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
Gas Engine 4 [(2)]	MDF 2	MDF 2	-	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
Gas Engine 5 [(2)]	MDF 2	MDF 2	-	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
MDF 1 burner	-	-	-	-	-	-	MDF 1
MDF 2 burner	-	-	-	-	-	-	MDF 2
Gas Turbine 1	Only if 1 or more Gas Engines are offline – a single Gas Turbine would replace the operation of a single Gas Engine.						
Gas Turbine 2							

Notes:
[(1)] *When the driers are offline the electricity demand for the site would be reduced and therefore not all gas engines would be needed. However, for a worst-case assessment it has been assumed that all gas engines could operate at the same time for short periods.*
[(2)] *Gas Engine 4 and 5 have not been installed yet, but are included in the EP, and as such have been considered in this assessment.*

Table 4: Operating Scenarios – Some Gas Engines Offline – Gas Turbines Used as Backup

Source	**MDF 2 Only Offline**	**MDF 1 and MDF 2 Offline – 1 GE Offline(1)**	**MDF 1 and MDF 2 Offline – 2 GE Offline(1)**	**MDF 1, MDF 2 and WESP 32 Offline – 1 GE Offline(1)**	**MDF 1, MDF 2 and WESP 32 Offline – 2 GE Offline(1)**	**MDF 1, MDF 2 and WESP 32 Offline – 1 GE Offline(1)**	**MDF 1, MDF 2 and WESP 32 Offline – 2 GE Offline(1)**
K1	K1	K1	K1	K1	K1	K1	K1
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-
K7	MDF 1	K7	K7	K7	K7	K7	K7
K8	MDF 1	K8	K8	K8	K8	K8	K8
Chip drier	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21
Gas Engine 1	MDF 1	-	-	-	-	-	-
Gas Engine 2	MDF 1	Gas Engine Stack	-	Gas Engine Stack	-	Gas Engine Stack	-
Gas Engine 3		Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
Gas Engine 4 (2)	-	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
Gas Engine 5 (2)	-	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
MDF 1 burner	-	-	-	-	-	-	-
MDF 2 burner	-	-	-	-	-	-	-
Gas Turbine 1	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack
Gas Turbine 2	-	-	Gas Turbine Stack	-	Gas Turbine Stack	-	Gas Turbine Stack

Notes:

Only those scenarios where the Gas Turbine would vent via its own stack are listed above.

(1) When the driers are offline the electricity demand for the site would be reduced and therefore not all gas engines would be needed. However, for a worst-case assessment it has been assumed that all gas engines could operate at the same time for short periods.

(2) Gas Engine 4 and 5 have not been installed yet, but are included in the EP, and as such have been considered in this assessment.

4 Legislation Framework and Policy

4.1 Air quality assessment levels

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC), which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values for sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter with a diameter of less than 10µm (PM_{10}) and a new AAD Target Value and Limit Value for fine particulates (those with a diameter of less than 2.5µm ($PM_{2.5}$). The fourth daughter Directive - 2004/107/EC - was not included within the consolidation. It sets health-based Target Values for polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable. Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010). The regulations also extend powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to local authorities for the implementation of these Directives.

The UK Government and the devolved administrations are required under the Environment Act (1995) to produce a national air quality strategy. This was last reviewed and published in 2007. The Air Quality Strategy (AQS) sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. This is the method of the implementation of the AADT Limits and Targets. This includes additional targets and limits for 15-minute sulphur dioxide and 1,3-butadiene and more stringent requirements for benzene and PAHs, known as AQS Objectives.

The Air Quality Strategy defines “standards” and “objectives” in paragraph 17:

“For the purposes of the strategy:

- *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems; and*
- *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale.”*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives:

“The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides.”

In 2019 the UK Government published the Clean Air Strategy (CAS). This sets out methods by which air pollution from all sectors will be reduced. The CAS has not introduced any new air quality limits. However, the CAS sets out the actions required across all parks of the government to meet legally binding targets to reduce five key pollutants (primary particulate matter ($PM_{2.5}$), ammonia (NH_3), nitrogen oxides (NOx), sulphur dioxide (SO_2) and non-methane volatile organic compounds (NMVOCs)) by 2020 and 2030 and secure health public health benefits. The CAS also makes a commitment to bring forward primary legislation on clean air as outlined in the Environmental Act.

The Environment Act 2021, passed in November 2021, has introduced a duty on the government to set a legally binding target for $PM_{2.5}$. Although the Environment Act does not stipulate the level it states that the Secretary of State lay a draft of the target for annual average levels of $PM_{2.5}$ before parliament by 31 October 2022. To date, no draft target level has been published.

The WHO set an annual mean $PM_{2.5}$ guideline value of 10 µg/m³ in 2005, which was updated to 5 µg/m³ in 2021. It is possible that the Secretary of State will set targets at either of the WHO recommendations or set an independently determined target. Whilst neither the 2005 nor 2021 WHO guideline values are currently legally binding, the impact of the Facility against these guideline values has been considered in this assessment.

For other pollutants the EA set Environmental Assessment Levels (EALs) in the environmental management guidance document 'Air Emissions Risk Assessment for your Environmental Permit'[1] (Air Emissions Guidance). The long-term and short-term EALs from this document have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS[2]).

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as Air Quality Assessment Levels (AQALs). Table 5 to Table 6 summarise the air quality objectives and guidelines used in this assessment.

Table 5: Air Quality Assessment Levels (AQALs)

Pollutant	Limit Value (µg/m³)	Averaging Period	Frequency of Exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AQS Objective
	40	Annual	-	AQS Objective
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AQS Objective
	40	Annual	-	AQS Objective
Particulate matter ($PM_{2.5}$)	25	Annual	-	AQS Target Value
	10	Annual	-	WHO 2005 Guideline
	5	Annual	-	WHO 2021 Guideline
Benzene	5.00	Annual	-	AQS Objective
	30	24 hours	-	Air Emissions Guidance

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

2 http://www.apis.ac.uk

Table 6: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration ($\mu g/m^3$)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75	Daily mean	Air Emissions Guidance / APIS
	200*		
	30	Annual mean	AAD Critical Level
Notes: **only for detailed assessments where the ozone is below the AOT40 critical level and sulphur dioxide is below the lower critical level of 10 µg/m³* The *AOT40 for ozone is 3,000 ppb.h (6,000 µg/m³.h) calculated from accumulated hourly ozone concentrations – AOT40 means the sum of the difference between each hourly daytime (08:00 to 20:00 Central European Time, CET) ozone concentration greater than 80 µg/m³ (40 ppb) and 80 µg/m³, for the period between 01 May and 31 July.*			

The Air Emissions Guidance includes a daily mean average NOx Critical Level of 75 $\mu g/m^3$ but acknowledge that for detailed assessments where the ozone is below AOT40 critical level and sulphur dioxide is below the lower critical level of 10 $\mu g/m^3$ the daily mean Critical Level of 200 $\mu g/m^3$ is appropriate. Consideration of the baseline ozone and sulphur dioxide concentrations has been made to determine the most appropriate critical level to use when considering the daily mean impact of NOx emissions.

In addition to the Critical Levels set out in the table above, provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific Critical Loads can be found in Appendix C.

4.2 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (TG16) (2021) (LAQM.TG(16)) explains where the AQALs apply.

Table 7: Guidance on Where AQALs Apply

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
1-hour mean	All locations where the annual mean and 24 and 8-hour mean AQALs apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: Box 1.1 LAQM.TG(16)

4.3 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in England and Wales through the Environmental Permitting Regulations (2012) (and subsequent amendments). The EP includes conditions to ensure that the environmental impact of the operations is minimised. This includes conditions to prevent fugitive emissions of dust and odour beyond the boundary of the permitted activity, and limits on emissions to air.

4.4 Local air quality management

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to periodically review and assess air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future ambient pollutant concentrations against AQALs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, then the local authority is required to declare an AQMA. For each AQMA, the local authority is required to produce an AQAP, the objective of which is to reduce pollutant levels in pursuit of the relevant AQALs.

5 Sensitive Receptors

5.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution across the modelling domain has been analysed to determine the impact at all areas of relevant exposure.

For completeness, analysis has also been carried out at the specific receptor locations stated in Table 8 and presented in Figure 5 within Appendix A.

Table 8: Human Sensitive Receptors

ID	Name	Location		Distance from Installation Boundary (m)
		X (m)	Y (m)	
R1	Afron Bradley Farm	328394	339485	550
R2	Lodge Farm	329168	339548	670
R3	Lodgefield Park	329049	339262	360
R4	Rhosywaun	328993	338676	85
R5	Chirk Community Hospital	329358	338975	460
R6	Chirk Infant School	329158	338426	160
R7	Highfield Farm	329747	338667	760
R8	Maes-y-Waun	329074	338157	53
R9	Colliery Road	329069	337877	290
R10	St Mary's Church	330303	337785	1,300
R11	Station Avenue	328876	337733	390
R12	Llwyn-y-cil	327984	338086	430
R13	New Hall	327596	338890	890
R14	Chirk Court	329045	338274	30

The list of receptors stated in Table 8 is not an exhaustive list, as such reference has also been made to the distribution of emissions where areas of public exposure may not be captured by the stated receptors.

5.2 Ecological sensitive receptors

A study was undertaken to identify the following sites of ecological importance in accordance with Air Emissions Guidance criteria:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), Local Wildlife Sites and ancient woodlands within 2 km of the Facility.

The sensitive ecological receptors identified are stated in Table 9 and presented in Figure 6 and Figure 7 within Appendix A. A review of the citation for ecological receptor has been undertaken to determine if lichens are an important part of the ecosystem's integrity for the purposes of determining the relevant Critical Level for the habitat.

Table 9: Sensitive Ecological Receptors

Site	Location		Distance from Installation boundary at closest point (km)	Lichens identified as present within citation
	X (m)	Y (m)		
European and UK designated sites				
River Dee and Bala Lake SAC, SSSI	Various points		1.0	No
Johnstown Newt Sites SAC	330614	345069	6.3	No
Berwyn and South Clwyd Mountains SAC	324820	342829	5.4	Yes
Berwyn SPA	319590	339130	8.4	Yes
Chirk Castle SSSI	Various points		0.5	Yes
Nant-y-Belan & Prynella Woods	Various points		2.4	Yes
Locally designated sites				
Barracks Field	Various points		1.1	Yes
Ceod-Y-Canal Wood	Various points		<0.05	Yes
Various Ancient Woodlands	Various points		-	Yes
NOTES: *For those sites contained within the modelling domain the maximum impact across any point within the site has been calculated by post processing the model output files*				

It has been assumed that lichens or bryophytes are contained in each of the locally designated sites as a precautionary approach. Full details of the habitats present at each ecological receptor and the habitat-specific Critical Loads are presented in Appendix C.

6 Baseline

The Facility is located on land adjacent to Holyhead Road, Chirk and covers a total area of approximately 40 hectares. The Facility comprises a number of large industrial process buildings including air emissions stacks, storage areas for raw materials, warehouse buildings for manufactured products, offices and car parking. The main residential area of Chirk is located to the east of the Facility with residential properties lining the majority of the eastern side of Holyhead Road. Chirk town centre is located approximately 500 m to the southeast of the Facility. The wider area beyond the urban settlement of Chirk is dominated by agricultural fields and woodland. Chirk Castle and its grounds are located to the west of the Facility, beyond the Llangollen Canal. This section includes a review of the baseline air quality and the definition of appropriate baseline concentrations to be used in this assessment.

This review has only focussed on the impact of those emissions which will change from the changes proposed within this application.

6.1 Local authority air quality review and assessment

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercise to review air quality within their area of jurisdiction. The Facility is located within Wrexham County Borough Council (WCBC) area.

There are no Air Quality Management Areas (AQMA) which have been declared within 5 km of the Facility. The closest AQMAs to the Facility are in the centre of Shrewsbury and Chester both located over 30 km away. Therefore, emissions from the Facility are not expected to be discernible within any AQMA.

6.2 National modelling – mapped background data

To assist local authorities with their responsibilities under Local Air Quality Management, Defra provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations have been downloaded for the grid squares containing the Facility and immediate surroundings.

The mapped background data is calibrated against monitoring data. For instance, the 2018 mapped background concentrations are based on 2018 meteorological data and are calibrated against monitoring undertaken in 2018. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration from within 2 km of the Facility and the concentration at the Facility, is presented in Table 10.

Table 10: Mapped Background Data

Pollutant	Annual mean concentration (µg/m³)		Dataset
	At Facility	Max within 2 km of Facility	
Nitrogen dioxide	10.84	10.84	DEFRA 2018 dataset
Particulate matter (as PM_{10})	10.94	15.39	DEFRA 2018 dataset
Particulate matter (as $PM_{2.5}$)	7.58	10.94	DEFRA 2018 dataset

Source: © Crown 2023 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL) and APIS.

6.3 LAQM monitoring

WCBC operate two continuous monitoring stations within Chirk:

1. Chirk, an urban industrial site, set up 22 July 2020; and
2. Chirk Community Hospital, an urban background site, set up 29 November 2021.

The location of both sites is shown on Figure 8 of Appendix A. Both sites monitor for oxides of nitrogen, nitrogen dioxide, particulates (as PM_{10}s, $PM_{2.5}$s and PM_1s), total VOC (C5 and above), temperature, wind direction and speed.

The following tables presents a summary of the monitoring from these sites, noting that both sites include a contribution from the operation of the Facility.

Table 11: Summary of Automatic Monitoring at Chirk

Pollutant	Parameter	AQAL	Chirk		Chirk Hospital
			2021	2022	2022
Oxides of nitrogen	Annual mean (µg/m³)	-	23.0	14.2	15.4
	Maximum daily mean (µg/m³)	-	57.9	77.3	47.0
	Data capture (%)	-	90.0%	92.3%	89.8%
Nitrogen dioxide	Annual mean (µg/m³)	40	18.2	11.6	13.3
	98th %ile 1-hour (µg/m³)	200	64.0	62.0	52.5
	Data capture (%)	-	89.7%	92.3%	89.8%
PM_{10}	Annual mean (µg/m³)	40	8.3	11.4	10.4
	Maximum daily mean (µg/m³)	-	24.4	36.9	39.1
	90th %ile of daily mean (µg/m³)	50	13.4	18.4	16.5
	Data capture (%)	-	86.5%	89.3%	89.6%
$PM_{2.5}$	Annual mean (µg/m³)	20	2.9	4.3	5.4
	Data capture (%)	-	86.5%	89.3%	89.6%

Pollutant	Parameter	AQAL	Chirk		Chirk Hospital
			2021	2022	2022
VOC	Annual mean (µg/m³)	-	4.5	17.8 (1)	10.4
	Maximum 1-hour (µg/m³)	-	478.1	6979.9(1)	148.9
	Data capture (%)	-	83.4%	84.8%	87.8%

NOTES:

Chirk analyser started monitoring on 22 July 2020, annual data capture in 2020 was less than 85% and therefore cannot be compared directly to the AQALs and is not presented here.

Chirk Community Hospital analyser started monitoring on 29 November 2021, annual data capture in 2021 was less than 85% and therefore cannot be compared directly to the AQALs and not presented here.

Data for both is still provisional as has not been verified according to the Air Quality Wales website.

(1) annual mean concentration driven by a few high results.

Source: Air Quality in Wales accessed 09 February 2023

This monitoring shows that background levels, including the current operation of the Facility, are likely to be well below the AQALs.

The monitoring of VOC at Chirk indicates a high maximum 1-hour concentration. The monitoring data is yet to be verified. However, a review of the raw data shows that the 99%ile of 1-hour concentrations at Chirk is only 64 µg/m³ (or 0.9% of the maximum measured). These few high results are driving the annual mean concentration. As such it is likely that when the data is fully verified this will be corrected.

WCBC undertakes non-automatic (diffusion tube) monitoring for nitrogen dioxide at four monitoring sites within Chirk. The locations of the monitoring are shown in Figure 8 of Appendix A. A summary of monitoring data from these sites is provided in Table 12. Data has been taken from the North Wales Authorities Collaborative Project 2021 Air Quality Progress Report which is the most recent report published at the time of writing this assessment.

Table 12: Summary of Non-Automatic Nitrogen Dioxide Monitoring

Site Name	Type	2018 Mapped Bg (µg/m³)	Annual mean concentration (µg/m³)				
			2016	2017	2018	2019	2020
Ceriog School	Suburban	8.9	13.2	12.5	11.8	12.4	10.0
Holyhead Rd	Intermediate	6.1	16.3	15.9	15.7	14.7	13.3
Chapel Lane	Roadside	6.1	21.2	24.6	-	-	-
Church Street	Roadside	5.1	-	-	18.3	14.3	12.3

Source: North Wales Authorities Collaborative Project 2021 Air Quality Progress Report and © Crown 2023 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

Due to their proximity, all of these monitoring sites will include a contribution from the Facility, and they demonstrate that background levels of nitrogen dioxide are relatively low in the local area.

All non-automatic monitoring sites have recorded nitrogen dioxide to be higher than the mapped background data for their locations which is expected as they are roadside sites and include a contribution from the Facility. However, as shown, the concentrations remain low and are well within the AQAL. As the contribution from the Facility is being modelled, the background concentration has been taken as the maximum mapped background concentration within 5 km of the Facility as presented in Table 10. While this also includes a contribution from the Facility, it is only as an average concentration for the grid square. In addition, consideration has been made to the spatially varying baseline levels of nitrogen dioxide within this assessment.

6.3.1 Formaldehyde

Although background concentrations of TVOCs are monitored by the continuous analysers operated by WCBC this does not include speciation of formaldehyde. In addition, formaldehyde is not routinely monitored in the UK.

In 2004 WCBC carried out two rounds of passive ambient monitoring for formaldehyde in Chirk. Following this, in 2005, the Environment Agency's Air Quality Modelling Assessment Unit (AQMAU) undertook a modelling exercise to determine the contribution of the Kronospan Facility to the background levels. A summary of this exercise is set out in the WCBC 2005 Updating and Screening Assessment. This states that the background concentration was 4 µg/m^3 and the contribution from the Kronospan Facility was 0.7 µg/m^3. It appears that this background concentration was extracted from the WHO document "guidelines for indoor air quality" which states that mean ambient air background concentrations range from 1 to 4 µg/m^3.

In 2016 some additional monitoring was undertaken by WCBC at a number of sites in Chirk and at the Wrexham AURN. This was only undertaken for a two-week period but showed that concentrations at the AURN were 1 µg/m^3, with concentrations in Chirk ranging from 0.6 to 1.2 µg/m^3. The concentrations monitored in Chirk included a contribution from the point sources at the Facility which have been modelled as part of this assessment. Therefore, for the purpose of this assessment the monitored concentration at the AURN has been used - 1µg/m^3.

6.4 Baseline conditions at ecological sites

The Air Pollution Information System (APIS) database sets out the baseline concentrations on a grid across the UK. Atmospheric concentrations of oxides of nitrogen, ammonia, acid and nitrogen deposition are provided on a 1 km x 1 km grid. Data is provided for the maximum across the ecological site. This data is the 2018 to 2020 average presented on APIS.

Table 13: APIS Data for Ecological Sites

ID	Site	Maximum concentration (µg/m^3)	
		Oxides of nitrogen	Sulphur dioxide
Annual mean Critical Level		**30**	**10**
R1	River Dee and Bala Lake SAC, SSSI (1)	11.29	1.34
R2	Johnstown Newt Sites SAC	10.17	1.03
R3	Berwyn and South Clwyd Mountains SAC	7.20	0.79
R4	Berwyn SPA	4.44	0.59
R5	Chirk Castle SSSI	12.96	0.81
R6	Nant-y-Belan and Prynela Woods SSSI	11.29	0.91
R7	Barracks Field	11.00	0.81
R8	Ceod-Y-Canal Wood	12.96	0.81

ID	Site	Maximum concentration (µg/m³)	
		Oxides of nitrogen	Sulphur dioxide
R9	Various Ancient Woodlands	12.96	1.34
NOTES: Maximum across each site within the modelling domain calculated by extracting from APIS via the search by location function the concentration for each grid square. For points outside the grid the concentration for the grid square containing the point modelled has been extracted from APIS.			

Source: APIS

As shown, the baseline data presented in APIS shows that maximum concentrations of oxides of nitrogen and sulphur dioxide are below the annual mean critical level at all sites.

Table 14: APIS data for Ecological Sites – Deposition

ID	Site	N deposition	Acid N deposition	Acid S deposition
		kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
Grassland deposition velocity				
R1	River Dee and Bala Lake SAC, SSSI	28.74	2.05	0.21
R2	Johnstown Newt Sites SAC	28.85	2.06	0.14
R3	Berwyn and South Clwyd Mountains SAC	21.36	1.53	0.16
R4	Berwyn SPA	24.79	1.77	0.21
R5	Chirk Castle SSSI	24.74	1.77	0.16
R6	Nant-y-Belan and Prynela Woods SSSI	-	-	-
R7	Barracks Field	24.74	1.77	0.16
R8	Ceod-Y-Canal Wood	-	-	-
R9	Various Ancient Woodlands	-	-	-
Woodland deposition velocity				
R1	River Dee and Bala Lake SAC, SSSI	-	-	-
R2	Johnstown Newt Sites SAC	-	-	-
R3	Berwyn and South Clwyd Mountains SAC	32.43	2.32	0.20
R4	Berwyn SPA	35.48	2.53	0.26
R5	Chirk Castle SSSI	39.30	2.81	0.20
R6	Nant-y-Belan and Prynela Woods SSSI	47.74	3.41	0.25
R7	Barracks Field	-	-	-
R8	Ceod-Y-Canal Wood	39.30	2.81	0.20
R9	Various Ancient Woodlands	48.37	3.45	0.25
NOTES:				

ID	Site	N deposition	Acid N deposition	Acid S deposition
		kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
Maximum across each site within the modelling domain calculated by extracting from APIS via the search by location function the concentration for each grid square. For points outside the grid the concentration for the grid square containing the point modelled has been extracted from APIS.				

Source: APIS

The values presented in Table 13 and Table 14 are grid square averaged values provided as a rolling 3-year mean and derived from a mixture of interpolation from measured data, and modelled data as set out in APIS. The APIS website explains that the use of a 3-year mean has been demonstrated to be a suitable time period to smooth out some of the inter-annual variations in deposition which occur due to the natural variability in annual weather patterns. Both acid nitrogen and acid sulphur have been presented as the Critical Load for acid deposition is a function of both.

6.5 Summary of baseline concentrations used in assessment

Sections 6.1 to 6.4 have provided a review of the local and national monitoring data and national modelled background concentrations. This review has shown that there are a number of nitrogen dioxide monitoring sites in the local area but each of these include a contribution from the Facility as it has been operating for a number of years. As the contribution from the Facility is being explicitly modelled the background concentration has been taken as the maximum mapped background concentration within 5 km of the Facility, noting that this also includes a contribution from the Facility as an average concentration for the grid square.

Table 15: Summary of Baseline Concentrations

Pollutant	Conc.	Units	Justification
Nitrogen dioxide	10.84	µg/m^3	Maximum mapped background concentration from within 2 km of Facility – Defra 2018 dataset.
Particulate matter (as PM_{10})	15.39	µg/m^3	Maximum mapped background concentration from within 2 km of Facility – Defra 2018 dataset.
Particulate matter (as $PM_{2.5}$)	10.94	µg/m^3	Maximum mapped background concentration from within 2 km of Facility – Defra 2018 dataset.
Formaldehyde	1	µg/m^3	Monitored concentration at Wrexham AURN in 2016.

7 Dispersion Modelling Methodology

7.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.2, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the NRW and the EA. An analysis of the variation in model outputs has been undertaken and the maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

7.2 Source and emissions data

The principal inputs to the model with respect to the emissions to air from the Facility are presented in Appendix B. When determining the release rate of pollutants, in the first instance the volumetric flow rate from each item of plant has been multiplied by the ELV. Justification of the volumetric flow rate, and temperature of the release is provided in Appendix B for each source, this is based on monitoring carried out between 2018 and 2022. Graphs of the parameters are provided in Appendix B. As shown, the volumetric flow rates vary but the inputs used in the model are a realistic assumption of flow rates from the plant. Graphs are also provided in Appendix B of emissions as a percentage of the ELV for key items of plant. This shows that assuming each item of plant operates continually at the ELV is extremely conservative. In addition, data has been provided from Kronospan which shows the operational loading for each item of plant. This shows that although the Facility operates on a 24-hour basis the loading of each process varies and none of the processes operate 100% of the time, as conservatively assumed within this modelling.

As set out in section 3.1.7, WESP 21 serves the new chip preparation plant and associated drier. The source parameters have been taken from monitoring data for WESP 21 as per the other sources on site. As with all other sources the emission rates have been determined by calculating the emission rate when operating at the existing and proposed ELV.

As per the existing EP emissions from WESP 32 only include those emissions from the press abatement system (A28). However, for the proposed scenario the volumetric flow rate and emissions from WESP 32 have been calculated based on the emissions from A28 combined with those from sources A5 and A6.

7.3 Other Inputs

Modelling has been undertaken using a nested grid of points; a 2 km x 2 km grid with a spatial resolution of 20 m nested within a 4.9 km x 4.9 km grid with a spatial resolution of 49 m. The high resolution of the finest grid has been chosen to ensure that the gridded output accurately captures the highest modelled concentrations. Reference should be made to Figure 10 of Appendix A for a graphical representation of the modelling domain used. The extent of the modelling domain is detailed in Table 16.

Table 16: Modelling Domain

Parameter	Fine grid	Wider grid
Grid Spacing (m)	20	49
Grid Start X	327700	326250
Grid Finish X	329700	331150
Grid Start Y	337550	336100
Grid Finish Y	339550	341000

7.3.1 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using meteorological data from the RAF Shawbury meteorological recording station for the years 2018 to 2022 sourced from Air Pollution Services. RAF Shawbury is approximately 30 km to the south-east of the Facility and is the closest and most representative meteorological station available.

NRW guidance recommends that five years of data are used to take into account inter-annual fluctuations in meteorological conditions. The meteorological data from the period 2018 to 2022 represents the most recent 5-years of weather data. Wind roses for each year can be found in Figure 12 within Appendix A.

The minimum Monin-Obukhov length can be selected in ADMS for both the dispersion site and the meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. The minimum Monin-Obukhov length has been set to 30 m for the dispersion site and 10 m for the meteorological site. The value of 30 m is recommended by CERC for mixed urban/industrial areas such as the dispersion site. The value of 10 m is recommended by CERC for small towns <50,000 inhabitants and is considered appropriate for the surroundings of the meteorological site.

The surface roughness length can be selected in ADMS for both the dispersion site and the meteorological site. A surface roughness length of 0.5 m has been selected for the dispersion site. This value is appropriate for 'parkland and open suburbia' and is considered appropriate for the area surrounding the Facility. A surface roughness value of 0.2 m has been selected for the meteorological site which is appropriate for the area surrounding the meteorological station.

The surface roughness length can be selected in ADMS for both the dispersion site and the meteorological site. The surface roughness has been set to 0.2 m for the meteorological site, which is appropriate for the relatively open surroundings of site. The surface roughness length varies widely across the modelling domain. To account for the varying surface roughness length a spatially varying surface roughness file has been generated and used as a model input. The land-use class for each point in the file has been estimated based on aerial mapping and the CERC roughness length classifications.

The parameters for the spatially-varying surface roughness file are shown in Table 17 and a visual representation provided in Figure 10 of Appendix A.

Table 17: Spatially Varying Surface Roughness File Parameters

Parameter	Value
Grid points	64 x 64
Grid Start X (m)	325725

Parameter	Value
Grid Finish X (m)	331675
Grid Start Y (m)	335575
Grid Finish Y (m)	341525

A summary of the meteorological parameters used in the dispersion modelling is shown in Table 18

Table 18: Meteorological parameters

Parameter	Dispersion Site	Met Site
Surface roughness length	Variable	0.2 m
Minimum Monin-Obukhov length	30 m	10 m

7.3.2 Terrain

It is recommended by CERC that, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling.

A terrain file large enough to cover the output grid of points was created using Ordnance Survey Terrain 50 data. The Johnstown Newt Site SAC, Berwyn and South Clwyd Mountains and Berwyn designated habitat sites lie outside of the output grid of points. Due to the distance to these receptors and the very low likelihood of a significant effect, the model has been run without the effect of terrain to assess the impact at these points.

The parameters of the terrain files used are outlined in Table 19. Reference should be made to Figure 10 of Appendix A for a graphical representation of the terrain file used.

Table 19: Terrain File Parameters

Parameter	Value
Grid points	64 x 64
Grid Start X (m)	325725
Grid Finish X (m)	331675
Grid Start Y (m)	335575
Grid Finish Y (m)	341525

7.3.3 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The EA recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 5.2 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 20. A site plan showing which buildings have been included in the model is presented in Figure 10 of Appendix A.

Table 20: Building Details

Buildings	Centre Point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
Main Factory A	328749.20	338386.40	11.50	438.25	230.60	81.1
K7 Boiler	328437.50	338318.00	31.00	22.50	33.00	181.0
CHIP	328434.90	338491.50	36.00	23.00	35.00	105.0
B	328438.00	338398.60	20.00	23.00	56.00	82.0
K8 - Biomass	328483.90	338387.20	30.00	45.00	40.00	82.0
Main Factory B	328515.30	338279.90	11.50	56.00	93.00	81.0
OSB	328511.20	338297.90	28.00	30.00	56.00	351.0
Raw Board	328715.70	338397.00	23.00	30.00	150.00	351.0
Silo A	328516.70	338488.60	26.00	25.50	-	-
Silo B	328543.50	338493.30	26.00	25.50	-	-
Silo C	328511.80	338515.60	26.00	25.50	-	-
Silo D	328540.20	338520.30	26.00	25.50	-	-
Chip Prep	328478.10	338514.90	26.00	30.00	30.00	81.0
Warehouse	328769.90	338783.30	6.00	98.00	182.00	89.0
MDF 2 Cyclones	328466.70	338249.10	42.00	20.00	20.00	81.0
GE 1 to 3	328520.80	338434.30	18.20	18.00	22.00	82.5
Kronoplus	328730.00	338589.90	6.00	11.00	23.00	81.0
Tanks	328712.10	338580.30	8.00	5.00		-

7.4 Chemistry

The Facility will release emissions of nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the AQALs are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario specified in the EA's guidance for dispersion modelling[3] which is appropriate where the primary nitrogen dioxide to NOx ratio is less than 10%. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

7.5 Baseline concentrations

Background concentrations for the assessment have been derived from monitoring and national mapping as summarised in Table 15. For short term averaging periods of less than 24-hours, the background concentration has been assumed to be twice the long-term ambient concentration following the EA recommendation within the Air Emission Guidance. When calculating the daily mean PM_{10} PEC the approach set out in LAQM.TG(22) box 7-16 has been applied in which the annual mean baseline concentration is added to the 90.41 percentile of 24-hour mean process contributions.

[3] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

8 Impact on Human Health

8.1 Screening criteria

The EA's Air Emissions Guidance states that to screen out 'insignificant' process contributions:

- the long-term process contribution must be less than 1% of the long-term environmental standard; and
- the short-term process contribution must be less than 10% of the short-term environmental standard.

Consultation with the EA has confirmed that if the above criteria are achieved, it can be concluded that "it is not likely that emissions would lead to significant environmental impacts" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

If process contributions cannot be screened out, assessment is to be undertaken for the following:

- the predicted environmental concentration (PEC) at the point of maximum impact – defined as the process contribution plus the baseline concentration; and
- the process contribution and PEC at areas of public exposure.

In these cases, consultation with the Environment Agency has revealed that if the long-term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[4] it can be concluded that "there is little risk of the PEC exceeding the AQAL", and the impact can be considered to be 'not significant'.

8.2 Normal operations

The detailed results tables presented in Appendix D presents the maximum impact using the 5-years of weather data for the normal operations. The results are presented for the maximum outside the site boundary, the maximum increase in impact, and the impact at the specific receptors identified.

The modelling assumes each item of plant operates at maximum capacity and emissions are at the relevant ELVs. As shown in Appendix B, although the Facility operates on a 24-hour basis the operational loading of each process is well below 100%, and each source operates below the ELVs, and in some cases by a significant margin. Therefore, these results are considered to be extremely conservative.

[4] Calculated as the AQAL minus twice the long-term background concentration.

8.2.1 Nitrogen dioxide

The proposed variation is seeking to increase the ELV for NOx from WESP 21. No other changes are proposed which would affect the predicted nitrogen dioxide impacts.

The detailed results tables in Appendix D show that the maximum increase in annual mean impacts associated the proposed variation cannot be screened out as 'insignificant'. However, the PEC remains below 70% of the annual mean AQAL. Therefore, the total impact of the Facility remains "not significant". The change in annual mean impact associated the proposed variation at all identified receptors can be screened out as 'insignificant'.

The 99.79%ile of 1-hour nitrogen dioxide concentration is predicted to be slightly higher than the permitted Facility, but the maximum increase is less than 10% of the AQAL and therefore, can be screened out as 'insignificant'.

The following figures have been produced which show the impact of nitrogen dioxide emissions for normal operations:

- Figure 14: Annual Mean Nitrogen Dioxide PEC - Normal Operations
- Figure 15: Annual Mean Nitrogen Dioxide - Normal Operations - Change in Impact
- Figure 16: 99.79%ile 1hour Nitrogen Dioxide PEC - Normal Operations
- Figure 17: 99.79%ile 1hour Nitrogen Dioxide - Normal Operations - Change in Impact

This analysis shows that at all areas of relevant exposure the total impact of the Facility is less than the AQAL. This is substantiated by the monitoring data which shows that baseline concentrations, which include a contribution from the Facility, are relatively low.

8.2.2 Particulate matter

The changes proposed include the re-ducting the emissions from the resin reactors and paper impregnation lines (existing emission points A5 and A6) to WESP 32. Both the existing emissions from WESP 32 (from the press abatement system) and those from the resin reactors and paper impregnation lines (existing emission points A5 and A6) have an ELV for particulate matter. As such the predicted impacts of particulate matter emissions would be affected by the proposed variation.

The detailed results tables in Appendix D show that the maximum increase in annual mean impacts associated the proposed variation can be screened out as 'insignificant'. This conservatively assumes that all items of plant (including all the dust units) operate continually at the ELV (or guarantee in the case of the dust units). As set out in Appendix B although the Facility does operate on a 24-hour basis the operational loading of each process is well below 100%, and each source operates below the ELVs, and in some cases by a significant margin. Therefore, these results are considered to be extremely conservative.

As set out in section 4.1 it is likely that the UK Government will set the WHO guideline for $PM_{2.5}$ in legislation. This will reduce the AQAL from 20 µg/m^3, as used in the above analysis, to 10 µg/m^3. The whole area exceeds the WHO guideline value, as the background concentration exceeds this without any modelled contribution from the Facility. It should be recognised that the Facility as applied for in this application forms part of the local baseline and Best Available Techniques are used to control emission from operations including dust.

The following figures have been produced which show the impact PM emissions for normal operations:

- Figure 18: Annual Mean PM10 PEC - Normal Operations (ex Dust Units)
- Figure 19: Annual Mean PM10 PEC - Normal Operations (inc Dust Units)

- Figure 20: Annual Mean PM10 PEC - Normal Operations - Change in Impact
- Figure 21: 90.41%ile Daily Mean PM10 PEC - Normal Operations (ex Dust Units)
- Figure 22: 90.41%ile Daily Mean PM10 PEC - Normal Operations (inc Dust Units)
- Figure 23: 90.41%ile Daily Mean PM10 - Normal Operations - Change in Impact
- Figure 24: Annual Mean PM2.5 PEC - Normal Operations (ex Dust Units)
- Figure 25: Annual Mean PM2.5 PEC - Normal Operations (inc Dust Units)
- Figure 26: Annual Mean PM2.5 PEC - Normal Operations - Change in Impact

This analysis shows that there is predicted to be a decrease in impacts to the west of the Facility. The maximum increase is predicted to occur to the south of the Facility.

As detailed the in the results tables the annual mean PEC for $PM_{2.5}$, and the daily mean PEC for PM_{10} exceeds the AQAL. This uses the highly conservative assumptions that:

- all items of plant (and dust units) operate continually at the ELVs;
- the entire dust emissions consist of only PM_{10} or $PM_{2.5}$.

A review of the plot files shows that the exceedences of the annual mean AQAL is only predicted to occur adjacent to the western site boundary and not in an area of public exposure. The area where the PEC exceeds 70% of the annual mean AQAL for $PM_{2.5}$ covers a larger area including some residential properties, but there are no areas of relevant exposure to the 24-hour mean AQAL where the PEC exceeds 70%. In any case the change in impact associated with the proposed variation can be screened out as 'insignificant'.

8.2.3 Formaldehyde

The changes proposed include the re-ducting the emissions from the resin reactors and paper impregnation lines (existing emission points A5 and A6) to WESP 32. Both the existing emissions from WESP 32 (from the press abatement system) and those from the resin reactors and paper impregnation lines (existing emission points A5 and A6) have an ELV for TVOC and formaldehyde. As such the predicted impact of VOC emissions would be affected by the proposed variation.

The detailed results tables in Appendix D show that the maximum change in long and short-term impacts associated the proposed variation can be screened out as 'insignificant'.

The following figures have been produced which show the impact of formaldehyde emissions for normal operations:

- Figure 27: Annual Mean Formaldehyde PEC - Normal Operations
- Figure 28: Annual Mean Formaldehyde - Normal Operations - Change in Impact
- Figure 29: Maximum 30-Minute mean Formaldehyde PEC - Normal Operations
- Figure 30: Maximum 30-Minute mean Formaldehyde - Normal Operations - Change in Impact

This analysis shows that at all areas of relevant exposure the total impact of the Facility is less than the AQAL. This is substantiated by the monitoring data which shows that baseline concentrations, which include a contribution from the Facility, are relatively low.

8.2.4 Other VOCs

The EP includes an emission limit for TVOCs. This consists of a wide range of VOCs. The Production of Wood-based Panels BREF states that:

> *"The main constitutes of the volatile organic fraction in wood are generally not considered in literature as possessing toxic properties. An exception is formaldehyde."*

In addition to formaldehyde (which is considered in Section 10.1.3), there are two AQALs set for two other VOCs; benzene and 1,3-butadiene. If either of these species were to be released from the Facility, it would be expected that the BREF and the existing EP would also consider these species. The ELVs are set for TVOC and formaldehyde but no other speciation is required. Assuming that the entire TVOC emissions consist of either benzene or 1,3-butadiene is extremely unlikely as if these VOCs were of concern limits would be set in a similar approach to formaldehyde.

8.3 Non-Standard Operations

Section 8.2 has detailed the impact of the Facility under normal operations. However, as detailed in section 3.2, the Facility may operate under non-standard conditions if, for instance, a drier is offline. A summary of the non-standard operating scenarios is provided below:

1. Scenario 1 – MDF 2 drier offline

   MDF 1 drier can use the exhaust gases from the K7 and K8 biomass plants and up to three gas engines, the electricity needed on site would be reduced so only three gas engines would be needed; two of which would be used in MDF 1 drier, and one would need to vent to atmosphere via its own dedicated stack. Therefore, this would result in an additional emission point to atmosphere from the gas engine. The impact of this operating scenario has been considered in section 8.3.1.

2. Scenario 2 – MDF 1 drier offline

   MDF 2 drier can use the exhaust gases from the K7 and K8 biomass plants and up to four gas engines, the electricity needed on site would be reduced so only four gas engines would be needed. Exhaust gases from all four gas engines can be accommodated within the MDF 2 drier. The impact of this operating scenario has been considered in section 8.3.2.

3. Scenario 3 – MDF 1 and MDF 2 drier offline

   If both MDF driers are offline, the exhaust gases from the biomass plants and gas engines would need to vent to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Therefore, this operating scenario would only occur for short periods. In this instance there would not be emissions from the MDF cyclones but there would be emissions of NOx from the K7 biomass plant, the K8 biomass plants, up to 5 gas engines and WESP 21 as a worst-case. The impact of this operating scenario has been considered in section 8.3.3.

4. Scenario 4 – All driers offline

   If both MDF driers are offline, the emissions would be as scenario (3) above, but emissions would also be released from the Chip drier emergency stack rather than the WESP 21. This is considered an emergency release. This scenario is limited to periods of less than 1-hour and any occurrences are reported. Therefore, this scenario has not been considered in section 8.3.4.

5. Scenario 5 – K7 and K8 biomass plants are offline

The drying process would still be able to operate but the K5 and K6 gas heaters will be used to heat the thermal oil for the presses. In this case emissions from site would also be from the K5 and K6 gas heaters. The impact of this operating scenario has been considered in section 8.3.5.

In all instances, the gas turbines will be used as back-up to the gas engines. The impact of all scenarios where one or more gas engines are not operating and either one or two gas turbines are needed has been analysed. For the worst-case emissions scenario, if a gas engine or gas turbine exhaust gases are used the mass release of emissions from the cyclones calculated will not change, as this is based on the ELV for the driers. Therefore, the impact of the back-up gas turbines has not been considered further in this analysis as effectively these would replace emissions from the gas engines and the impact of both scenarios is similar. In addition, testing of the gas turbines would only occur in the event that two engines of the engines are offline.

8.3.1 MDF 2 drier offline – scenario 1

If the MDF 2 drier is offline:

- the MDF 1 drier will use the exhaust gases from the K7 biomass plant, the K8 biomass plant and two gas engines;
- the electricity needed on site would be reduced so only 3 gas engines would be needed; and
- the exhaust gases of two engines would be used in MDF 1 drier, and one of the engines would need to vent to atmosphere via its own dedicated stack.

Therefore, this would result in an additional emission point to atmosphere from the gas engine. The gas engine will only include an ELV for NOx.

Under normal operations exhaust gases from K7 would vent to atmosphere via the MDF 2 drier. However, if this is offline these will vent to atmosphere via the MDF 1 drier. In any case the NOx, PM, TVOC and CH_2O ELVs for the MDF 1 drier will need to comply with even the additional sources need to vent to atmosphere via the MDF 1 drier.

The detailed results tables presented in Appendix E presents the maximum impact using the 5-years of weather data when the MDF 2 drier is offline. The results are presented for the maximum outside the site boundary and the impact at the specific receptors identified. Impacts have been presented for the point of maximum impact in each year and the maximum increase in concentration at any point as a result of the proposed variation.

8.3.1.1 Nitrogen dioxide

The detailed results tables in Appendix E show that the maximum change in annual mean impacts associated the proposed variation cannot be screened out as ‘insignificant’. However, the PEC remains below 70% of the annual mean AQAL. Therefore, the total impact of the Facility remains “not significant”. The change in annual mean impact associated the proposed variation at all identified receptors can be screened out as ‘insignificant’.

The 99.79%ile of 1-hour nitrogen dioxide concentrations is predicted to be slightly higher than the permitted Facility, but the maximum increase is less than 10% of the AQAL and therefore, can be screened out as ‘insignificant’.

The following figures have been produced which show the change in impact of nitrogen dioxide emissions when the MDF 2 drier is offline:

- Figure 31: Annual Mean Nitrogen Dioxide - MDF 2 Offline - Change in Impact
- Figure 32: 99.79%ile 1hour Nitrogen Dioxide - MDF 2 Offline - Change in Impact

8.3.1.2 Particulate matter

The detailed results tables in Appendix E show that the maximum change in annual and daily mean impacts associated the proposed variation can be screened out as 'insignificant'. This conservatively assumes that all items of plant (including all the dust units) operate continually at the ELV (or guarantee in the case of the dust units). As set out in Appendix B, although the Facility does operate on a 24-hour basis, the operational loading of each process is well below 100%, and each source operates below the ELVs, and in some cases by a significant margin. Therefore, these results are considered to be extremely conservative.

This analysis shows that there is predicted to be some exceedences of the daily mean AQAL for PM_{10} and annual mean AQAL for $PM_{2.5}$. However, this is based on the extremely conservative assumption that:

- all items of plant (and dust units) operate continually at the ELVs;
- the entire dust emissions consist of only PM_{10} or $PM_{2.5}$.

The following figures have been produced which show the change in impact of dust emissions when the MDF 2 drier is offline:

- Figure 33: Annual Mean PM10 - MDF 2 Offline - Change in Impact
- Figure 34: 90.41%ile Daily Mean PM10 - MDF 2 Offline - Change in Impact
- Figure 35: Annual Mean PM2.5 - MDF 2 Offline - Change in Impact

8.3.1.3 Formaldehyde

The detailed results tables in Appendix E show that the maximum change in long and short-term impacts associated the proposed variation can be screened out as 'insignificant'.

The following figures have been produced which show the change in impact of formaldehyde emissions when the MDF 2 drier is offline:

- Figure 36: Annual Mean Formaldehyde - MDF 2 Offline - Change in Impact
- Figure 37: 30-minute Mean Formaldehyde - MDF 2 Offline - Change in Impact

8.3.2 MDF 1 drier offline – scenario 2

If the MDF 1 drier is offline:

- The MDF 2 drier will use the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to four gas engines; and
- the electricity needed on site would be reduced so only 4 gas engines would be needed.

Therefore, this would not result in an additional emission point to atmosphere. However, the MDF 2 drier will then release emissions from the K8 biomass plant and the K7 biomass plant. In any case the ELVs for the MDF 2 drier will need to comply with even the additional sources need to vent to atmosphere via the MDF 2 drier.

The detailed results tables provided in Appendix F present the maximum impact using the 5-years of weather data when the MDF 1 drier is offline. The results are presented for the maximum outside the site boundary, the maximum change in impact, and the impact at the specific receptors identified. As shown, the impact is lower than both the normal operations scenario and MDF 2 offline scenario 1.

8.3.3 MDF 1 and MDF 2 driers offline – scenario 3

If both MDF driers are offline, the exhaust gases from the K7 and K8 biomass plants and the gas engines would release to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed by the Facility would be reduced and these combustion plants would not be needed and would be shut down. Kronospan would not operate the combustion plant in power only generation mode for prolonged periods as the board manufacturing process will not have a significant power demand when the MDF 1 and MDF 2 driers are offline. Therefore, this operating scenario would only occur for short periods.

The detailed results tables presented in Appendix G presents the maximum impact using the 5-years of weather data when both the MDF 1 and MDF 2 driers are offline. The results are presented for the maximum outside the installation boundary and the impact at the specific receptors identified. This analysis assumes each item of plant operates at peak capacity.

As shown in Appendix G, at the point of maximum impact, and at many of the identified sensitive receptors, the change in impact associated with the increase in NOx ELV for WESP 21 from that set out in the existing EP cannot be screened out as insignificant. However, the PEC remains below 70% of the annual mean AQAL. Therefore, the total impact of the Facility remains “not significant”.

8.3.4 All driers offline – scenario 4

If both MDF driers are offline, the emissions would be as per scenario 3 (section 8.3.3), but emissions would also be released from the Chip drier emergency stack rather than WESP 21. This is considered an emergency release which would be limited to periods of less than 1-hour and any occurrences would be reported. Therefore, this scenario has not been considered further.

8.3.5 K7 and K8 biomass plants offline – scenario 5

If either the K7 biomass plant or the K8 biomass plant are offline, the MDF driers would still be able to operate but the K5 or K6 gas heaters will be used to provide heat for the thermal oil for the presses. In this case, NOx emissions from Facility would be released from the K1 boiler, MDF 1 cyclone, MDF 2 cyclone, K5 or K6. The worst-case scenario is that both the K7 and K8 biomass plants are offline, as in this instance both the K5 and K6 gas heaters would be needed to provide heat for the thermal oil for the presses. The detailed results tables presented in Appendix H present the maximum impact using the 5-years of weather data when the K7 and K8 biomass plant are offline and K5 and K6 gas heaters are needed to heat the thermal oil. This scenario only affects predicted NOx impacts.

As shown in Appendix H, the maximum increase in concentration cannot be screened out as insignificant. However, the PEC remains below 70% of the annual mean AQAL. Therefore, the total impact of the Facility remains “not significant”. The change in impact can be screened out as ‘insignificant’ at all areas of exposure.

8.3.6 Summary

Table 21 provides a summary of the maximum increase in impact from the Facility for each scenario.

As shown, there are slight differences between the different operating scenarios. The greatest increase impact is predicted to occur when the MDF 1 and 2 driers are offline. This is because although when the K7 biomass plants and K8 biomass plants are offline there would be more sources on site at the location of the peak impact the main contributor is WESP 21. In any case, the maximum PEC for nitrogen dioxide and formaldehyde is less than 70% of the AQAL which conservatively assumes that this operation occurs throughout the year, whereas if MDF 1 and 2 were offline the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Kronospan would not operate the combustion plant in power only generation mode for prolonged periods as the board manufacturing process will not have a significant power demand when the MDF 1 and MDF 2 driers are offline. Therefore, this operating scenario would only occur for short periods.

The increase in impact can be screened out as ‘insignificant’ for all pollutants other than nitrogen dioxide. However, as set out in the preceding sections the PEC remains below 70% of the AQAL and therefore, the total impact of the Facility remains “not significant”.

Table 21: Sumary of maximum increase in impact

Quantity	Normal Ops	MDF 2 Offline	MDF 1 Offline	MDF 1 and 2 Offline	K7 and K8 Offline
Annual mean nitrogen dioxide	6.0%	6.9%	1.2%	1.2%	1.2%
1-hour nitrogen dioxide	10.7%	15.9%	2.2%	1.9%	2.2%
Annual mean formaldehyde	0.5%	0.5%	0.5%	0.5%	-
30-minute mean formaldehyde	1.6%	2.4%	1.6%	1.7%	-
Annual mean PM (as PM_{10})	0.3%	0.3%	0.3%	0.3%	-
Daily mean PM (as PM_{10})	2.3%	2.1%	2.2%	1.9%	-
Annual mean PM (as $PM_{2.5}$)	0.5%	0.6%	0.6%	0.5%	-
NOTES: All impacts presented as the change in impact as a percentage of the AQAL.					

9 Impact at Ecological Receptors

9.1 Daily mean Critical Level

The closest site which monitors ozone and/or sulphur dioxide concentrations is located in Wrexham, located approximately 12 km to the north of the Facility and does not monitor for ozone. Baseline concentrations of sulphur dioxide are modelled by APIS. As shown in Table 13 the concentration at each site is well below the Critical Level of 10 µg/m^3.

As there is no modelling or monitoring directly representative of local concentrations a review of the monitoring of ozone from all sites across the UK has been carried out.

The AO40 has been calculated, results graphed up showing where the baseline concentration exceeds the AO40 in each year in Figure 10 of Appendix A. As shown, there are locations where the AO40 exceeds the Critical Level but on average very few sites recorded exceedances of the AO40 level in the UK. The only sites which on average exceed are located in the south of England.

This analysis demonstrates that the concentrations of sulphur dioxide and ozone are well below the respective Critical Levels in the areas affected by emissions from the Facility. As such it is considered that the daily mean NOx Critical Level of 200 µg/m^3 is relevant and has been used for the purpose of this assessment.

9.2 Screening

The Environment Agency has produced Operational Instruction documents which explain how to assess aerial emissions from new or expanding Integrated Pollution Prevention and Control (IPPC) regulated industry applications, issued under the Environmental Permitting Regulations. The process to follow to satisfy the requirements of the Conservation of Habitats and Species Regulations 2010, Countryside and Rights of Way (CRoW) Act 2000, and the EA's wider duties under the Environment Act 1995 and the Natural Environment and Rural Communities Act 2006 (NERC06) are outlined.

Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" provides the following risk-based screening criteria for nature conservation sites:

Table 22: Ecological Screening Criteria

Threshold	European sites	SSSIs	NNR, LNR, LWS, ancient woodlands
Y (% threshold long-term)	1	1	100
Y (% threshold short-term)	10	10	100
Z (5 threshold)	70	70	100
NOTE: *Short term considered both daily and weekly timescales*			

Source: EA Operational Instruction 67_12

Where:

- Y is the long-term process contribution calculated as a percentage of the relevant Critical Level or Load; and

- Z is the long-term predicted environmental concentration (PEC) calculated as a percentage of the relevant Critical Level or Load.

Operational Instruction 66-12 states:

- If process contribution < Y% Critical Level and Load then emissions from the application are 'not significant', and
- If PEC < Z% Critical Level and Load it can be concluded 'no likely significant effect' (alone and in-combination).

AQTAG 17 – "Guidance on in combination assessments for aerial emissions from EPR permits" states that:

> *"Where the maximum process contribution (PC) at the European site(s) is less than the Stage 2 de-minimis threshold of the relevant critical level or load, the PC is considered to be inconsequential and there is no potential for an alone or in-combination effects with other plans and projects."*

Consultation with the EA has confirmed that the "Stage 2 de-minimis threshold" is the criteria outlined in Operational Instruction 67_12 outlined above. It has been agreed that this guidance is appropriate for use by NRW.

9.3 Methodology

9.3.1 Atmospheric emissions

The impact of emissions from the Facility has been compared to the Critical Levels listed in Table 6. Further assessment would be undertaken where the process contribution of a particular pollutant is greater than 1% of the long term or 10% of the short-term Critical Level for European and UK designated sites, and where the process contribution of a particular pollutant is greater than 100% of the Critical Level for locally-designated sites.

9.3.2 Deposition of emissions

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS.

An assessment has been made for each habitat feature identified in APIS for each designated site. The site-specific features tool has been used to identify the feature habitats, and then the search by location tool to find the habitat specific Critical Load for the specific points assessed within the designated sites. The relevant Critical Loads are presented in Appendix C.

If the change in impact of process emissions upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

APIS does not include site specific Critical Loads for non-designated sites. In lieu of this, the search by location function of APIS has been used. The Critical Loads using this function are based on a broad habitat type and location.

9.3.2.1 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 23.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 24.
4. Compare this result to the nitrogen deposition Critical Load.

Table 23: Deposition Factors

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

9.3.2.2 Calculation methodology – acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Facility. The steps to determine the acid deposition flux are as follows:

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in section 9.3.2.
2. Apply the conversion factor for N outlined in Table 23 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.
5. Add the contribution from S to HCl and treat this sum as the total contribution from S.
6. Plot the results against the Critical Load functions.

The March 2014 version of AQTAG 6 document states, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in the APIS tool). This should include the contribution of HCl from wet deposition.

Previous consultation with AQMAU has confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this analysis, it has been assumed that wet deposition of HCl is double dry deposition. It is understood that this approach is considered appropriate by NRW.

Table 24: Conversion Factors

Pollutant	Conversion Factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

The contribution from the Facility has been calculated using the APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

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

9.4 Operating scenarios

The change proposed as part of this variation effect the impacts of emissions of NOx, PM, TVOC and CH_2O. Of these pollutants Critical Levels have only been set for NOx. As such this analysis only focusses on the changes associated with the proposed increase in the emission limit for NOx for WESP 21.

The Critical Levels for the protection of ecosystems are set for NOx and are expressed as a daily and an annual mean, and acid and nitrogen deposition are expressed as an annual deposition rate. The operating scenarios which occur for periods of 1-hour or less are therefore not considered in this assessment. Of the scenarios identified in Section 3, only the following are expected to occur for periods of a day or more:

1. Normal operations

   MDF1 and MDF2 driers operating. The only relevant emissions from the Facility are from the K1 boiler, MDF 1 cyclone, MDF 2 cyclone and WESP 21. The impact of this operating scenario has been considered further.

2. Non-standard operations scenario 1 - MDF 2 offline

   MDF 1 drier can use the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to three gas engines, the electricity needed on site would be reduced so only three gas engines would be needed; two of which would be used in MDF 1 drier, and one would need to vent to atmosphere via its own dedicated stack. Therefore, the only relevant emissions from site would be from the K1 boiler, MDF 1 cyclones, a single gas engine, and WESP 21. The impact of this operating scenario has been considered in section 9.5.

3. Non-standard operations scenario 2- MDF 1 offline

   MDF 2 drier can use the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to four gas engines, the electricity needed on site would be reduced so only four gas engines would be needed. Exhaust gases from all four gas engines can be accommodated within the MDF 2 drier. Therefore, the only relevant emissions from the Facility would be from the K1 boiler, MDF 2 cyclones, the WESP 21 – i.e. no change from normal operations, albeit emissions of acid gases would differ as the concentration of these would be sourced from the K7 biomass plant and the K8 biomass plant. The analysis has shown that this would have a lower environmental impact then either the normal operations or MDF 2 offline scenario and as such this scenario has not been considered further.

4. Non-standard operations scenario 5 - K7 biomass plant and the K8 biomass plant are offline

   The drying process would still be able to operate but the K5 and K6 heaters will be used to heat the thermal oil for the presses. In this case relevant emissions from the Facility would be from the K1 boiler, MDF 1 cyclones, MDF 2 cyclones, K5 and K6. This scenario is not expected to occur for extended periods and not for a continuous 24-hour period.

The only scenario in which all the combustion plant on site would be operating concurrently would be if the MDF 1 and MDF 2 driers are unavailable. However, if MDF 1 and MDF 2 driers are unavailable the electricity demand on site would be reduced and not all items of combustion plant would be required. This scenario would only occur for periods of 1 hour or less. Therefore, this scenario has not been considered in relation to the impact on ecological receptors.

9.5 Emissions of acid gases from MDF 2

When reviewing the model inputs for HCl and HF it is noted that the g/s release rate for the MDF 2 drier is very high. Under normal operations, the source of these pollutants to the drier would be the K7 biomass boiler. The amount of these pollutants which would need to be released from the K7 biomass boiler to achieve the ELV on the MDF 2 driers has been calculated as shown in Table 25.

Table 25: Emissions of acid gases from MDF 2 drier

Parameter	MDF 2	K7	K8
Vol flow per flue	55.9	8.9	9.4
No. of flues	4	1	1
ELV (mg/Nm^3)			
HCl	30	35	15
HF	1	2	3
Release rate (g/s)			
HCl	1.677	0.311	0.141
HF	0.056	0.018	0.028

Under normal operations, the emissions from the K7 biomass plant would be divided by the 4 cyclones and the release rate from each cyclone would be:

- 0.078 g/s of HCl which is 4.6% of the release rate assuming operation of the MDF 2 drier at the ELV and
- 0.004 g/s of HF which is 7.9% of the release rate assuming operation of the MDF 2 drier at the ELV.

As such the emission rate for HCl and HF from MDF 2 drier has been calculated in the same way as SO2, i.e. taking the release rate from the sources venting to atmosphere via the drier.

9.6 Emissions scenarios

The impact of the emissions on ecological receptors has considered the following:

- The change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP; and
- The total impact of the Facility operating at the proposed ELVs.

This has included the following worst-case assumptions:

1. All items of plant run at peak capacity when operating. In reality, each item of plant is not continually operated at peak capacity as operations are dependent upon production.
2. Emissions from all combustion plant are at the ELVs. Monitoring of emissions from the existing combustion plant on-site show that these normally operate below the ELVs.
3. Operation of all items of plant occur during the worst-case weather conditions for dispersion. It is unlikely that the non-standard operations would occur at the same time as the adverse conditions for dispersion of emissions occur.

4. The predicted impacts are based on the maximum predicted concentration using 5 years of weather data.

9.7 Results

When determining the impact of the operations in relation to the Critical Level and Critical Loads it is appropriate to consider the normal operating and non-standard operating scenarios, noting that both are conservative as they assume all plant continually operates at the ELVs and it does not consider periods of shutdown or reduced operations. Detailed results tables for normal operations are provided in Appendix D, and when the MDF 2 drier is offline are provided in Appendix E.

Kronospan has been operating the Facility in Chirk since 1972. Therefore, the contribution from the Facility should be allowed for within the background, and this should form the baseline for concentrations at each site. The mapped background concentration clearly includes a contribution from the Facility as this is included as a point source within the national air emissions inventory. Therefore, there is already a contribution from the Facility within the predicted PEC and total concentrations and deposition rates are likely to be lower. As explained previously, the results are based on very conservative modelling assumptions.

9.7.1 Impacts at European and UK designated habitat sites

There are three identified sites of European importance within the screening distances, Johnstown Newt Site SAC, Berwyn and South Clwyd Mountains SAC, and Berwyn SPA. The detailed results tables show that at each of these sites:

1. The greatest impact of the Facility is predicted to occur during normal operations.
2. The change in impact associated with the increase in the emission limit for NOx for WESP 21, compared to the emission limit in the existing EP is less than 1% of the long-term and less than 10% of the short-term Critical Levels. Therefore, it can be screened out as 'insignificant'.
3. The total impact of the Facility operating at the proposed emission limit is less than 1% of the long-term and less than 10% of the short-term Critical Levels. Therefore, it can be screened out as 'insignificant'.
4. The change in impact associated with the increase in the proposed emission limit for NOx for WESP 21, compared to the emission limit in the existing EP is less than 1% of the Critical Loads for nitrogen and acid deposition. Therefore, it can be screened out as 'insignificant'.
5. The total impact of the Facility operating at the proposed ELVs is less than 1% of the lower Critical Load for nitrogen deposition. Therefore, it can be screened out as 'insignificant'.
6. The total impact of the Facility operating at the proposed ELVs is less than 1% of the upper Critical Load for acid deposition. Therefore, it can be screened out as 'insignificant'.

At Berwyn Mountains SAC and Berwyn SPA, the total impact of the Facility operating at the proposed ELVs is greater than 1% of lower Critical Load for acid deposition. However, the predicted impacts are comparable to those for the Permitted Facility. There is predicted to be an increase in acid deposition of 0.07% of the lower Critical Loads at both sites from the impact of the Facility operating at the permitted ELVs. Furthermore, as the total impact of the Facility remains below 1% of the upper Critical Load the impact can be described as not significant.

9.7.1.1 River Dee and Bala Lake SAC and SSSI

The maximum impact has been calculated for the grid points within the modelling domain within the extent of the Dee and Bala Lake SAC and SSSI. Analysis of the predicted impacts has shown that:

1. The greatest impact of the Facility is predicted to occur during normal operations.
2. The change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP in relation to the Critical Level. Therefore, it cannot be screened out as 'insignificant'.
3. Whilst the change in impact cannot be screened out as insignificant, the total impact of the Facility when including the background (the PEC) operating at the proposed ELVs is less than 70% of the Critical Level and can be described as not significant.
4. The habitats identified at the site are not sensitive to nitrogen or acid deposition.

Therefore, it can be concluded that the impact of emissions from the Facility on the Dee and Bala Lake SAC and SSSI will not be significant.

9.7.1.2 Nant-y-Belan and Prynella Woods SSSI

The maximum impact has been calculated for the grid points within the modelling domain within the extent of the Nant-y-Belan and Prynella Woods SSSI. Analysis of the predicted impacts has shown that:

- The greatest impact of the Facility, based on operation at the ELVs in the existing EP, is during normal operations. However, with the proposed change to the emission limit for NOx for WESP 21, the greatest impact occurs when MDF 2 is offline.
- The change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP in relation to the Critical Level. Therefore, it cannot be screened out as 'insignificant'.
- Whilst the change in impact cannot be screened out as insignificant, the total impact of the Facility when including the background (the PEC) operating at the proposed ELVs remains less than 70% of the Critical Level. Therefore, it can be described as not significant.
- The change in impact associated with the increase in the emission limit for NOx ELV for WESP 21 from that set out in the existing EP in relation to the Critical Load for nitrogen and acid deposition can be screened out as insignificant.
- The total impact of the Facility when including the background (the PEC) operating at the proposed ELVs exceeds the Critical Load for nitrogen deposition and acid deposition.

At Nant-y-Belan and Prynella Woods SSSI the total impact of the Facility, operating at the proposed emission limit, is greater than 1% of upper and lower Critical Load for nitrogen and acid deposition. However, the impacts are comparable to those predicted for the total impact of the Facility operating at the permitted emission limits. Therefore, the predicted increase in acid and nitrogen deposition impacts associated with the increase in NOx ELV for the WESP 21 from that set out in the existing EP can be screened out as insignificant.

Overall, it can be concluded that the impact of emissions from the Facility on the Nant-y-Belan and Prynella Woods SSSI will not be significant.

9.7.1.3 Chirk Castle SSSI

As set out Kronospan has been operating the Facility in Chirk since 1972. Chirk Castle was granted SSSI status in 2011, i.e. after Kronospan commenced operation of the Facility. Therefore, the contribution from the Facility should be allowed for and this should form the baseline for concentrations at Chirk Castle.

The maximum impact has been calculated for the grid points within the modelling domain within the extent of Chirk Castle SSSI. Analysis of the predicted impacts has shown that:

1. The greatest annual mean impact of the Facility is predicted to occur during normal operations, but the greatest daily mean impact is predicted to occur when the MDF 2 drier is offline;
2. With reference to the Critical Levels set in the Air Emissions Guidance the change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP cannot be screened out as 'insignificant'.
3. Whilst the change in impact cannot be screened out as insignificant when assessed against Critical levels in the Air Emissions Guidelines:
   - the total impact of the Facility when including the background (the PEC) operating at the proposed ELVs is less than 70% of the long term Critical Level; and
   - the total impact of the Facility when including the background (the PEC) operating at the proposed ELVs is less than 70% of the daily Critical Level.
4. With reference to the Critical Loads the change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP cannot be screened out as 'insignificant', and the maximum total impact of the Facility when including the background (the PEC) operating at the proposed emission limit exceeds the Critical Load.

In relation to nitrogen and acid deposition impacts, although the change in impact cannot be screened out as insignificant, and the total impact of the Facility operating at the proposed emission limits exceeds the Critical Load. The impacts are comparable to those predicted for the total impact of the Facility operating at the permitted emission limits.

Therefore, overall, it can be concluded that the impact of emissions from the Facility on Chirk Castle SSSI will not be significant.

9.7.1.4 Summary of impacts at European and UK designated sites

The following table provides a summary of the descriptor of the total impact of the Facility with the proposed emission limit for NOx for WESP 21 with that based on operation at the ELVs in the existing EP, whether the description of the impact is any different, and description of the change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP.

As shown, there is not predicted to be a change in overall description of the impact of the Facility at any ecological site.

Table 26: Summary of Impacts at European and UK Designated Sites

Site	Descriptor of total impact of Facility operating at the ELVs in the EP	Description of the total impact of the Facility operating at the proposed ELVs	Change in description (yes/no)	Description of change in impact associated with the increase in ELV for the WESP 21
River Dee and Bala Lake SAC and SSSI				
Oxides of nitrogen – annual mean	PEC not significant	PEC not significant	No	Not insignificant
Oxides of nitrogen – daily mean	PEC not significant	PEC not significant	No	Insignificant
N deposition	Not sensitive	Not sensitive	-	-
Acid deposition	Not sensitive	Not sensitive	-	-
Johnstown New Sites SAC				
Oxides of nitrogen – annual mean	PC insignificant	PC insignificant	No	Insignificant
Oxides of nitrogen – daily mean	PC insignificant	PC insignificant	No	Insignificant
N deposition	Not sensitive	Not sensitive	-	-
Acid deposition	Not sensitive	Not sensitive	-	-
Berwyn Mountains SAC and Berwyn SPA				
Oxides of nitrogen – annual mean	PC insignificant	PC insignificant	No	Insignificant
Oxides of nitrogen – daily mean	PC insignificant	PC insignificant	No	Insignificant
N deposition – lower Critical Load	PC insignificant	PC insignificant	No	Insignificant
N deposition – upper Critical Load	PC insignificant	PC insignificant	No	Insignificant
Acid deposition – lower Critical Load	PEC > Critical Level	PEC > Critical Level	No	Insignificant
Acid deposition – upper Critical Load	PC insignificant	PC insignificant	No	Insignificant
Chirk Castle SSSI				
Oxides of nitrogen – annual mean	PEC not significant	PEC not significant	No	Not insignificant
Oxides of nitrogen – daily mean	PEC not significant	PEC not significant	No	Not insignificant

Site	Descriptor of total impact of Facility operating at the ELVs in the EP	Description of the total impact of the Facility operating at the proposed ELVs	Change in description (yes/no)	Description of change in impact associated with the increase in ELV for the WESP 21
N deposition – lower Critical Load	PEC > Critical Load	PEC > Critical Load	No	Not insignificant
N deposition – upper Critical Load	PEC > Critical Load	PEC > Critical Load	No	Not insignificant
Acid deposition – lower Critical Load	PEC > Critical Load	PEC > Critical Load	No	Not insignificant
Acid deposition – upper Critical Load	PEC > Critical Load	PEC > Critical Load	No	Not insignificant
Nant-y-Belan & Prynella Woods SSSI				
Oxides of nitrogen – annual mean	PEC not significant	PEC not significant	No	Insignificant
Oxides of nitrogen – daily mean	PC insignificant	PC insignificant	No	Insignificant
N deposition – lower Critical Load	PEC > Critical Load	PEC > Critical Load	No	Insignificant
N deposition – upper Critical Load	PEC > Critical Load	PEC > Critical Load	No	Insignificant
Acid deposition – lower Critical Load	PEC > Critical Load	PEC > Critical Load	No	Insignificant
Acid deposition – upper Critical Load	PEC > Critical Load	PEC > Critical Load	No	Insignificant

9.7.1.5 Figures

For reference the following plot files have been produced:

- Figure 38: Annual Mean Oxides of Nitrogen - Normal Operations
- Figure 39: Annual Mean Oxides of Nitrogen - Normal Operations - Change in Impact
- Figure 40: Maximum Daily Mean Oxides of Nitrogen - Normal Operations
- Figure 41: Maximum Daily Mean Oxides of Nitrogen - Normal Operations - Change in Impact
- Figure 42: Annual Mean Oxides of Nitrogen - MDF 2 Offline
- Figure 43: Annual Mean Oxides of Nitrogen - MDF 2 Offline - Change in Impact
- Figure 44: Maximum Daily Mean Oxides of Nitrogen - MDF 2 Offline
- Figure 45: Maximum Daily Mean Oxides of Nitrogen - MDF 2 Offline - Change in Impact

9.7.2 Impacts at locally designated habitat sites

The impact of emissions from the Facility has been calculated for the local wildlife sites by post processing the model files to determine the maximum impact across each local wildlife site.

As outlined above the mapped background concentration clearly includes a contribution from the Facility as this is included as a point source within the national air emissions inventory. Therefore, there is already a contribution from the Facility within the predicted PEC and total concentrations are likely to be lower.

The following table provides a summary of the following for each local wildlife site with reference to the Critical Level and Critical Loads:

- The change in impact associated with the increase in NOx ELV for the WESP 21 from that set out in the existing EP; and
- The total impact of the Facility.

A change in impact is considered to be insignificant if the change in impact associated with the proposed ELV for NOx for the WESP 21 from that set out in the existing EP is less than 1% of the long term or less than 10% of the short term Critical Level or Critical Load.

The total impact of the Facility is considered to be not significant if the contribution from the Facility is less than the Critical Level or Critical Load as set out in the EA Operational Instructions guidance.

Table 27: Summary of Impact at Local Wildlife Sites

Site	Descriptor of total impact of Facility operating at the ELVs in the EP	Description of the total impact of the Facility operating at the proposed ELVs	Change in description (yes/no)	Description of change in impact associated with the increase in ELV for the WESP 21
Barracks Fields				
Oxides of nitrogen – annual mean	Not significant	Not significant	No	Not insignificant
Oxides of nitrogen – daily mean	Not significant	Not significant	No	Insignificant
N deposition – lower Critical Load	Not significant	Not significant	No	Insignificant
N deposition – upper Critical Load	Not significant	Not significant	No	Insignificant
Acid deposition – Critical Load	Not significant	Not significant	No	Insignificant
Coed-Y-Canal Wood				
Oxides of nitrogen – annual mean	Not significant	Not significant	No	Not insignificant
Oxides of nitrogen – daily mean	Not significant	Not significant	No	Not insignificant
N deposition – lower Critical Load	Not significant	Not significant	No	Not insignificant
N deposition – upper Critical Load	Not significant	Not significant	No	Not insignificant
Acid deposition – Critical Load	Not significant	Not significant	No	Insignificant
Ancient Woodlands				
Oxides of nitrogen – annual mean	Not significant	Not significant	No	Not insignificant
Oxides of nitrogen – daily mean	Not significant	Not significant	No	Not insignificant
N deposition – lower Critical Load	Not significant	Not significant	No	Insignificant
N deposition – upper Critical Load	Not significant	Not significant	No	Insignificant
Acid deposition – Critical Load	Not significant	Not significant	No	Insignificant

As shown the description of the impact of the Facility is comparable to those predicted for the total impact of the Facility operating at the proposed ELVs and the dispersion modelling used for the existing EP determination.

At Barracks Fields and the Ancient Woodlands, whilst the change in impact associated with the increase in NOx ELV for the WESP 21 from that set out in the existing EP cannot be screened out as insignificant the total impact of the Facility can be described as not significant. Furthermore, Coed-y-Canal Wood the total impact of the Facility can be described as not significant and the contribution from the Facility is not predicted to exceed the Critical Level.

This analysis conservatively assumes that all items of plant operate at the respective emission limits. However, as shown in Appendix B, actual emissions are lower than the ELV and not all plant will operate continuously throughout the year. Therefore, actual impacts are likely to be lower than those predicted within this assessment.

9.8 Other local point sources of emissions

The following applications have been identified within 10 km of the Facility:

1. Mondelez MCPD application (ref: PAN-008579),
2. Five Fords WwTW gas to grid facility (ref: PAN-002939)
3. Conrad (Hawarden) Limited (ref: PAN-010150).

These projects are shown on Figure 13 of Appendix A with reference to the Facility and the European designated ecological sites. As shown, applications No. 2 and No. 3 are located approximately 10 km to the east of the Berwyn and South Clwyd Mountains SAC. Based on the wind direction it is unlikely for any significant cumulative impacts with the Facility at this SAC. The River Dee and Bala Lake SAC is 4 km from applications 2 and 3. However, the Facility is about 10 km away from this area. Therefore, there is no risk of significant cumulative impacts. Application No. 1 is just to the south of the Facility. Therefore, further analysis of the cumulative impact of this project has been carried out.

9.8.1 Mondelez MCPD application

The MCPD application at the Mondelez site is to install a new steam raising boiler plant. The existing boilers will be retained at the site but will only operate on a stand-by basis only. As such, only the impact of the new steam raising boiler has been considered. The permit application documentation (ref: PAN-008579) includes a detailed Air Quality Assessment which includes all the model inputs for the new steam raising boiler plant.

The Air Quality Assessment includes detailed results tables presenting the impact of NOx at ecological receptors. The maximum annual mean NOx impact at any SAC, SPA or SSSI, was at Chirk Castle SSSI, was predicted to be 0.09 $\mu g/m^3$, or 0.3% of the Critical Level. Furthermore, the maximum daily mean NOx impact was also at Chirk Castle SSSI and was predicted to be 1.01 $\mu g/m^3$. Therefore, the contribution from the Mondelez site was screened out as insignificant. The additional contribution from the Mondelez site would not significantly change the predicted impact of emissions at any of the ecological receptors.

9.8.2 Oswestry gas peaking plant

The Oswestry gas peaking plant is a standby generator comprising of 12 natural gas generators located approximately 8.5 km to the south of the Facility. Planning permission for the peaking plant was granted in October 2020 and we understand an EP application has been granted by the EA (EPR/PP3405BE).

The peaking plant is located 8.5 km to the south of the Facility, and more than 10 km from either:

- Berwyn and South Clwyd Mountain SAC;
- Berwyn SPA; and
- Johnstown Newt Site SAC.

Therefore, the cumulative impact of emissions from the Facility and Oswestry gas peaking plant on these features has been screened out for assessment purposes and the analysis within this assessment has only considered the cumulative impact on the River Dee and Bala Lake SAC.

The planning application for the peaking plant was supported by an Air Quality Assessment[5] which explained that the generators would operate for 2,500 hours per year. The planning application did not consider the impact that emissions would have upon ecology. Therefore, it is not possible to qualitatively determine what the cumulative impact of the Facility and the Oswestry gas peaking plant would be. However, the model inputs were set out in Appendix A2 of the Air Quality Assessment.

The model inputs have been used to model the predicted impact of the peaking plant in combination with the Facility and determine the cumulative impact of emissions on the Natura 2000 sites listed in the planning application for the peaking plant. The model inputs for the peaking plant only include emissions of NOx; therefore, this is the only pollutant which has been modelled; however, the analysis has taken into consideration emissions of NOx, nitrogen and acid deposition.

A review of APIS shows that there are no established critical loads for "*riverine habitats and running waters (rivers with floating vegetation often dominated by water-crowfoot)*", Therefore, this analysis has only focussed on impacts of oxides of nitrogen emissions in relation to the critical levels for the protection of habitats.

The maximum annual mean impact of process emissions from the peaking plant is predicted to be 0.11 $\mu g/m^3$ at the points used to represent the River Dee and Bala Lake SAC, assuming 100% operation of the peaking plant. However, as stated previously, the Air Quality Assessment states that the peaking plant would only operate for 2,500 hours per year: therefore, the annualised impact would be 0.0302 $\mu g/m^3$. This is considered to be an extremely small additional contribution at this feature. Therefore, from a cumulative impact perspective, it would not change the conclusions of the assessment.

[5] Air Quality Assessment: Gas Power Generation Facility, Land off A5, Oswestry, Air Quality Consultants, September 2020.

10 Conclusions

This Dispersion Modelling Assessment has been carried out to support the EP variation application for the Kronospan Facility.

The dispersion modelling undertaken has used a number of highly conservative assumptions.

1. All items of plant run at peak capacity when operating.

   Each item of plant is not continually operated at peak capacity as operations are dependent upon production.
2. Emissions from all plant are at the ELVs set in the existing EP, or that proposed in the case of the WESP 21.

   Monitoring of the emissions from the existing combustion plant on-site show that these normally operate below the ELVs.
3. Operation of all items of plant occur during the worst-case weather conditions for dispersion;

   It is unlikely that the non-standard operations would occur at the same time as the adverse conditions for dispersion of emissions occur.
4. The predicted impacts are based on the maximum predicted concentration using 5 years of weather data.

With regards to the impact on human health, during normal operations, although the predicted process contribution cannot be screened out as 'insignificant', the total impact of the Facility operating at the proposed ELVs can be described as not significant. The same conclusion can be reached for the identified non-standard operating scenarios.

With regard to the impact on ecological features, only those operating scenarios which could occur for periods of at least one day have been considered. The results have shown that:

- At all European designated sites, the change in impact associated with the increase in the emission limit for NOx for WESP 21 from that set out in the existing EP can be screened out as insignificant; and the total impact of the Facility operating at the proposed emission limits can be screened out as insignificant.
- At River Dee and Bala Lake SAC and SSSI, whilst the change in impact cannot be screened out as insignificant, the description of the impact for the Facility operating at the proposed emission limits is the same as that operating at the emission limits set in the existing EP.
- At Chirk Castle SSSI, whilst the change in impact cannot be screened out as insignificant, the description of the impact for the Facility operating at the proposed ELVs is the same as that operating at the emission limits set in the existing EP.
- At Nant-y-Belan and Prynella Woods SSSI, the change in impact can be screened out as insignificant with the exception of annual mean NOx impacts. However, the description of the impact for the Facility operating at the proposed emission limits is the same as that operating at the emission limits set in the existing EP.
- At locally designated sites the description of the impact for the Facility operating at the proposed emission limits is the same as that operating at the emission limits set in the existing EP.

Additional consideration has been made to the in-combination impact of emissions. This has shown that the inclusion of other identified sources would not have a significant impact.

Appendices

A Figures

Legend

★ Human Sensitive Receptors

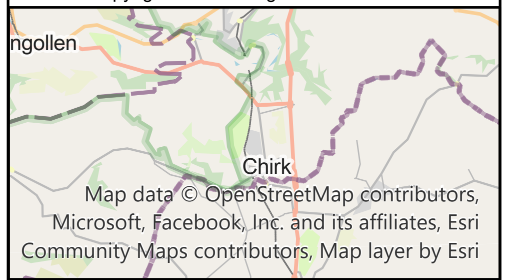
Installation Boundary

Client:	Kronospan
Site:	Chirk
Project:	2376_Kronospan_3

Title:

Figure 5 - Facility and Human Receptors

Drawn by: RSF	Date: 20/02/2023



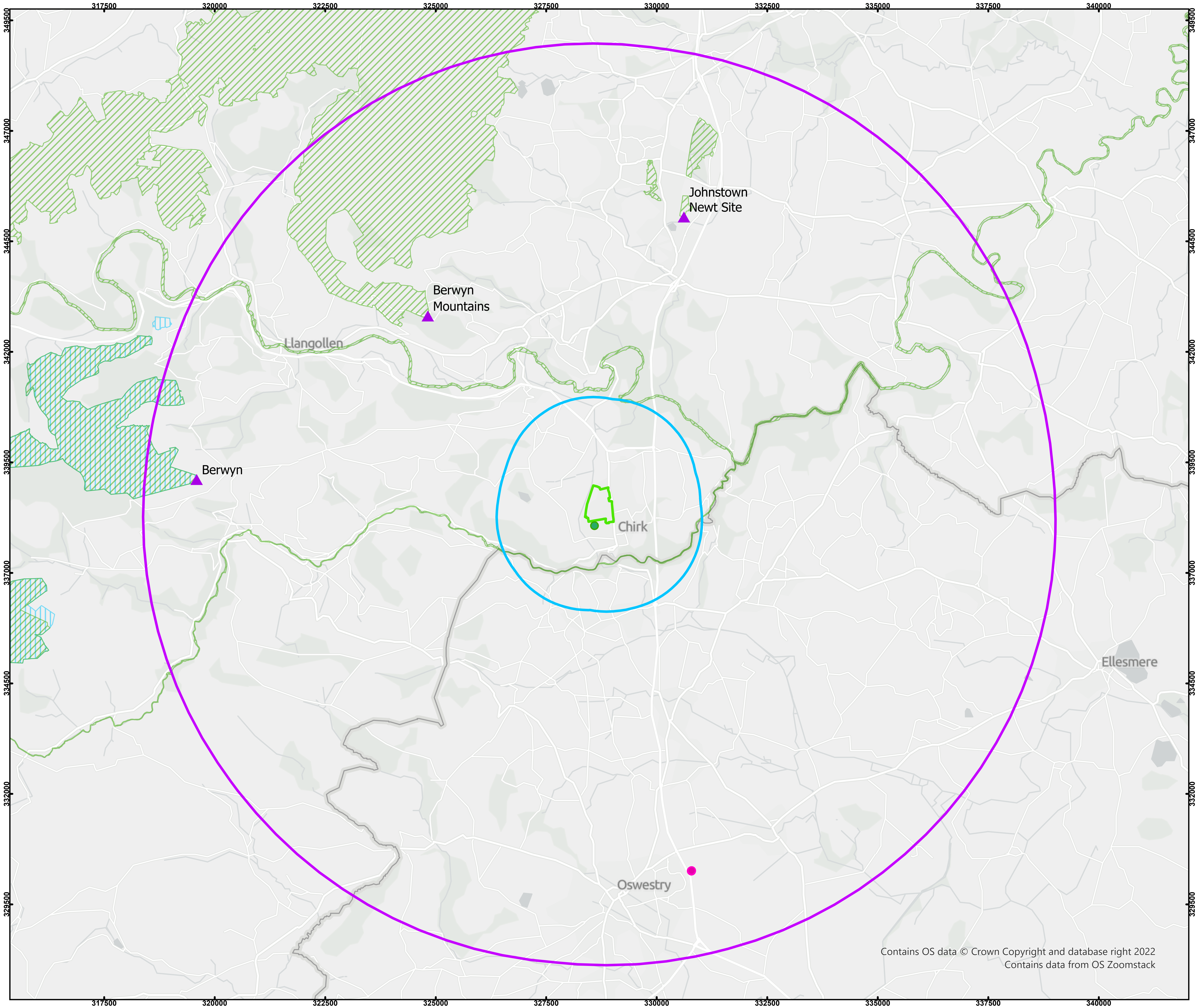
0 0.1 0.2 0.4 km

N

Scale: 1:10,000

FICHTNER
Consulting Engineers Limited

Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618



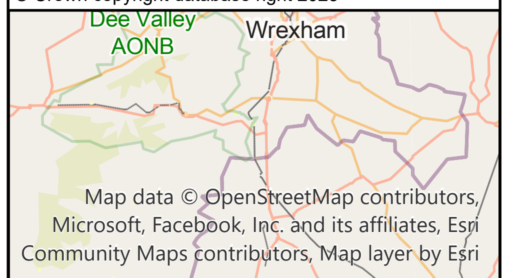
Legend

- Mondelez
- Peaking Plant
- Eco Receptor Points
- 10km from Installation
- 2km from Installation
- Installation Boundary
- SAC
- SPA

Client:	Kronospan
Site:	Chirk
Project:	2376_Kronospan_3
Title:	

Figure 6 - Ecological Receptors

Drawn by: RSF	Date: 20/02/2023



0 0.75 1.5 3 km

Scale: 1:80,000

N

FICHTNER
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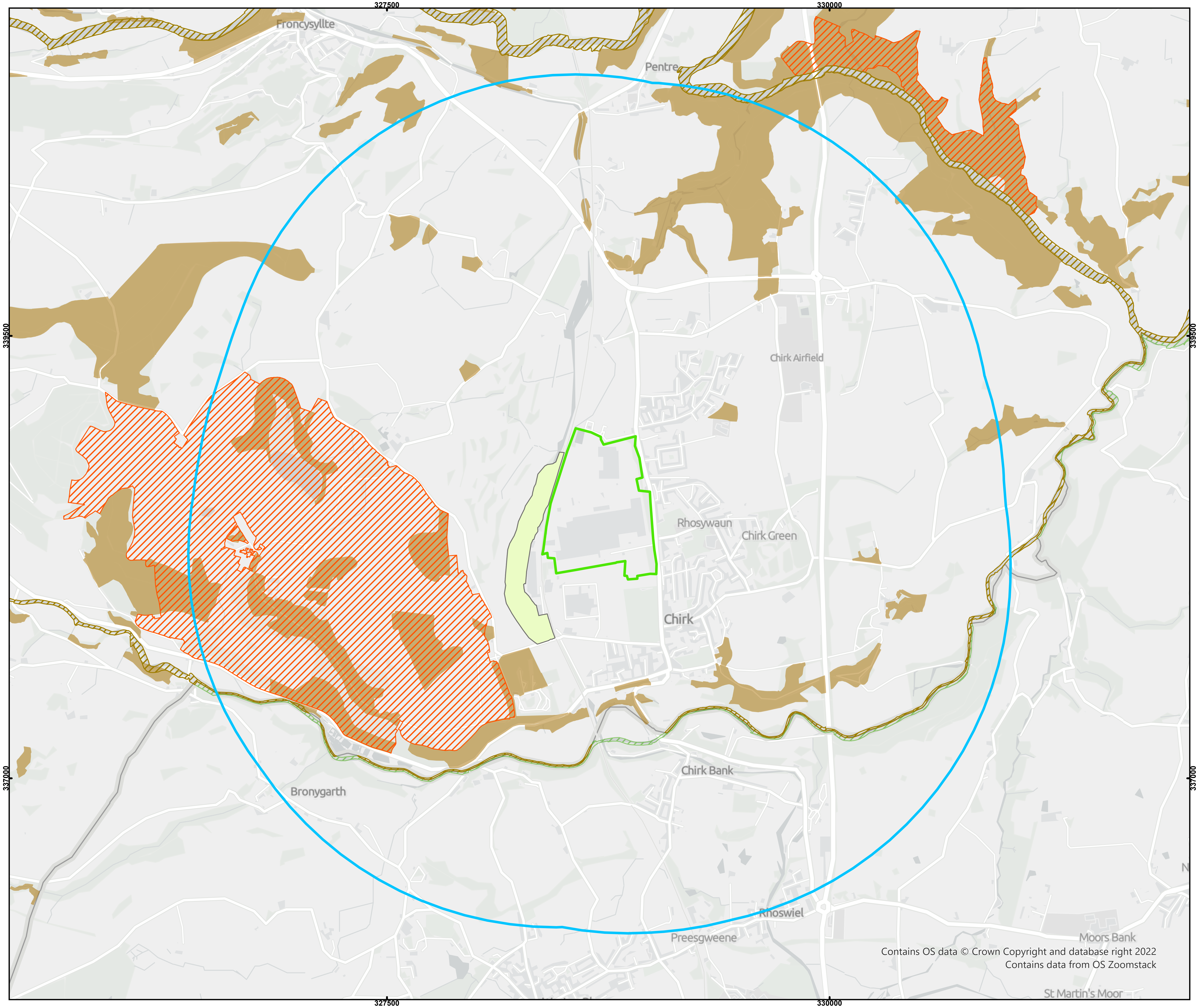
Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618



Legend

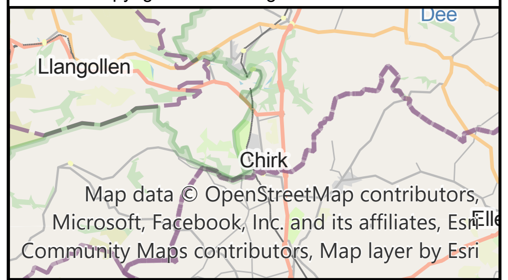
- Eco Receptor Points
- Canal_Wood
- 10km from Installation
- 2km from Installation
- Installation Boundary
- SAC
- SSSI
- Ancient Woodlands

Client:	Kronospan
Site:	Chirk
Project:	2376_Kronospan_3

Title:

Figure 7 - Ecological Receptors Zoomed

Drawn by: RSF | Date: 20/02/2023



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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Legend

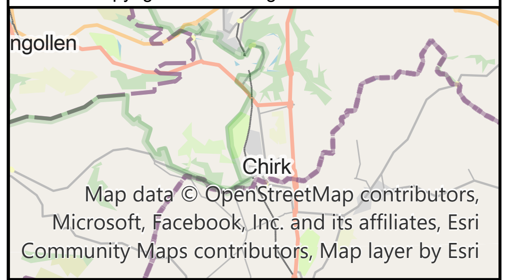
- Monitoring Sites
- Installation Boundary

Client:	Kronospan
Site:	Chirk
Project:	2376_Kronospan_3

Title:

Figure 8 - Local Monitoring Locations

Drawn by: RSF | Date: 20/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

FICHTNER
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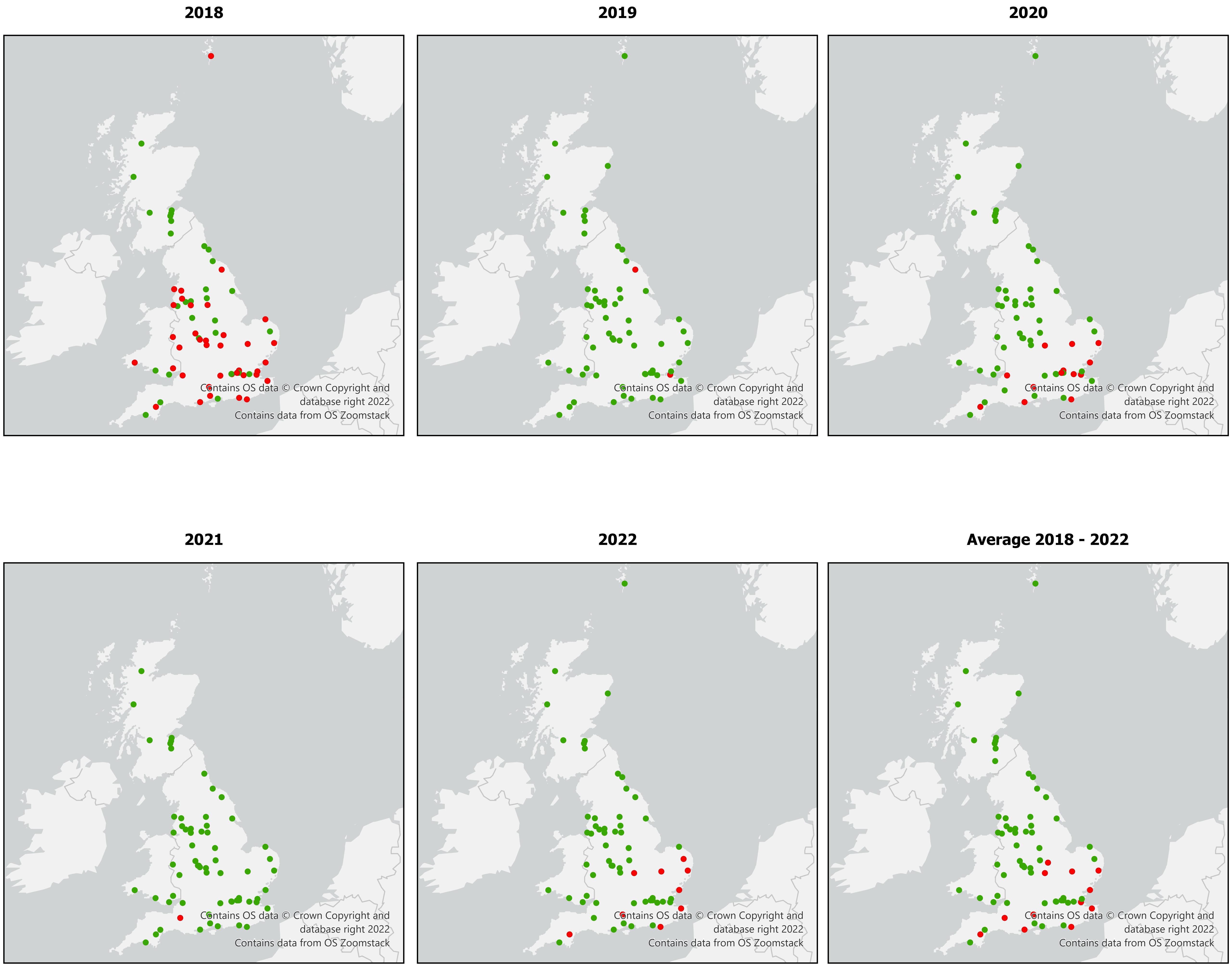

Legend

AOT40

- < 3,000 ppb.hr
- > 3,000 ppb.hr

AOT40 calculated from accumulated hourly ozone concentrations - sum of the difference between each hourly daytime (08:00 to 20:00 Central European Time) ozone concentration greater than 40 ppb and 40 ppb for the period between 01 May and 31 July

Title:

Figure 9 - Ozone Analysis

Drawn by: RSF | Date: 20/02/2023

0 115 230 460 km

N

Scale: 1:11,000,000

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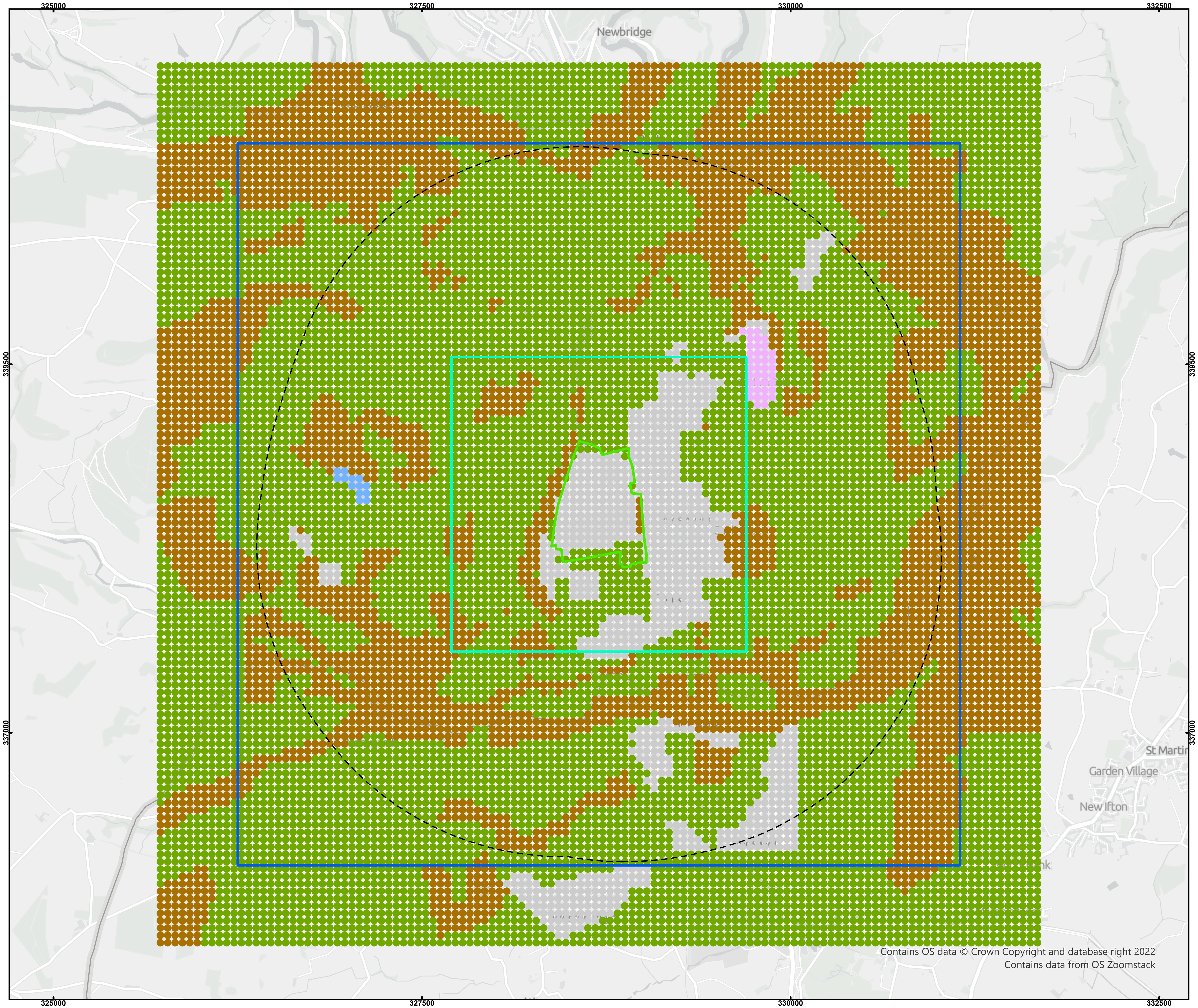


Legend

- 2km from Installation
- Installation Boundary
- Fine Grid
- Main Grid

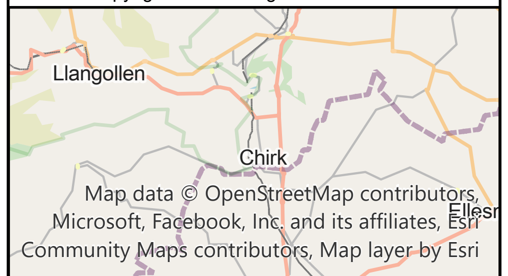
Roughness length (m)

- 0.001
- 0.03
- 0.3
- 0.5
- 0.75

Title:

Figure 10 - Model Inputs

Drawn by: RSF | Date: 20/02/2023



0 0.23 0.45 0.9 km

N

Scale: 1:24,000

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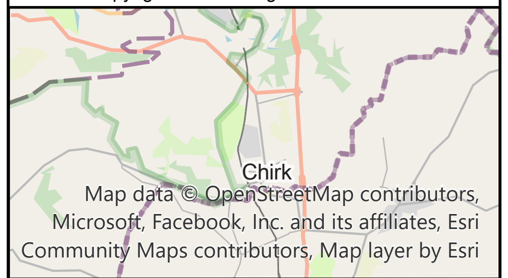
Legend

- Dust Units
- Point Sources
- Buildings
- Installation Boundary

Title:

Figure 11 - Buildings and Sources

Drawn by: RSF | Date: 20/02/2023



0 0.03 0.06 0.12 km

Scale: 1:3,000

N

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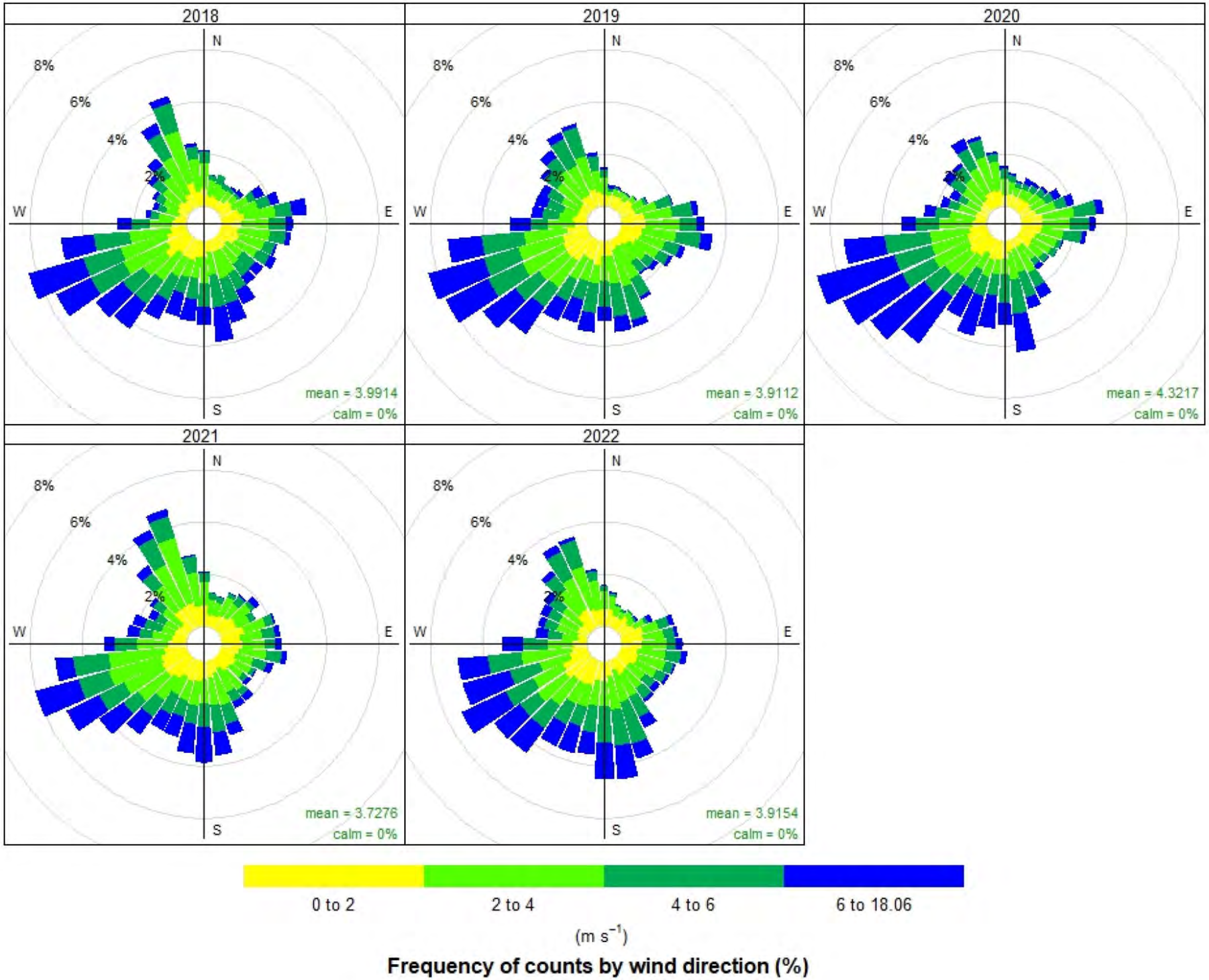

Title:

Figure 12 - Shawbury Met Data

Drawn by: RSF | Date: 28/02/2023

Scale:

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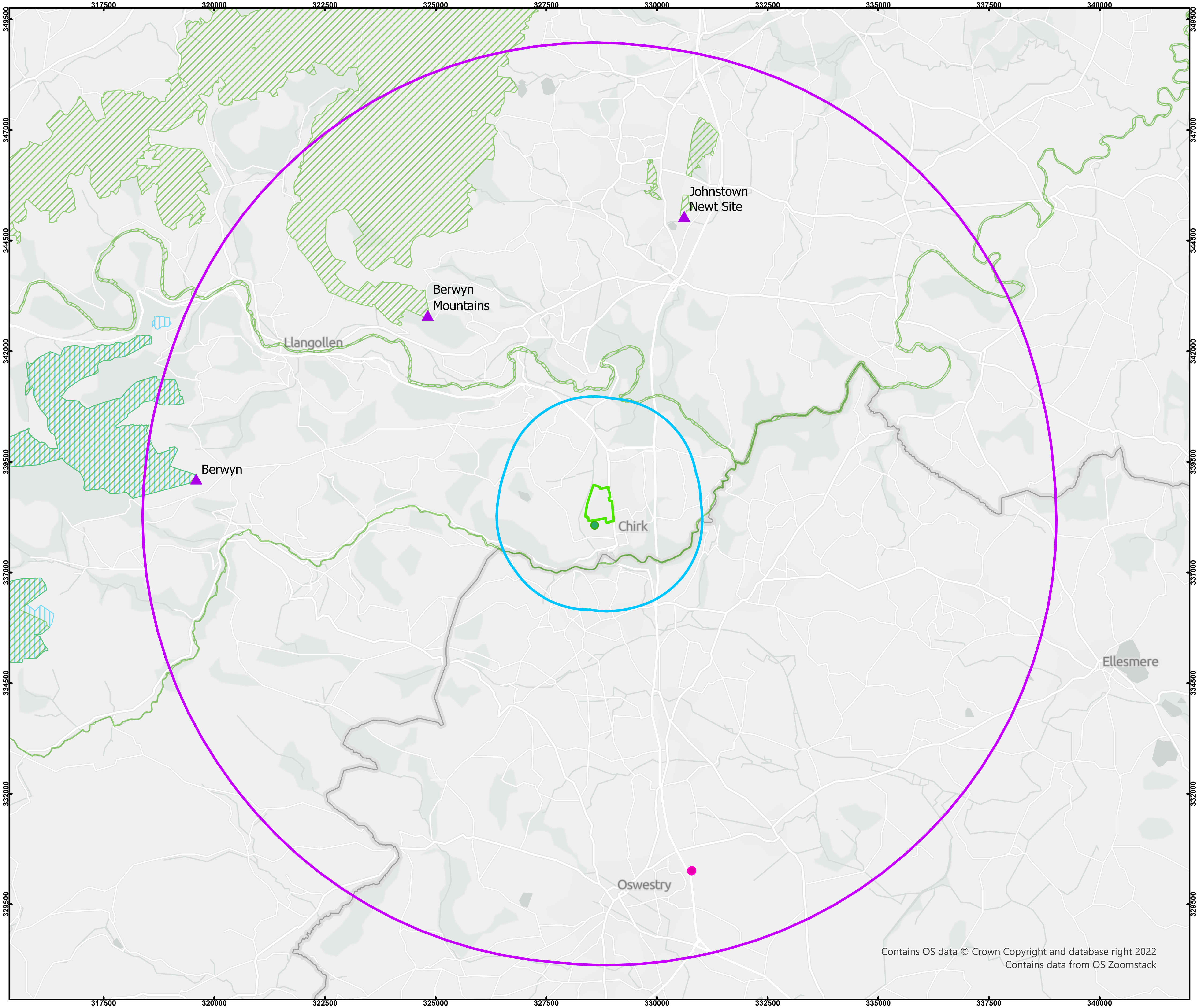


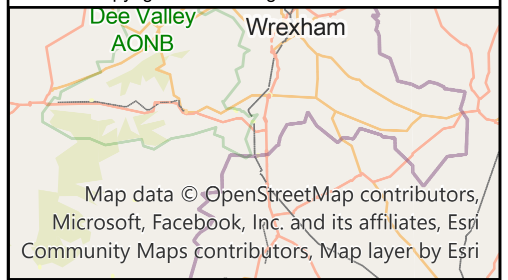
Legend

- Mondelez
- Peaking Plant
- Eco Receptor Points
- 10km from Installation
- 2km from Installation
- Installation Boundary
- SAC
- SPA

Title:

Figure 13 - Cumulative Sources

Drawn by: RSF	Date: 20/02/2023



0 0.75 1.5 3 km

N

Scale: 1:80,000

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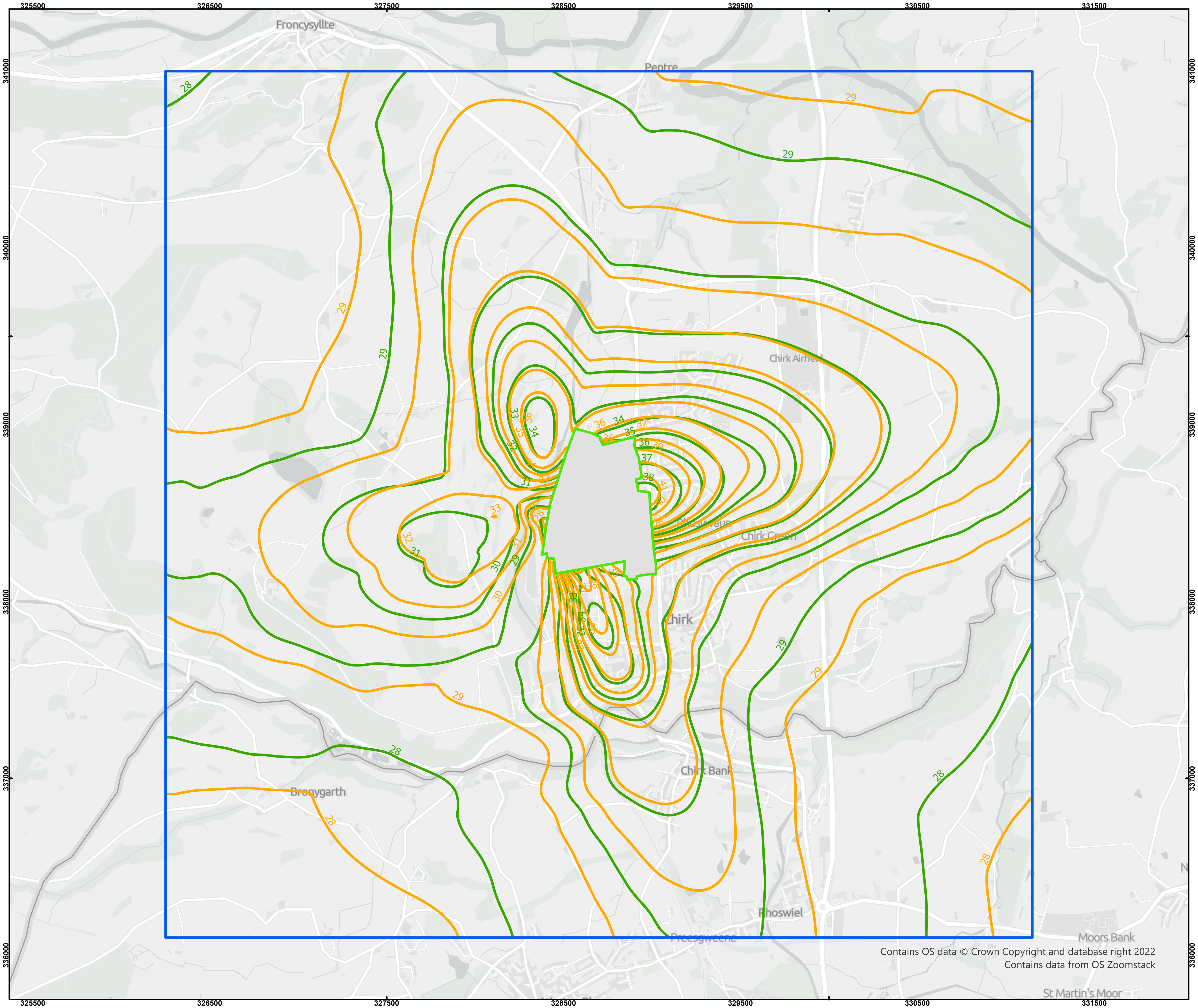


Legend

Main Grid

Proposed

Permitted

Proposed PEC

Value

<70%

>70%

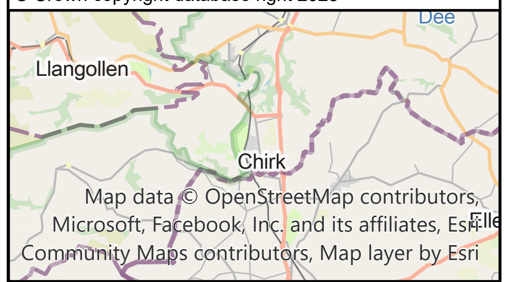
>100%

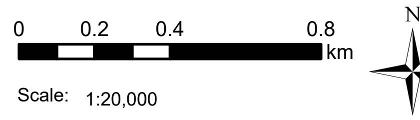
Assumes 70% conversion of NOx to NO2.
PEC as % of AQAL inclusive of a background concentration of 10.84 ug/m3

Title:

Figure 14 - Annual Mean Nitrogen Dioxide PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023





Scale: 1:20,000

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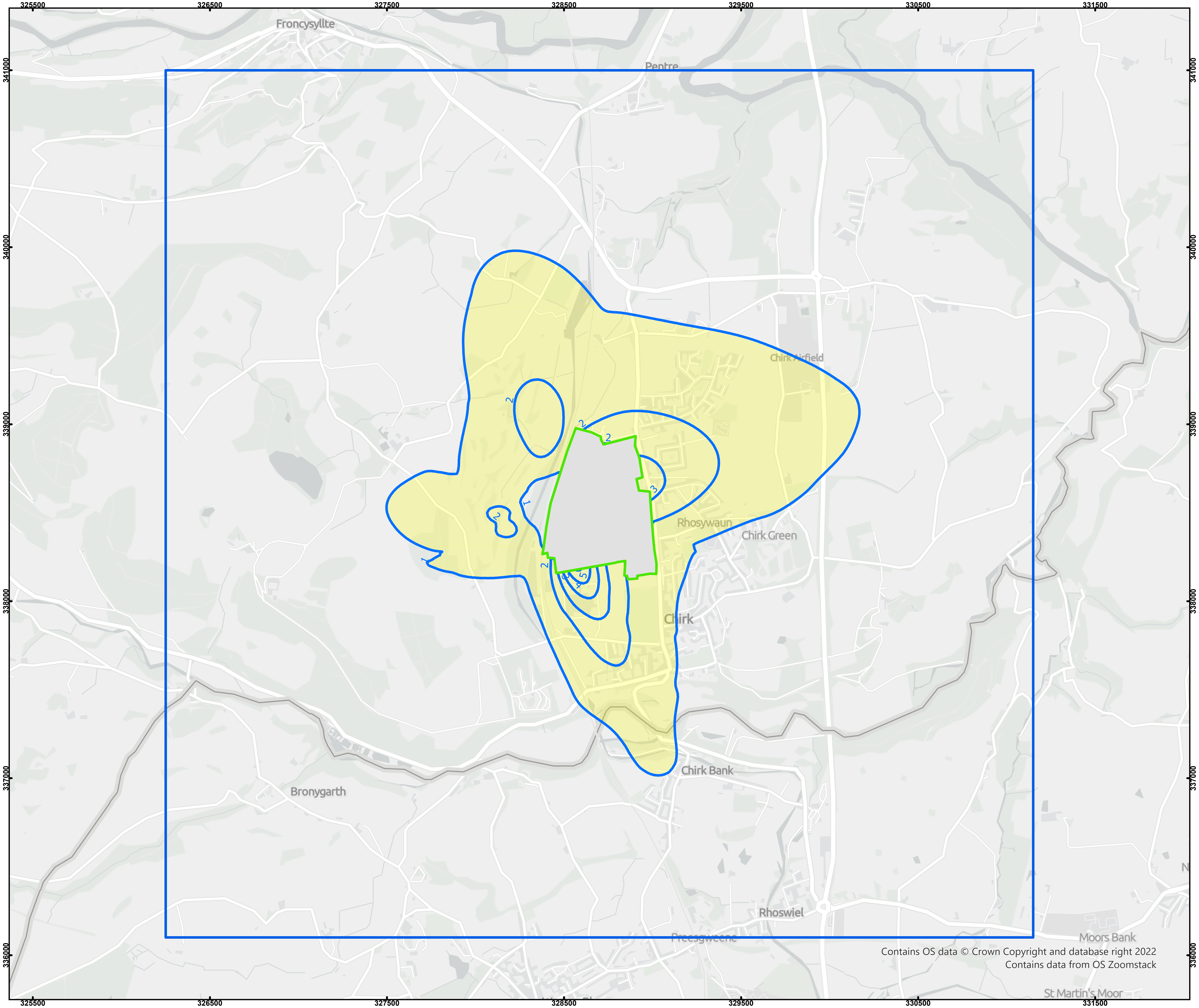

Legend

Main Grid

Change in impact

<1%

>1%

Assumes 70% conversion of NOx to NO2.
PC as % of AQAL.

Title:

Figure 15 - Annual Mean Nitrogen Dioxide Change in Impact - Normal Operations

Drawn by: RSF | Date: 21/02/2023

0 0.2 0.4 0.8 km

Scale: 1:20,000

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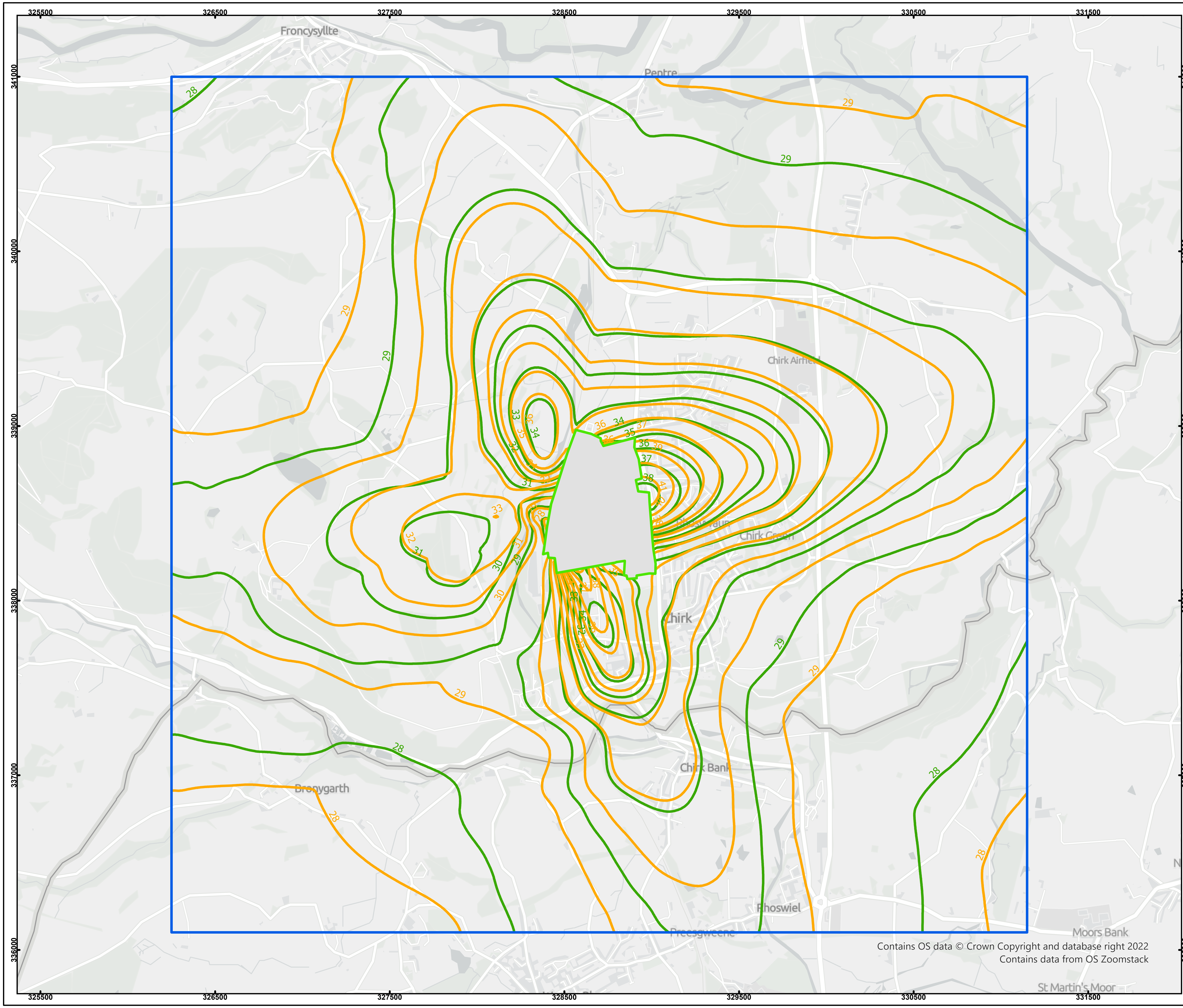


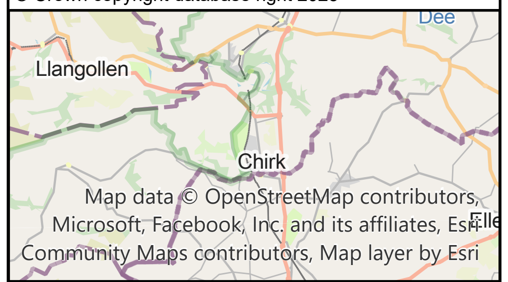
Legend

- Main Grid
- Proposed
- Permitted

Assumes 35% conversion of NOx to NO2.
Impact 99.79%ile of 1-hour concentrations
PEC as % of AQAL inclusive of a background concentration of 21.68 ug/m3

Figure 16 - 1-hour Mean Nitrogen Dioxide PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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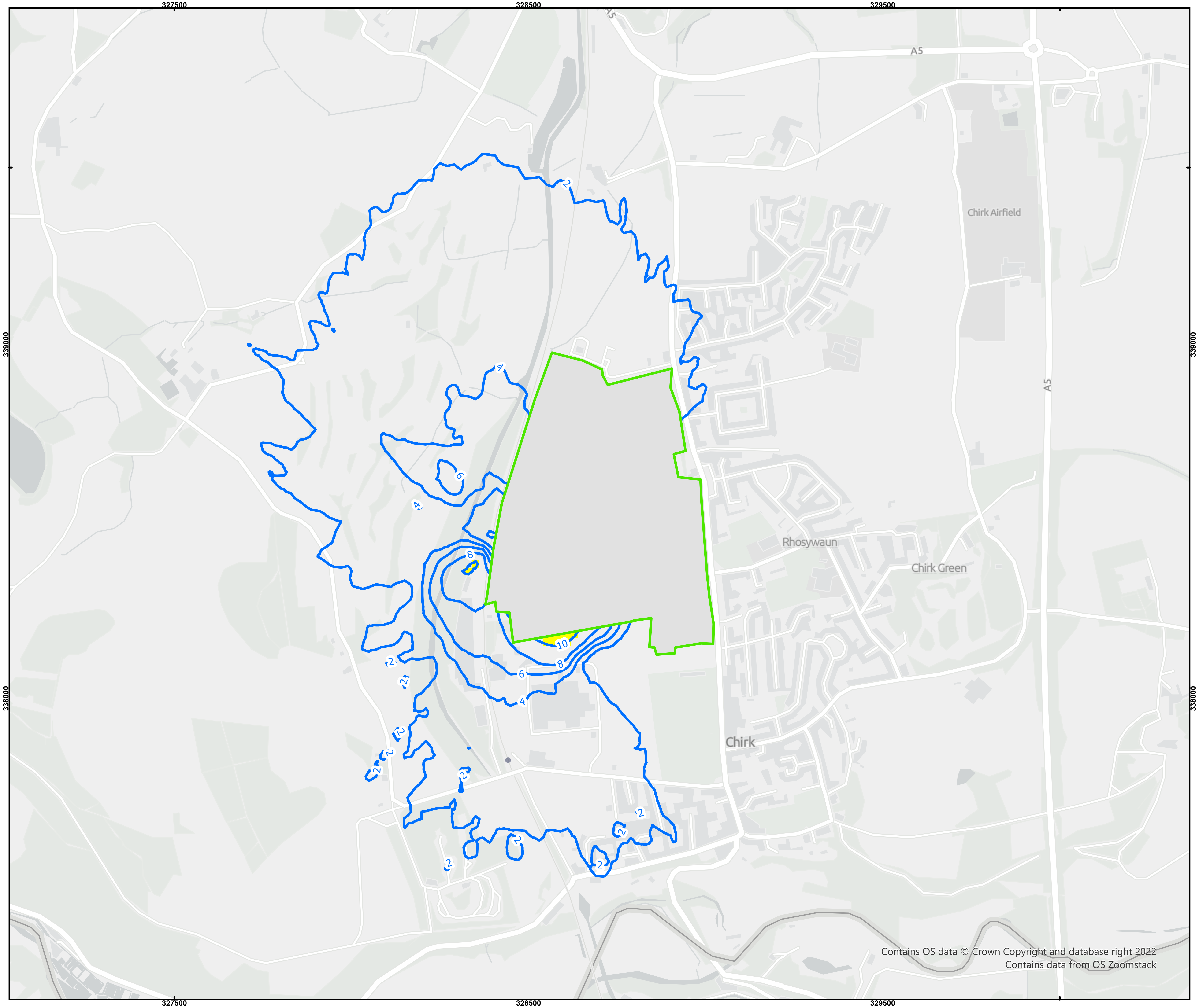


Legend

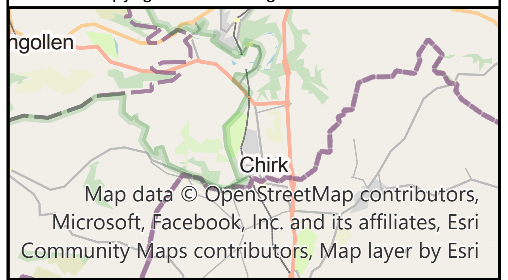
- Main Grid
- Change in impact
- <10%
- >10%

Assumes 35% conversion of NOx to NO2.
Impact 99.79%ile of 1-hour concentrations,
PC as % of AQAL.

Title:

Figure 17 - 1-hour Mean Nitrogen Dioxide Change in Impact - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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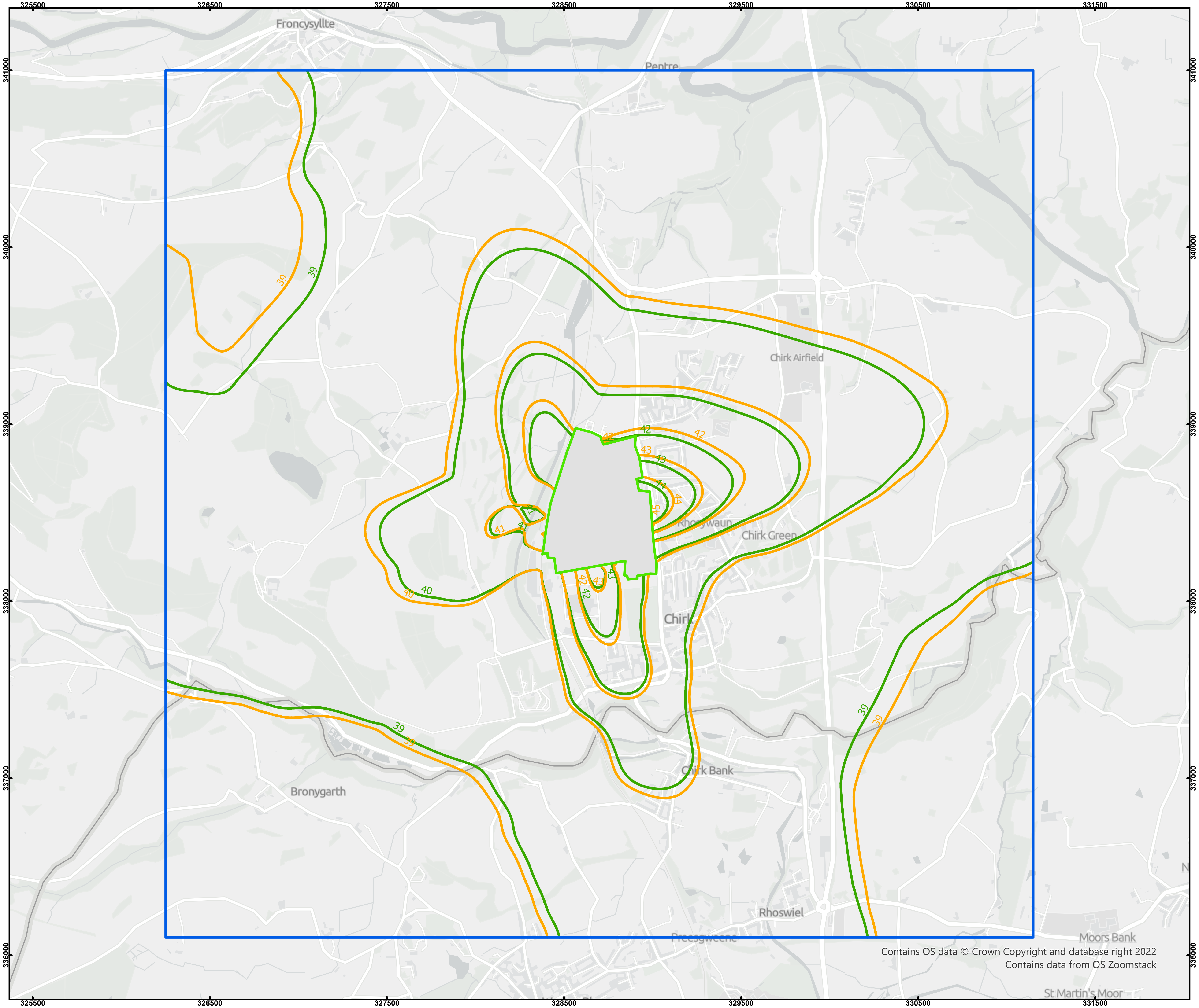


Legend

Main Grid

Proposed

Permitted

Proposed PEC

<70%

>70%

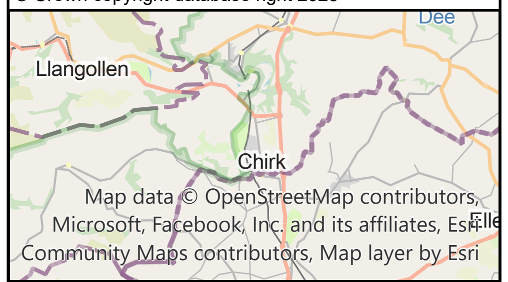
>100%

Assumes entire dust emissions consist of only PM10 fraction.
Excluding dust units
PEC as % of AQAL inclusive of a background concentration of 15.39 ug/m3

Title:

Figure 18 - Annual Mean PM10 (ex Dust Units) PEC - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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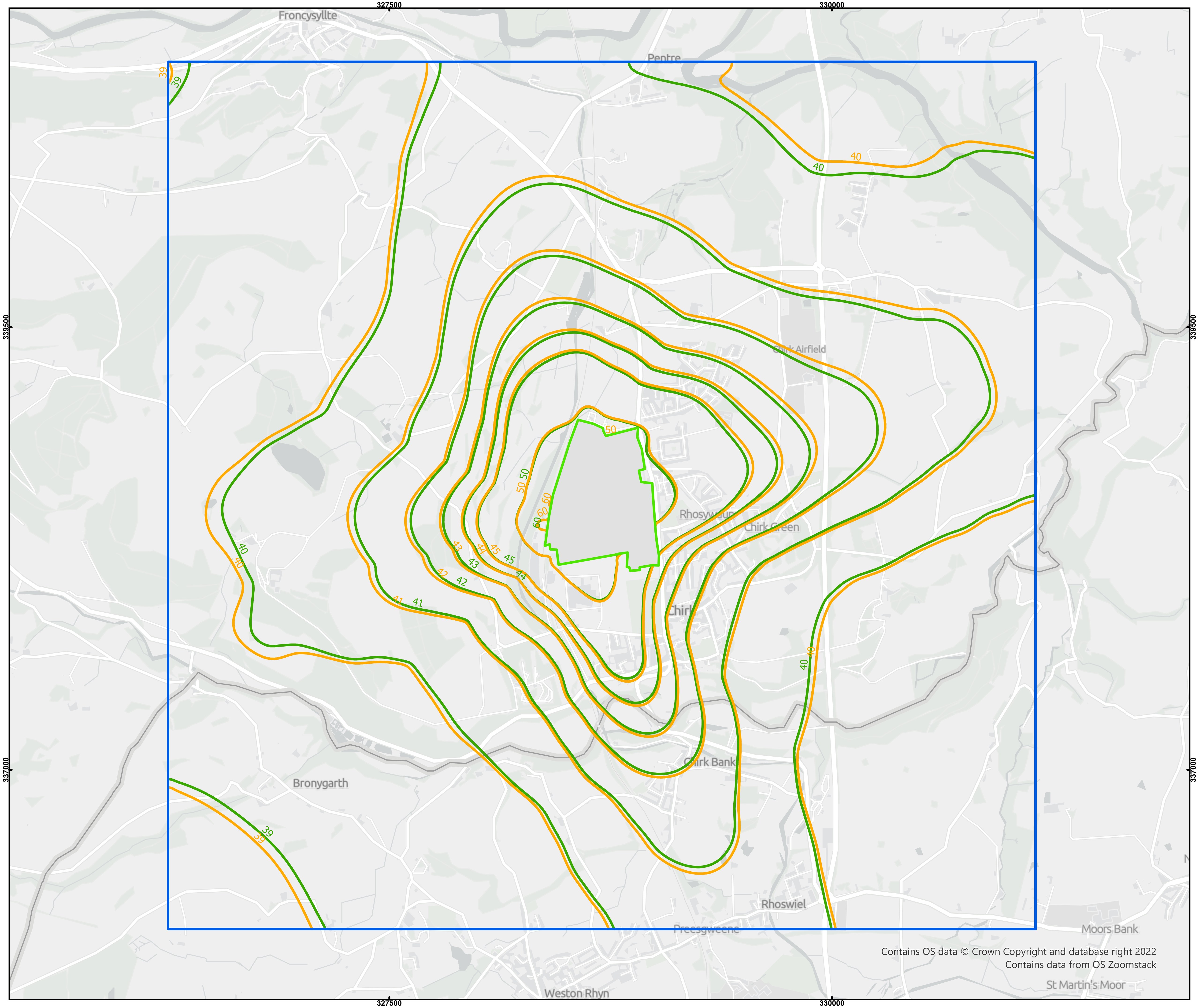


Legend

Main Grid

Proposed

Permitted

Proposed PEC

<70%

>70%

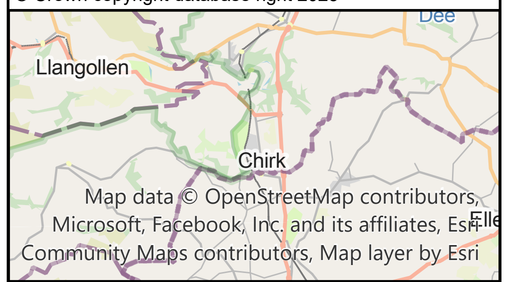
>100%

Assumes entire dust emissions consist of only PM10 fraction.
Including dust units
PEC as % of AQAL inclusive of a background concentration of 15.39 ug/m3

Title:

Figure 19 - Annual Mean PM10 (inc Dust Units) PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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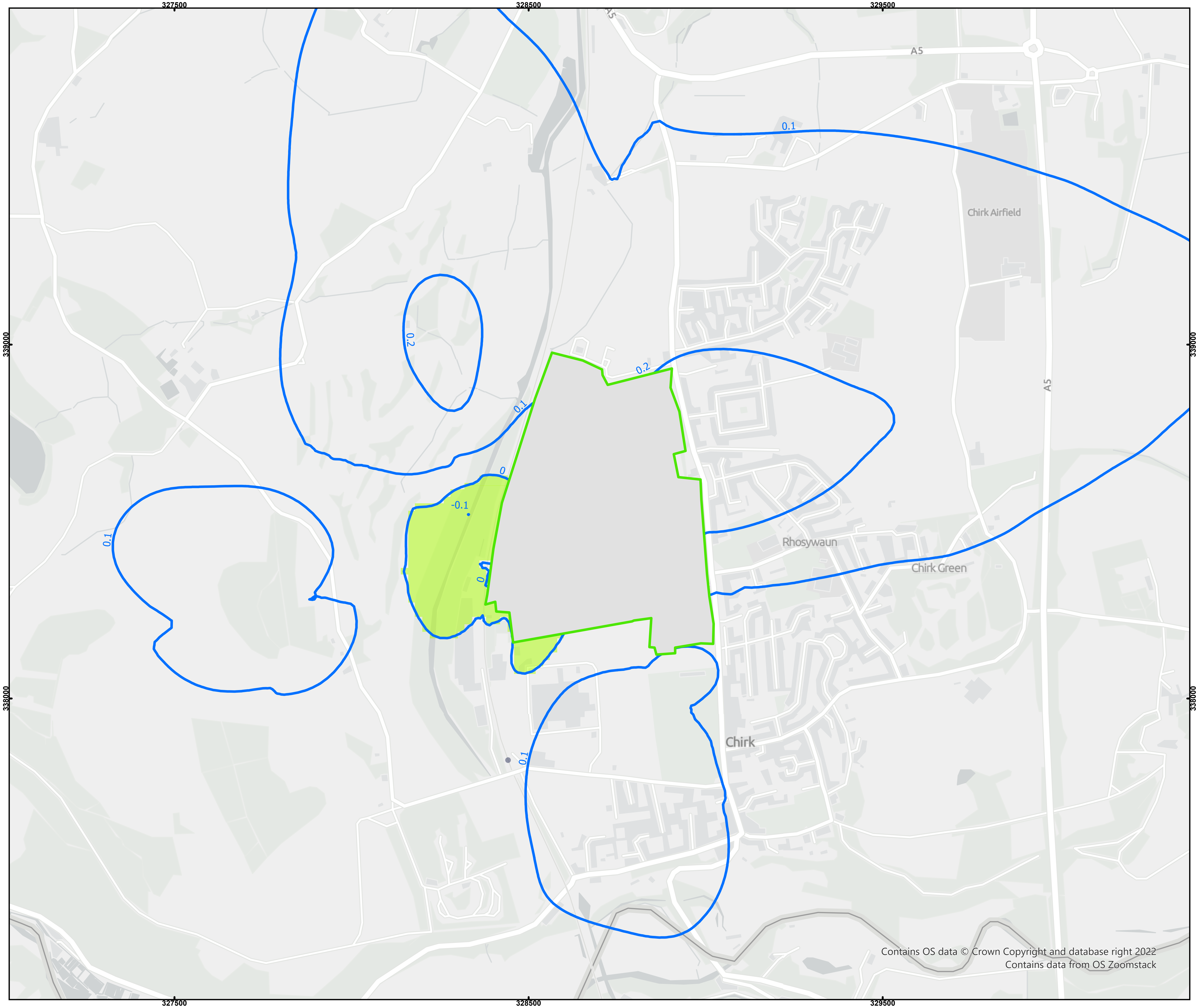


Legend

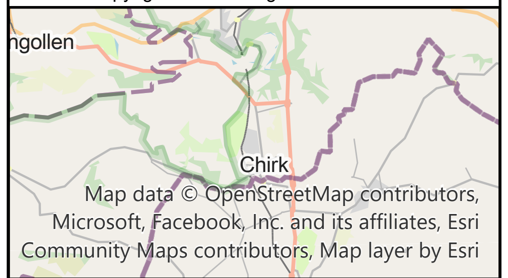
- Main Grid
- Change in impact
- Decrease
- Increase <1%
- Increase >1%

Assumes entire dust emissions consist of only PM10 fraction.
PC as % of AQAL

Title:

Figure 20 - Annual Mean PM10 Change in Impact - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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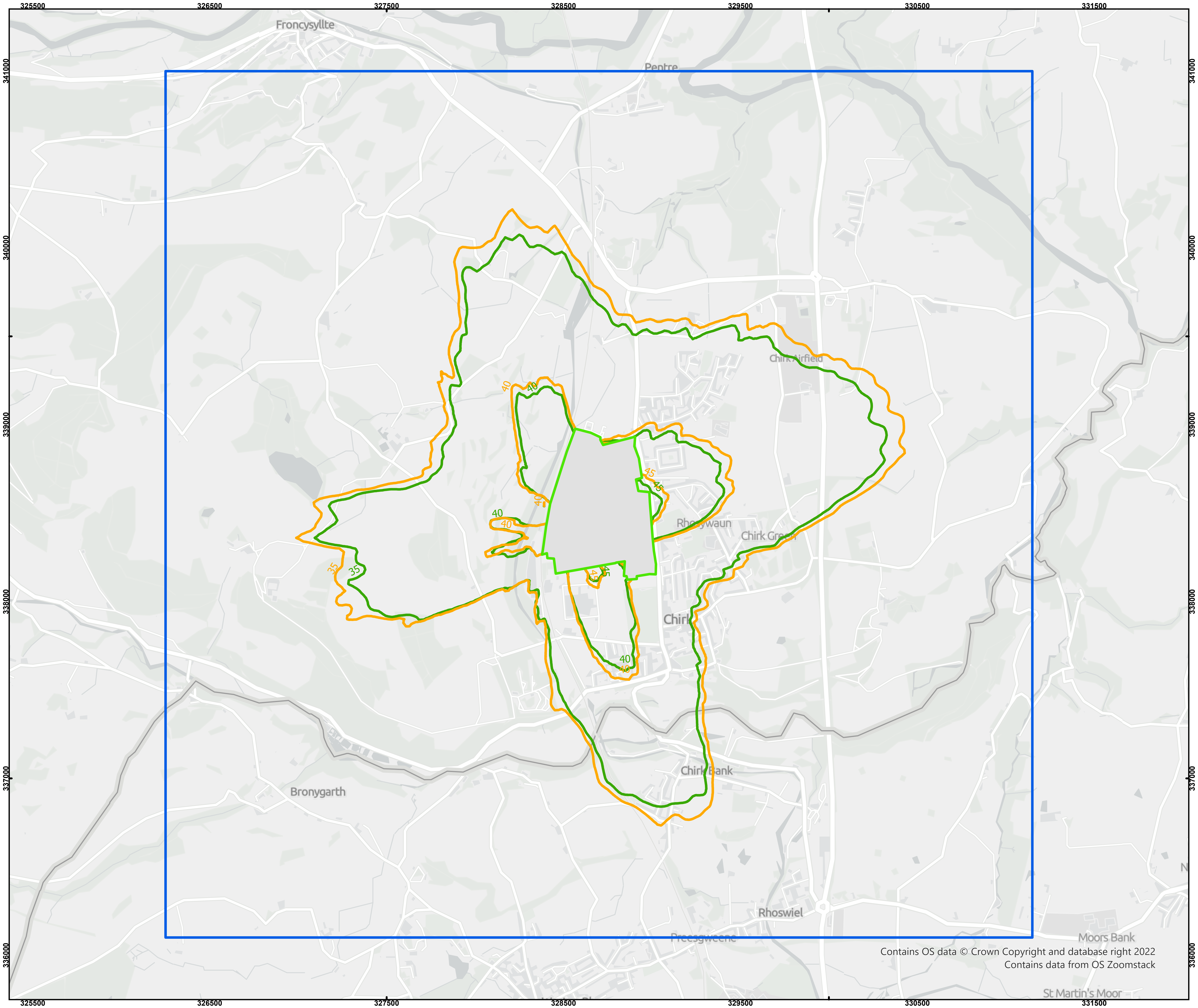


Legend

Main Grid

Proposed

Permitted

Proposed PEC

<70%

>70%

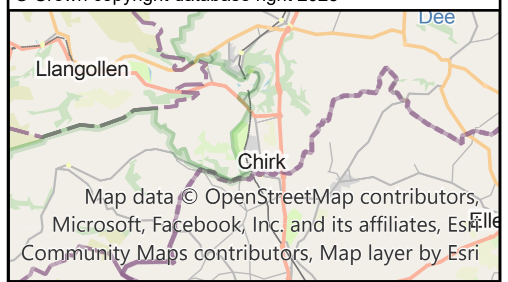
>100%

Assumes entire dust emissions consist of only PM10 fraction.
Excluding dust units.
90.41%ile of daily means.
PEC as % of AQAL inclusive of a background concentration of 15.39 ug/m3.

Title:

Figure 21 - Daily Mean PM10 (ex Dust Units) PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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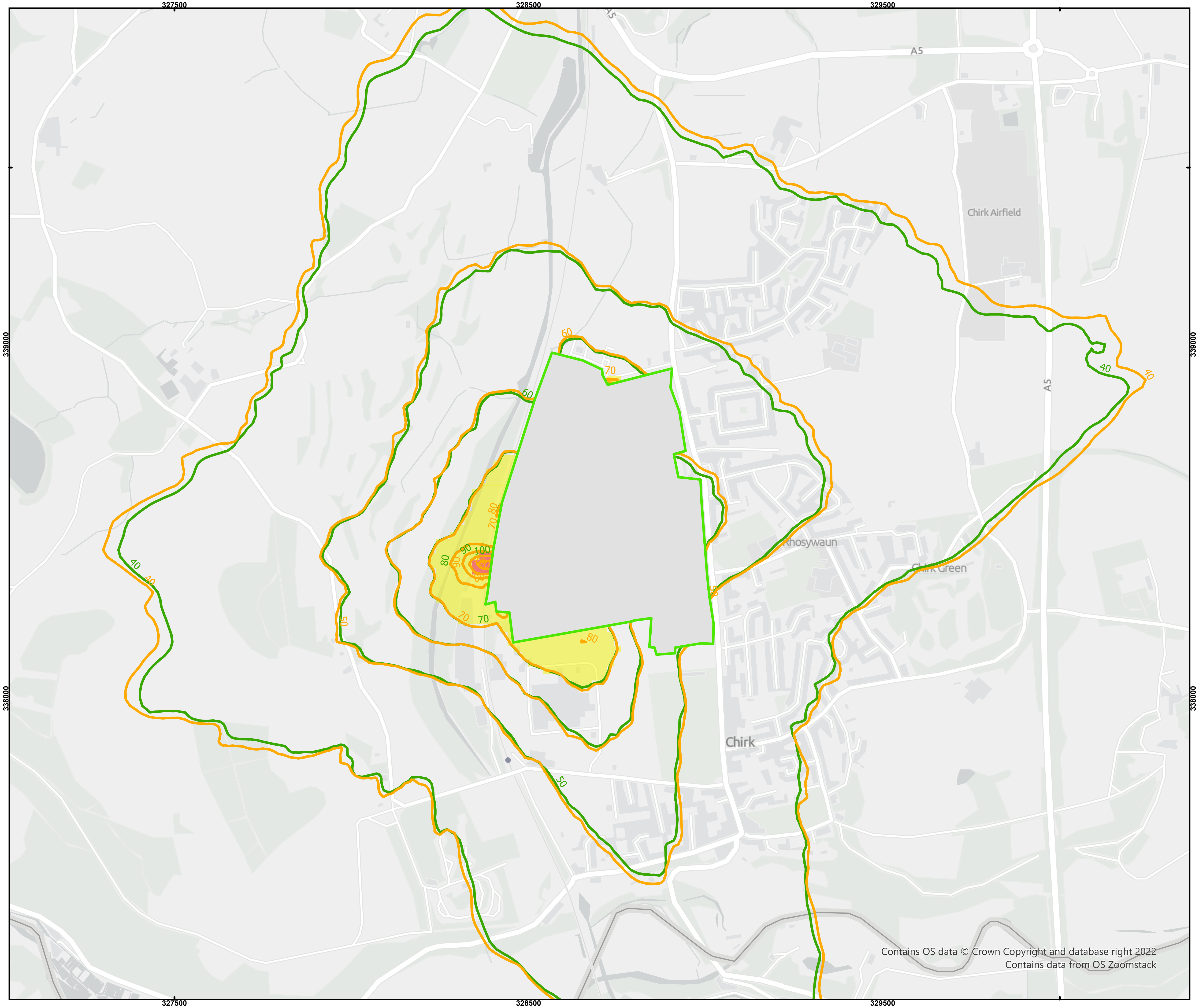


Legend

- Main Grid
- Proposed
- Permitted

Proposed PEC

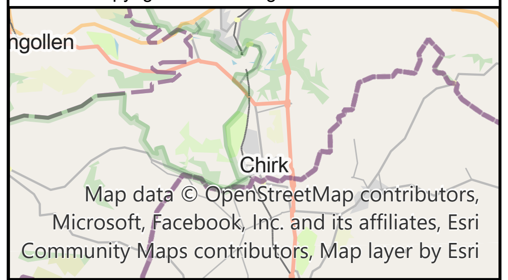
- <70%
- >70%
- >100%

Assumes entire dust emissions consist of only PM10 fraction.
Including dust units.
90.41%ile of daily means.
PEC as % of AQAL inclusive of a background concentration of 15.39 ug/m3.

Title:

Figure 22 - Daily Mean PM10 (inc Dust Units) PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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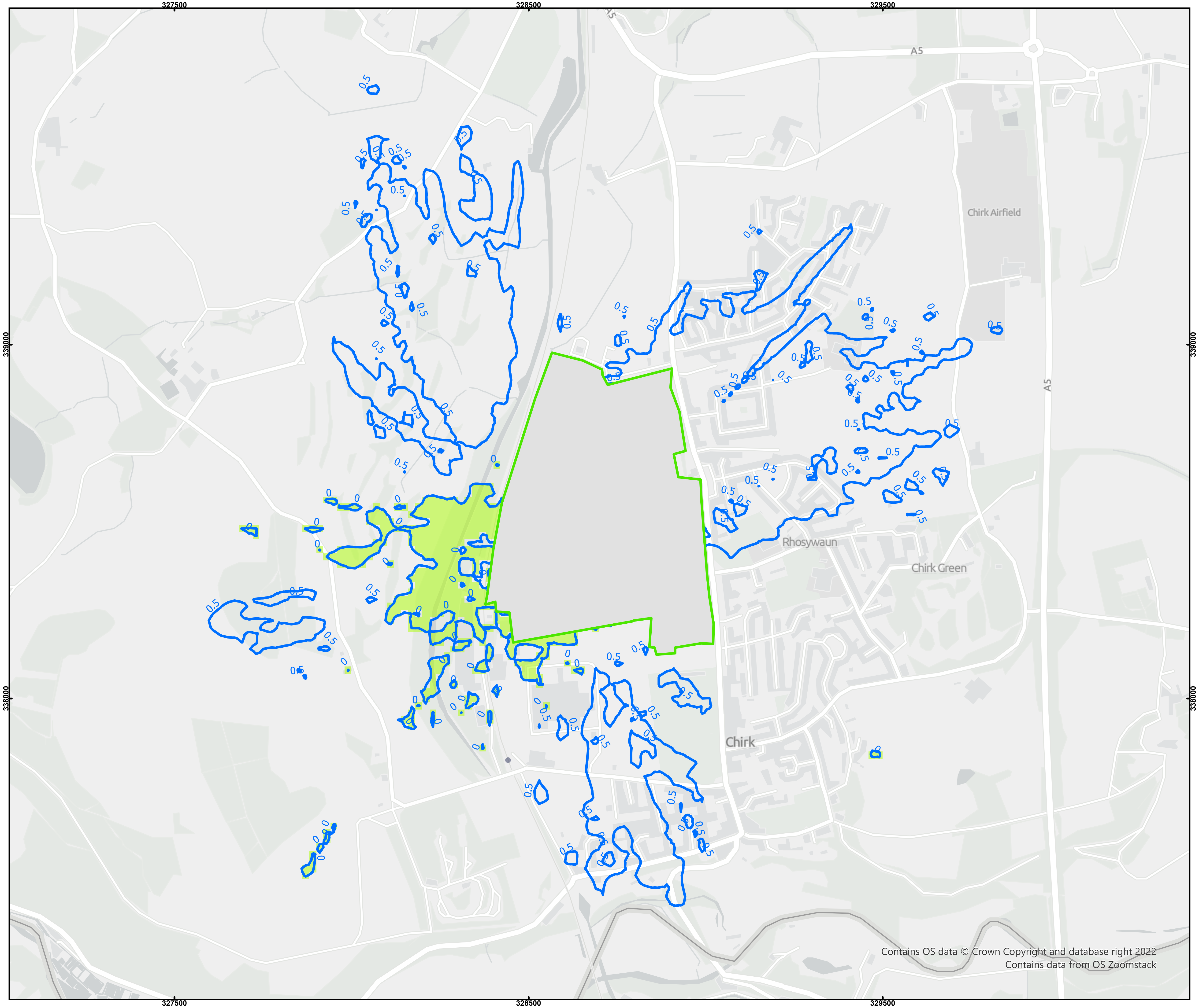


Legend

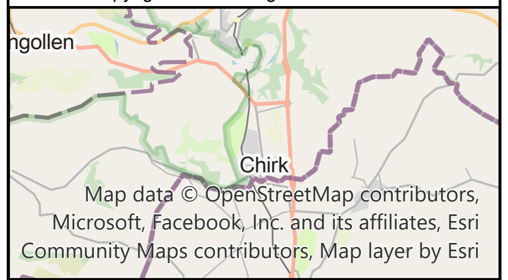
- Main Grid
- Change in impact
- Decrease
- Increase <1%
- Increase >1%

Assumes entire dust emissions consist of only PM10 fraction.
90.41%ile of daily means.
PC as % of AQAL.

Title:

Figure 23 - Daily Mean PM10 Change in Impact - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

Scale: 1:10,000

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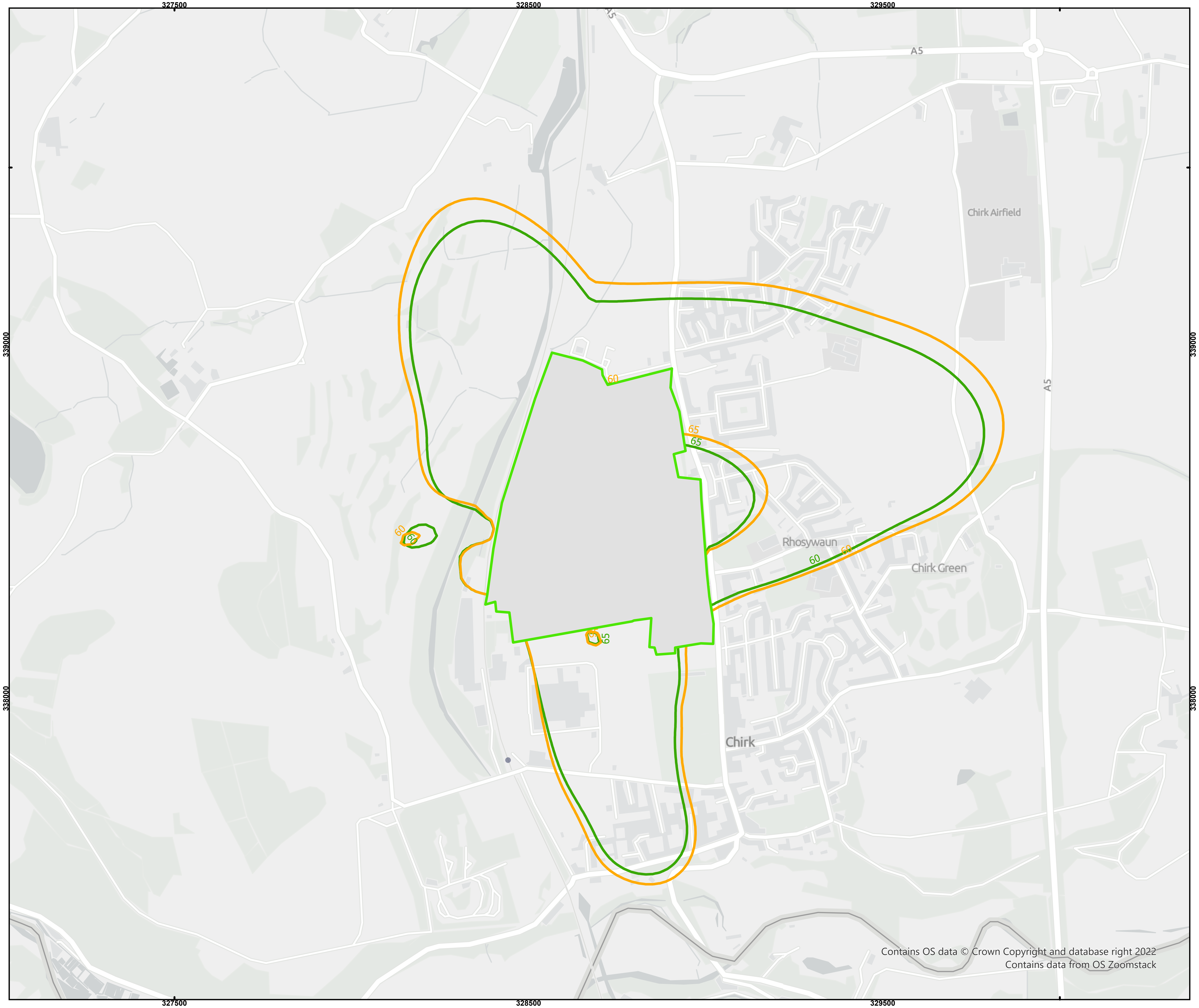


Legend

Main Grid

Proposed

Permitted

Proposed PEC

<70%

>70%

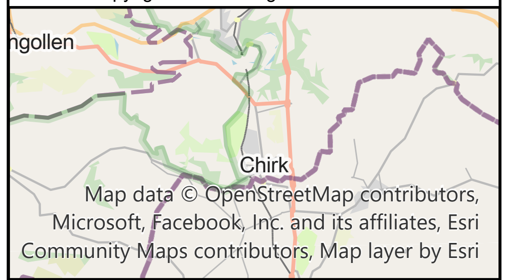
>100%

Assumes entire dust emissions consist of only PM25 fraction. Excluding dust units
PEC as % of AQAL inclusive of a background concentration of 10.94 ug/m3

Title:

Figure 24 - Annual Mean PM25 (ex Dust Units) PEC - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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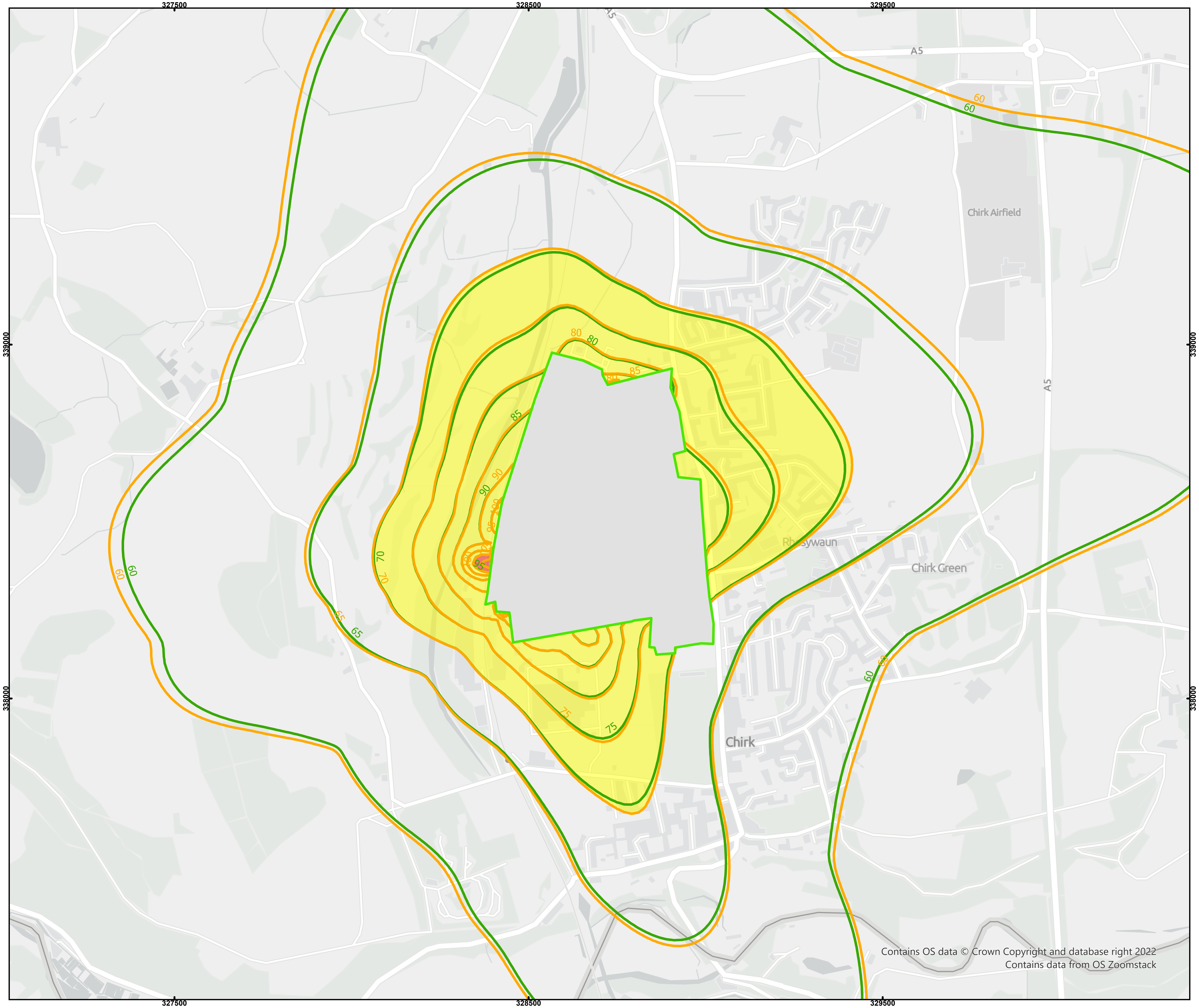

Legend

- Main Grid
- Proposed
- Permitted

Proposed PEC

- <70%
- >70%
- >100%

Assumes entire dust emissions consist of only PM2.5 fraction. Including dust units
PEC as % of AQAL inclusive of a background concentration of 10.94 ug/m3

Title:

Figure 25 - Annual Mean PM25 (inc Dust Units) PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023

0 0.1 0.2 0.4 km

Scale: 1:10,000

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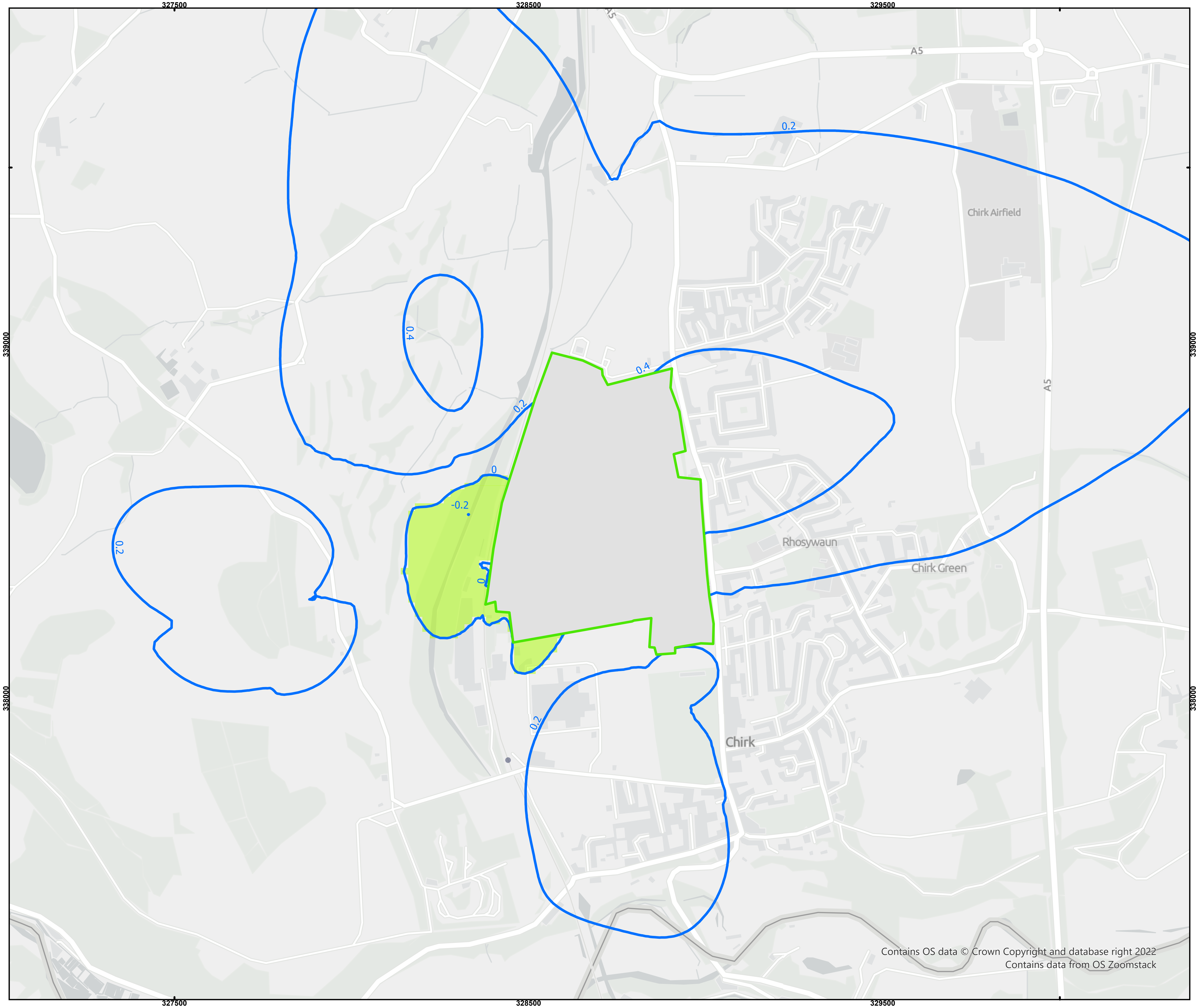


Legend

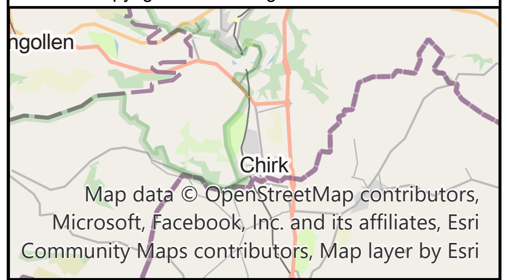
- Main Grid
- Change in impact
- Decrease
- Increase <1%
- Increase >1%

Assumes entire dust emissions consist of only PM2.5 fraction.
PC as % of AQAL

Title:

Figure 26 - Annual Mean PM25 Change in Impact - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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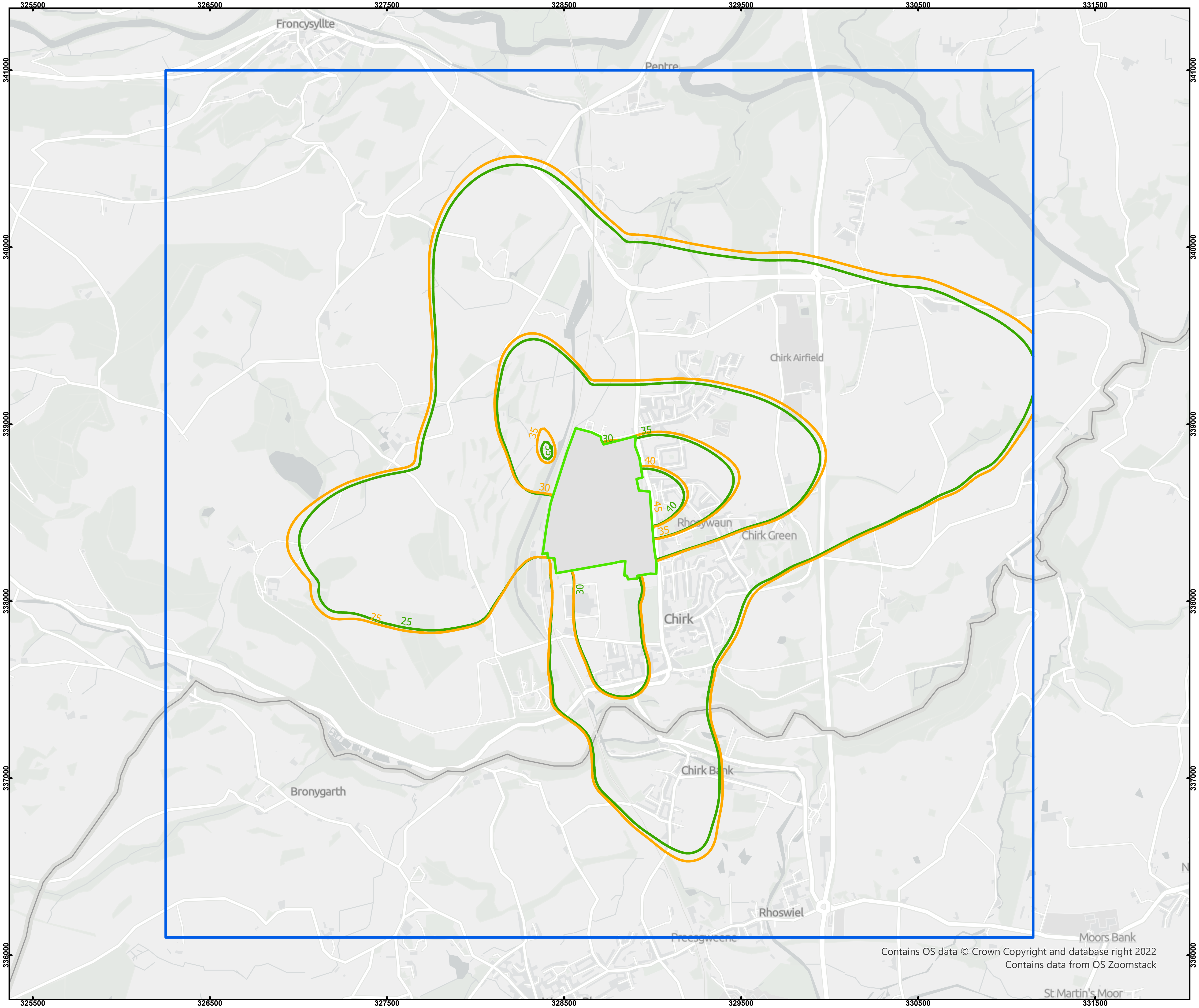


Legend

Main Grid

Proposed

Permitted

Proposed PEC

<70%

>70%

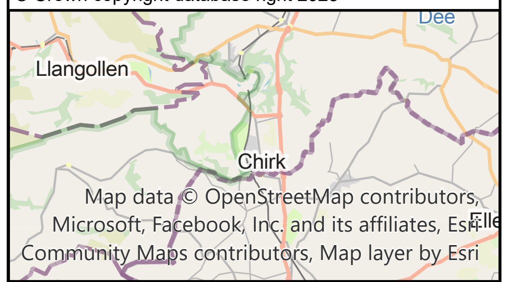
>100%

PEC as % of AQAL inclusive of a background concentration of 1 ug/m3

Title:

Figure 27 - Annual Mean CH2O PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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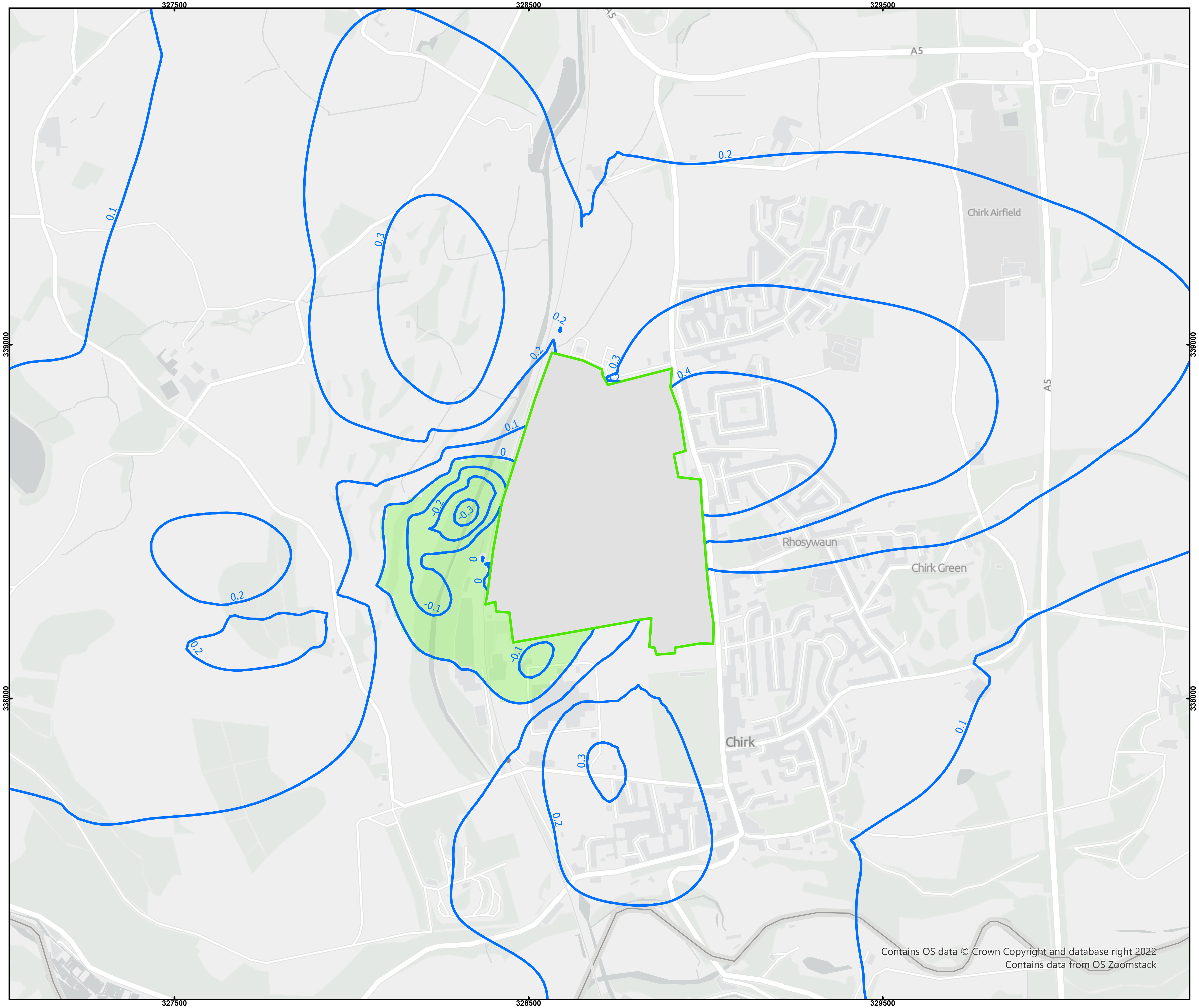


Legend

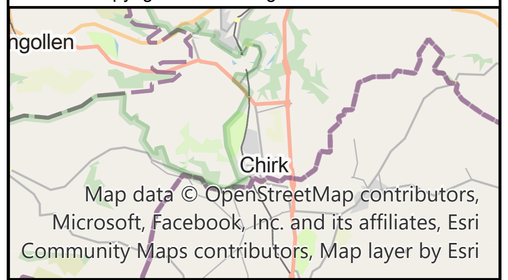
- Main Grid
- Change in impact
- Decrease
- Increase <1%
- Increase >1%

PC as % of AQAL.

Title:

Figure 28 - Annual Mean CH2O Change in Impact - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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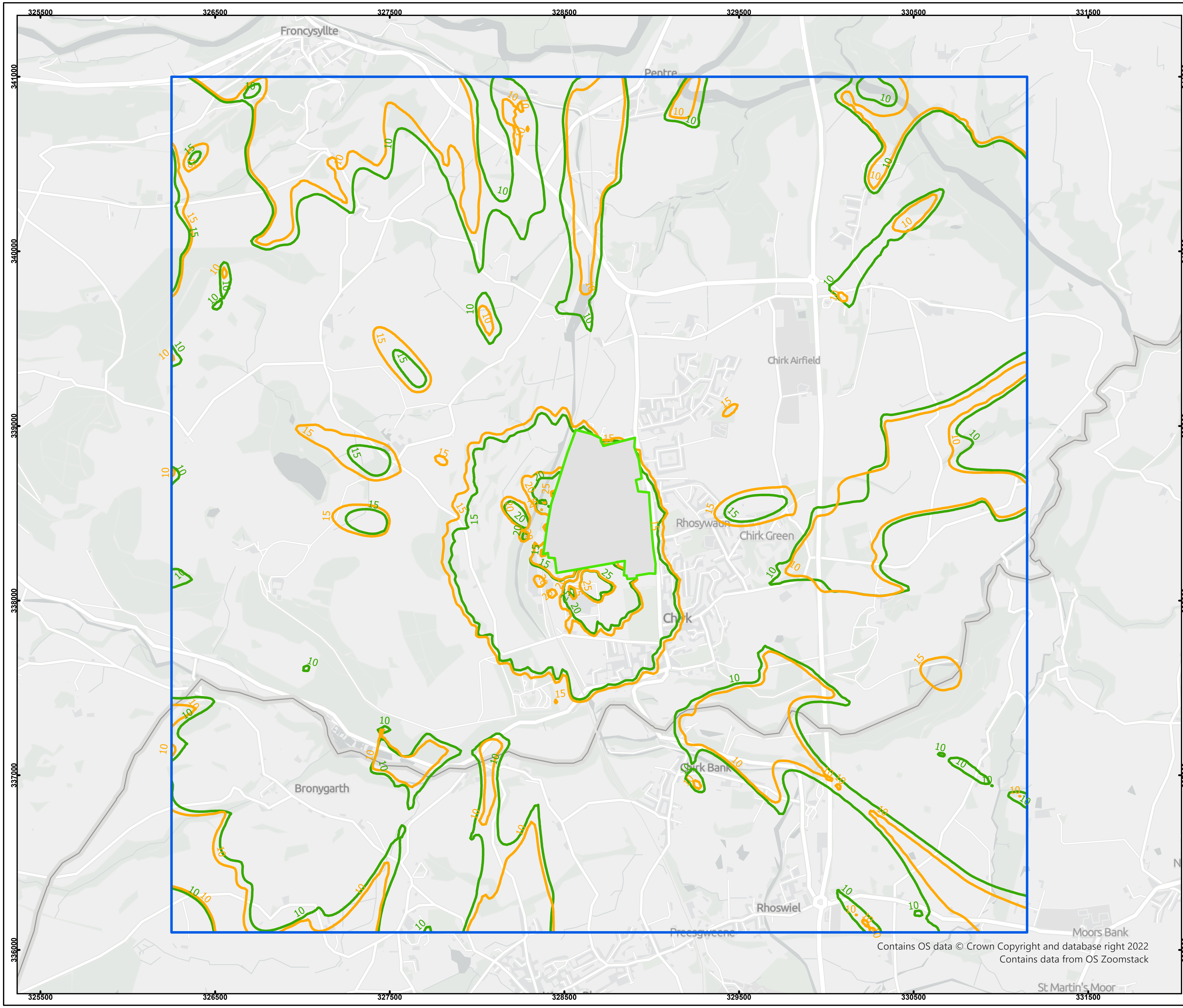


Legend

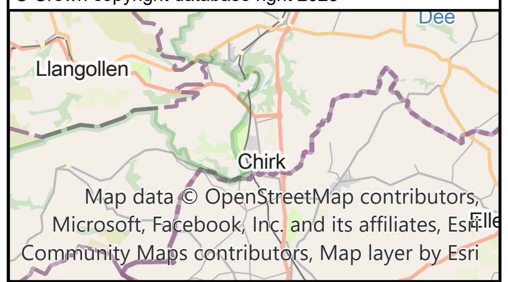
- Main Grid
- Proposed
- Permitted

Impact maximum of 30-minute concentrations
PEC as % of AQAL inclusive of a background concentration of 2 ug/m3

Title:

Figure 29 - 30-min Mean CH2O PEC - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

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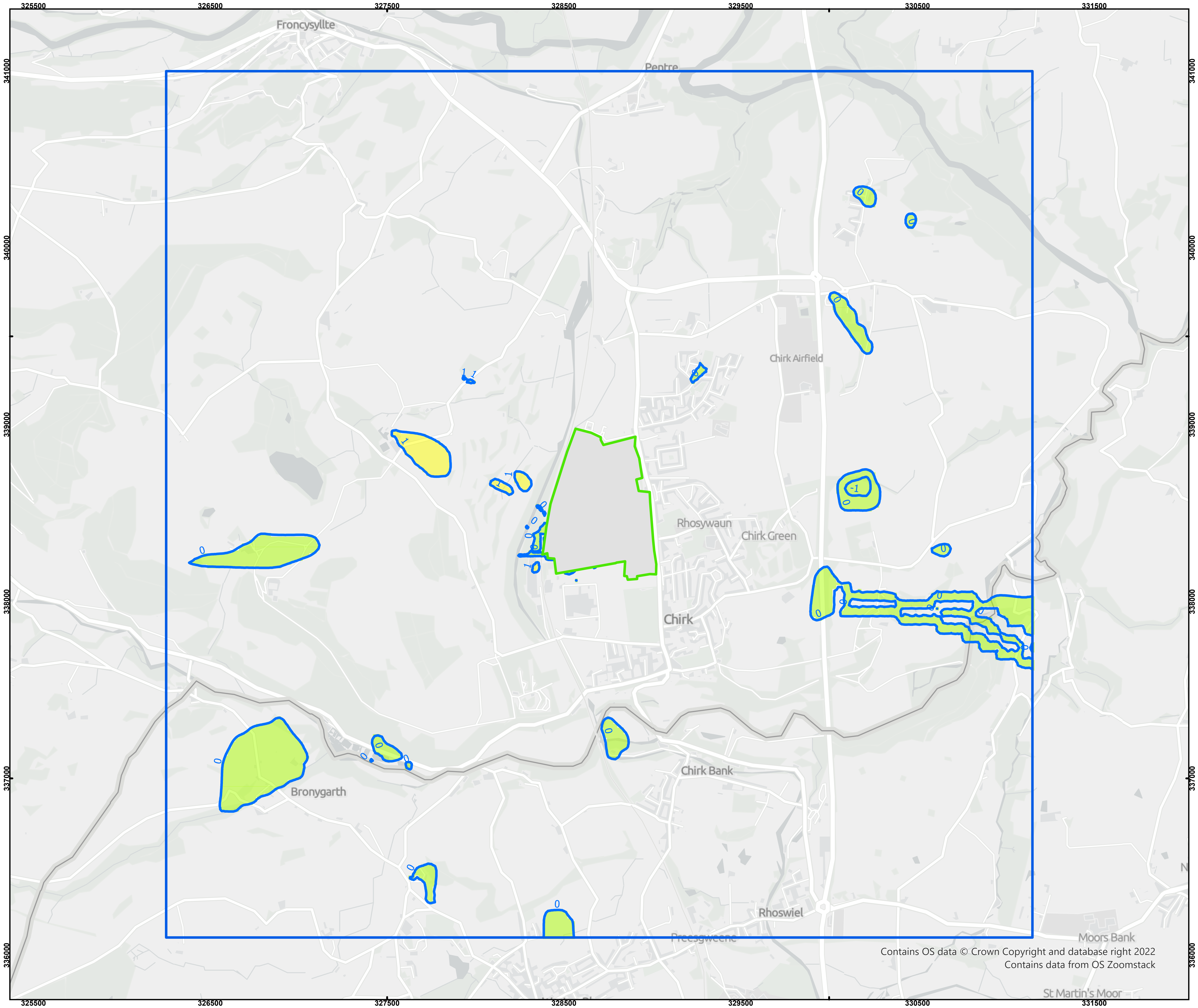


Legend

Main Grid

Change in impact

Value

Decrease

Increase <1%

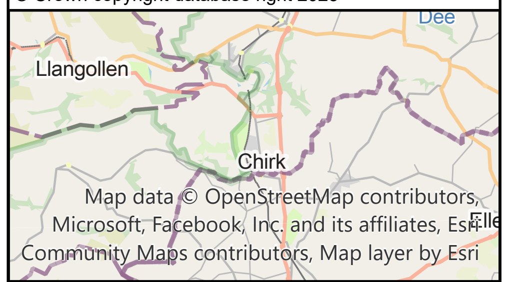
Increase >1%

Impact maximum 30-minute concentrations,
PC as % of AQAL.

Title:

Figure 30 - 30-min Mean CH2O Change in Impact - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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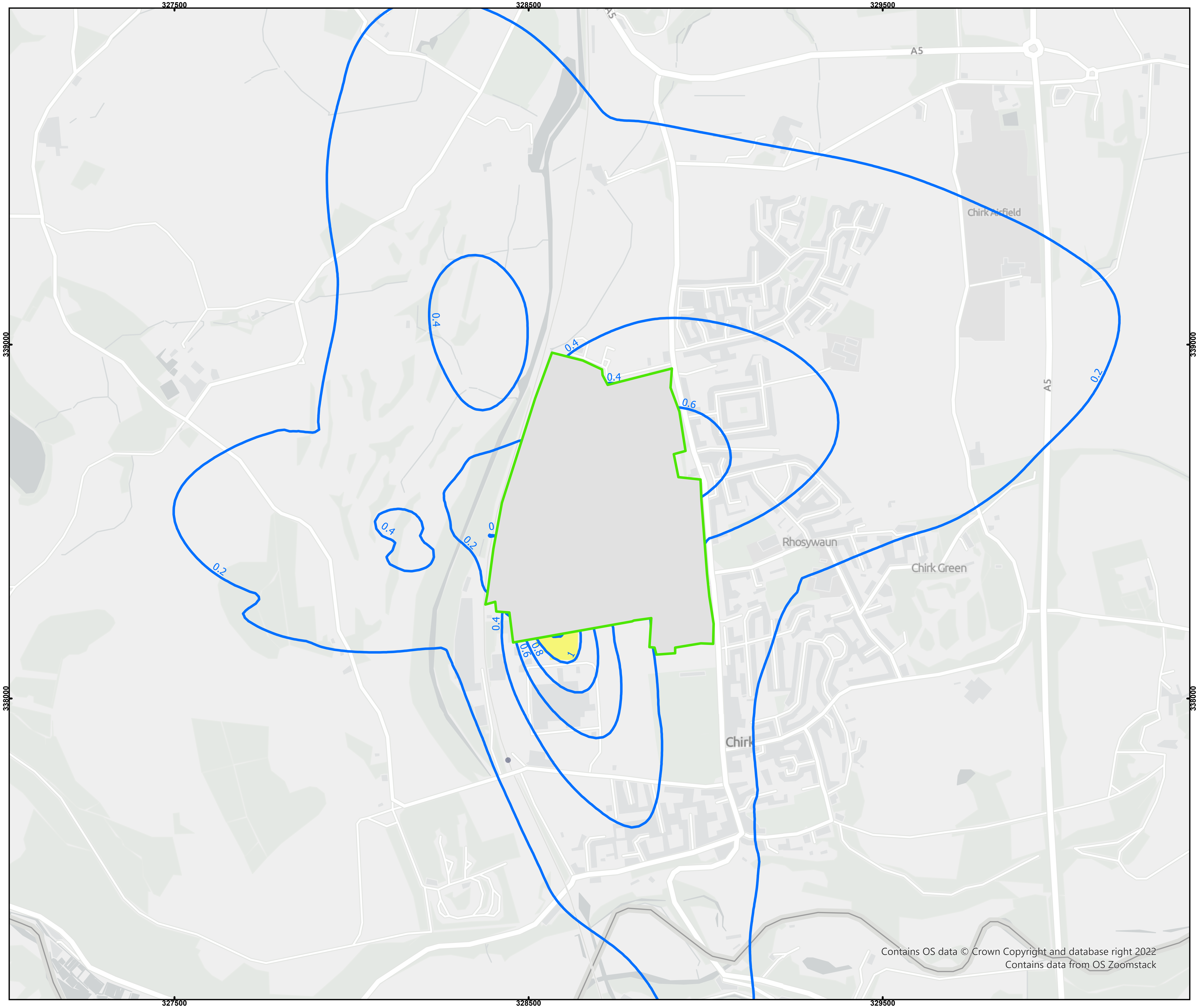
Fax: 0161 474 0618



Legend

Main Grid

Change in impact

Value

<1%

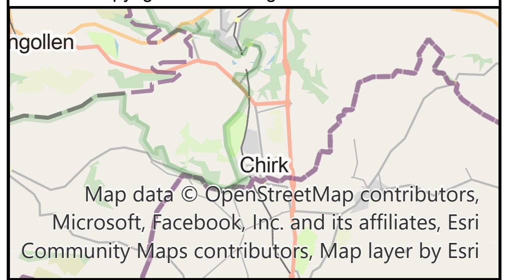
>1%

Assumes 70% conversion of NOx to NO2.
PC as % of AQAL.

Title:

Figure 31 - Annual Mean Nitrogen Dioxide Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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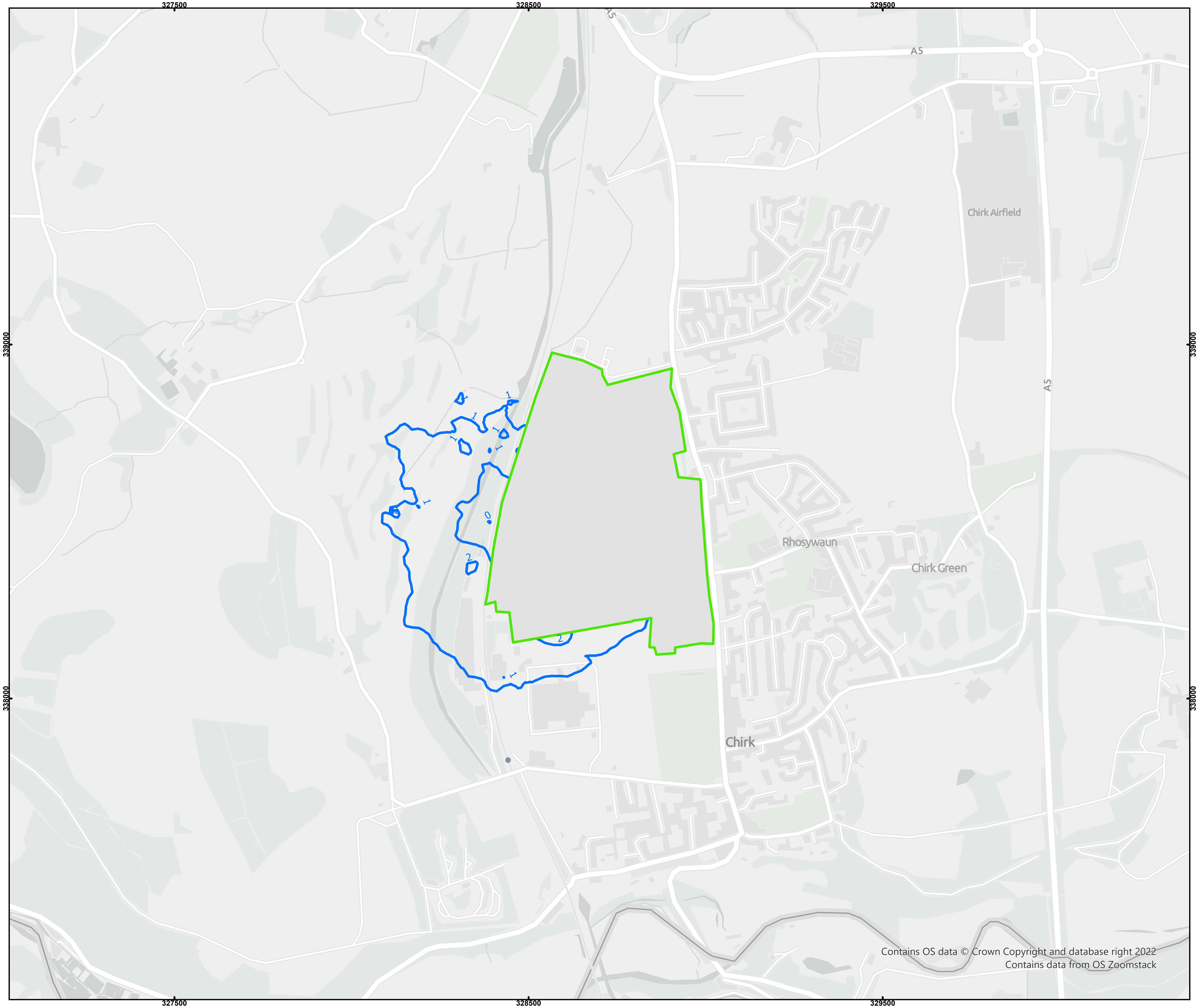


Legend

Main Grid

Change in impact

Value

<10%

>10%

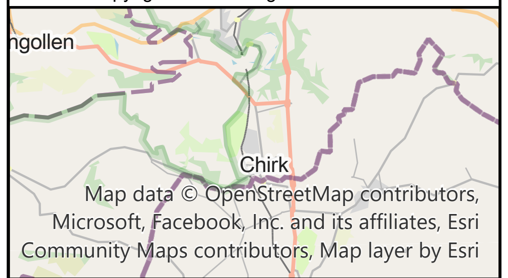
Assumes 35% conversion of NOx to NO2.
Impact 99.79%ile of 1-hour concentrations,
PC as % of AQAL.

Client:	Kronospan
Site:	Chirk
Project:	2376_Kronospan_3

Title:

Figure 32 - 1-hour Mean Nitrogen Dioxide Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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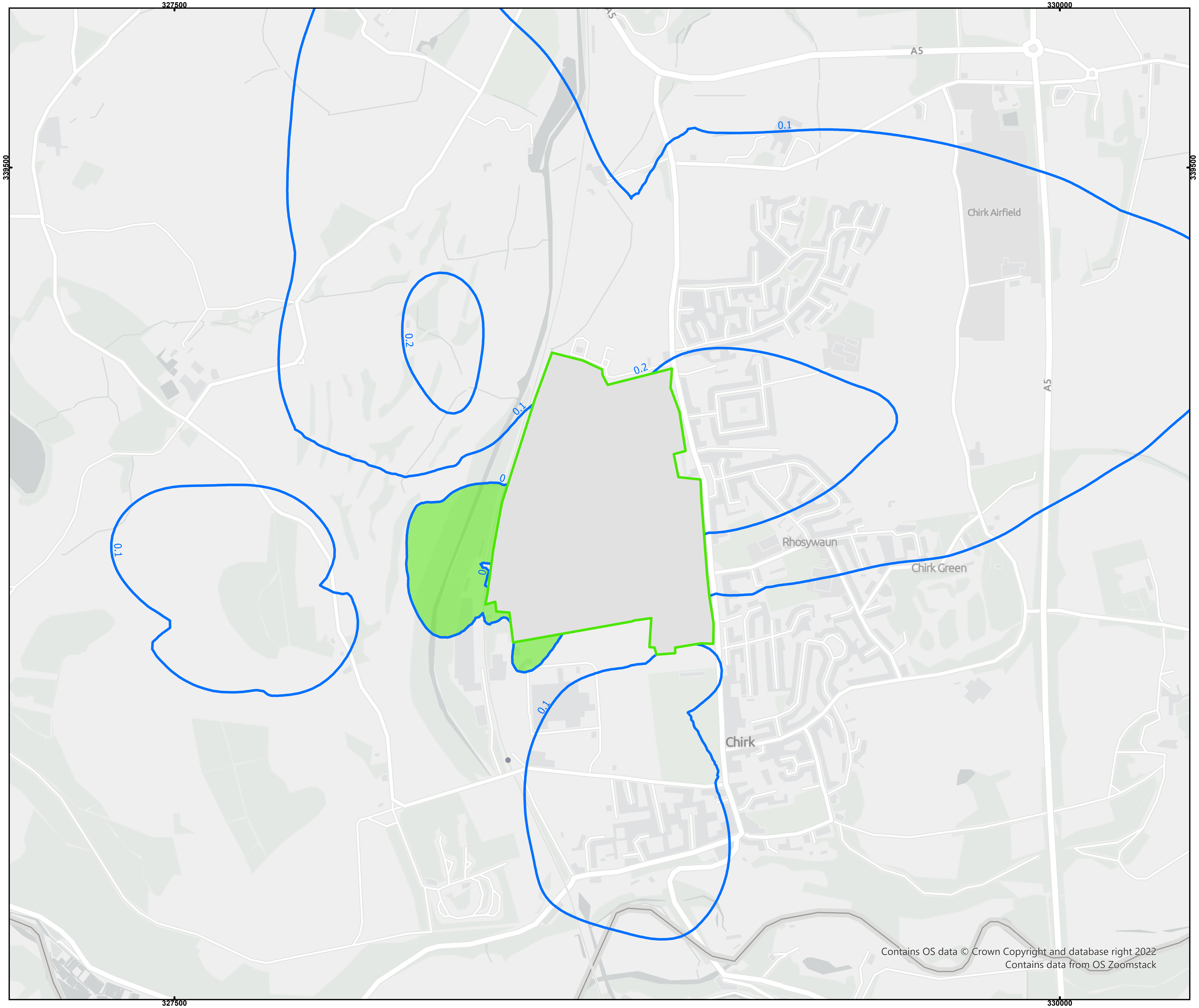


Legend

Main Grid

Change in impact

Value

Decrease

Increase <1%

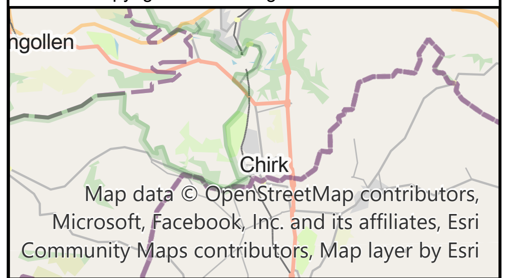
Increase >1%

Assumes entire dust emissions consist of only PM10 fraction.
PC as % of AQAL

Title:

Figure 33 - Annual Mean PM10 Change in Impact - MDF 2 Offline

Drawn by: RSF | Date: 21/02/2023



0 0.1 0.2 0.4 km

Scale: 1:10,000

N

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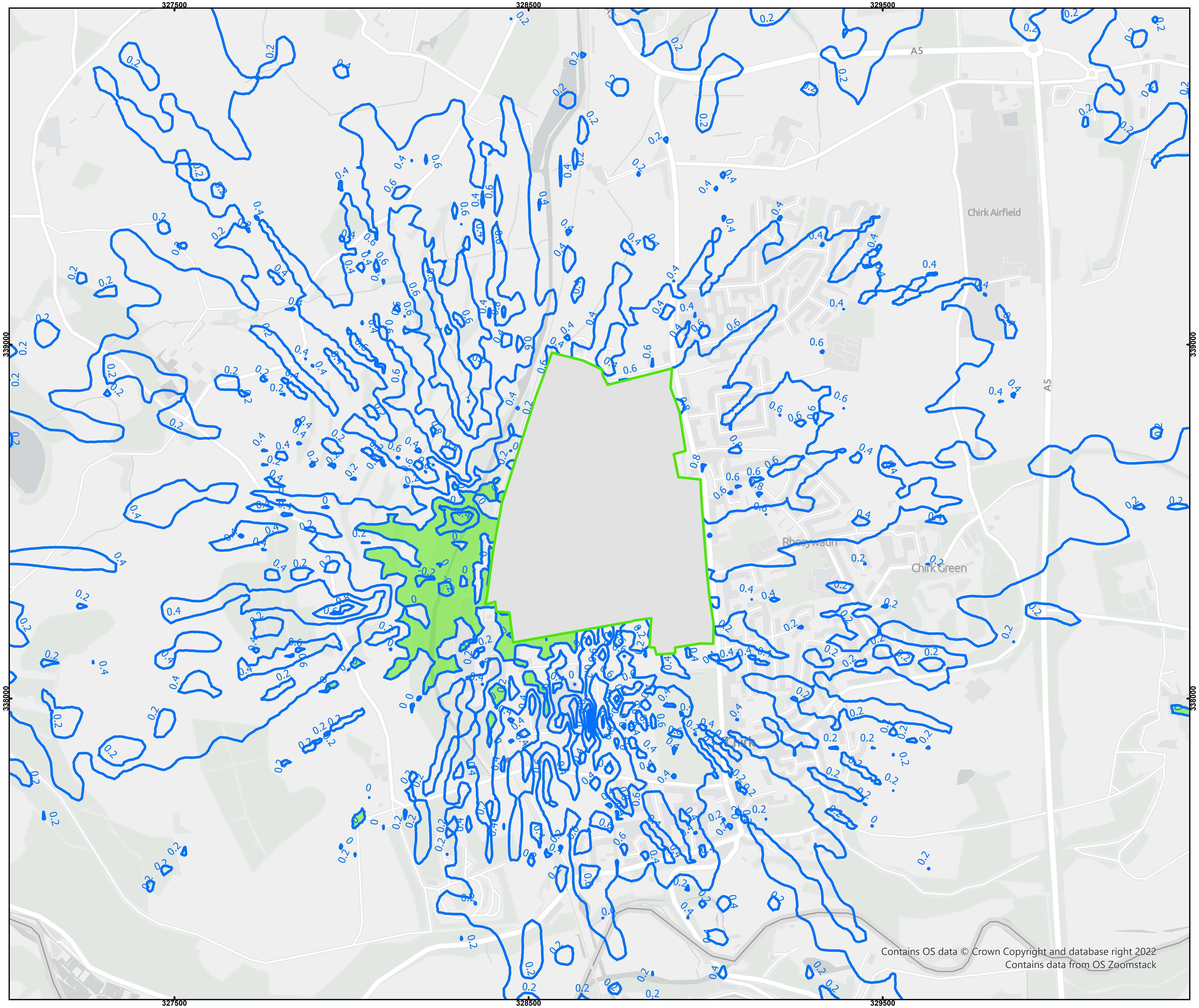


Legend

- Main Grid
- Change in impact

Value

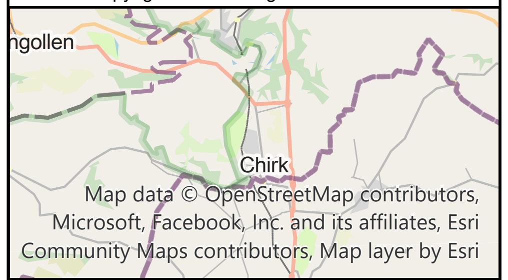
- Decrease
- Increase <1%
- Increase >1%

Assumes entire dust emissions consist of only PM10 fraction.
90.41%ile of daily means.
PC as % of AQAL.

Title:

Figure 34 - Daily Mean PM10 Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

Scale: 1:10,000

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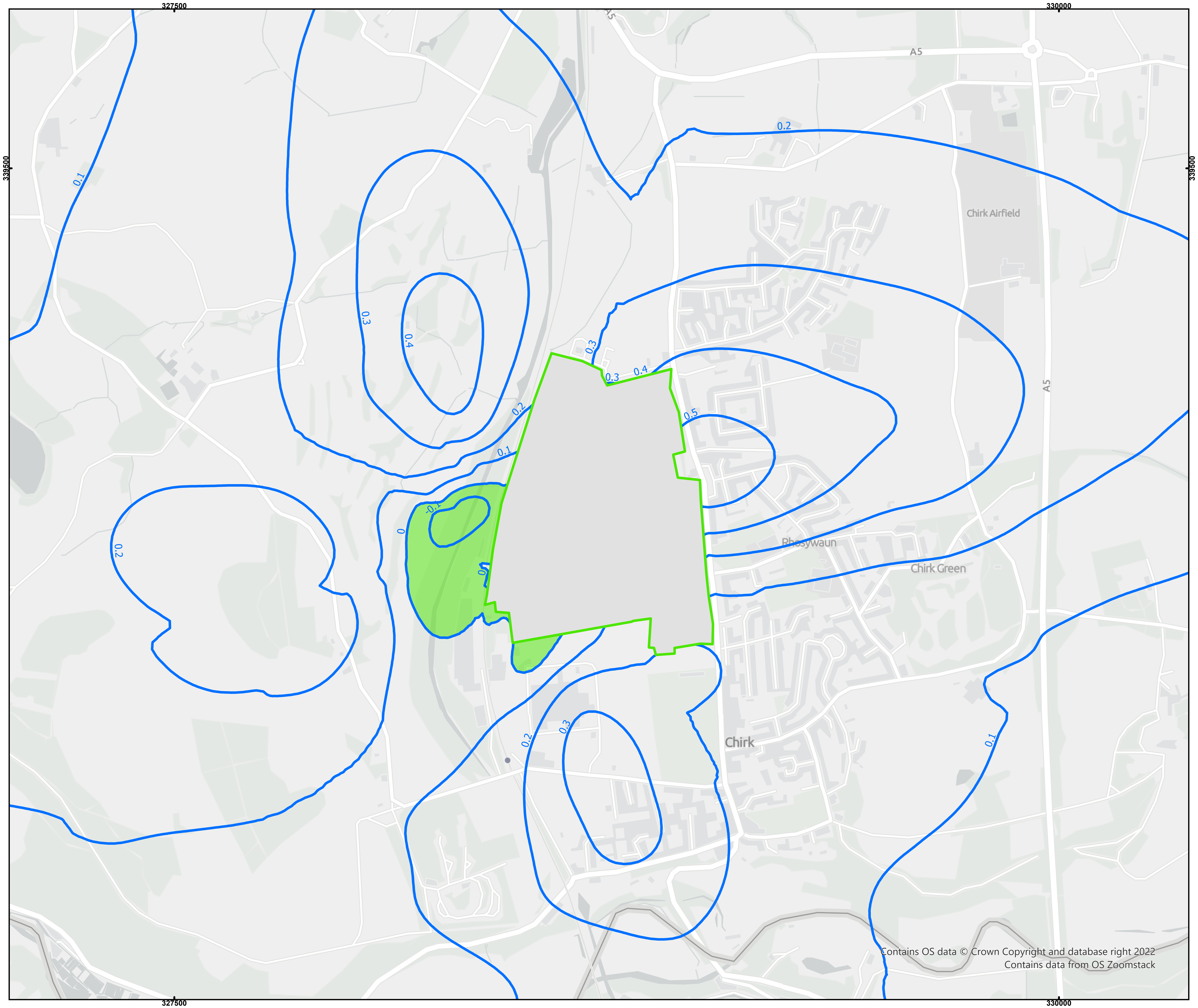


Legend

Main Grid

Change in impact

Value

Decrease

Increase <1%

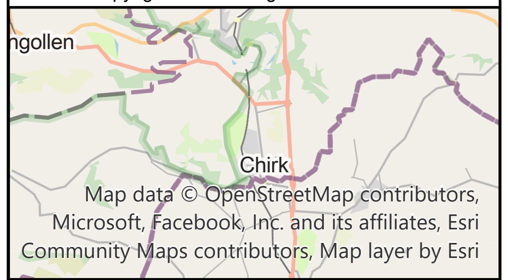
Increase >1%

Assumes entire dust emissions consist of only PM2.5 fraction.
PC as % of AQAL

Title:

Figure 35 - Annual Mean PM25 Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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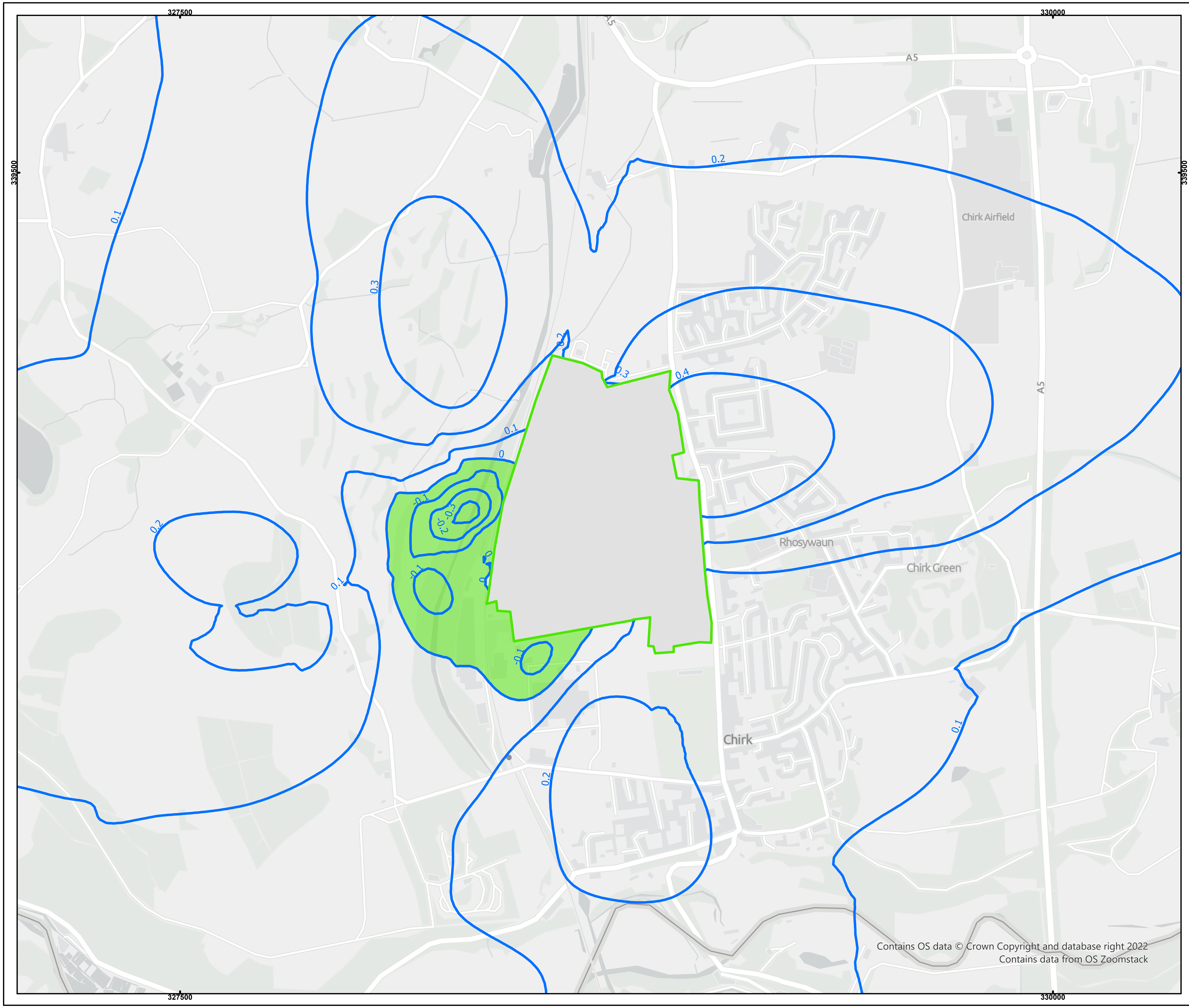


Legend

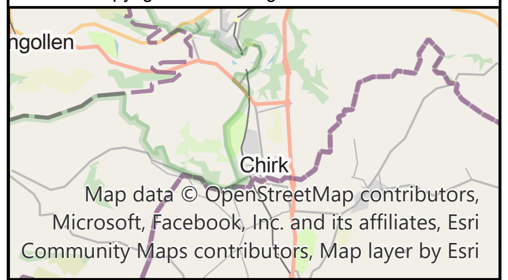
- Main Grid
- Change in impact
- Decrease
- Increase <1%
- Increase >1%

PC as % of AQAL.

Title:

Figure 36 - Annual Mean CH2O Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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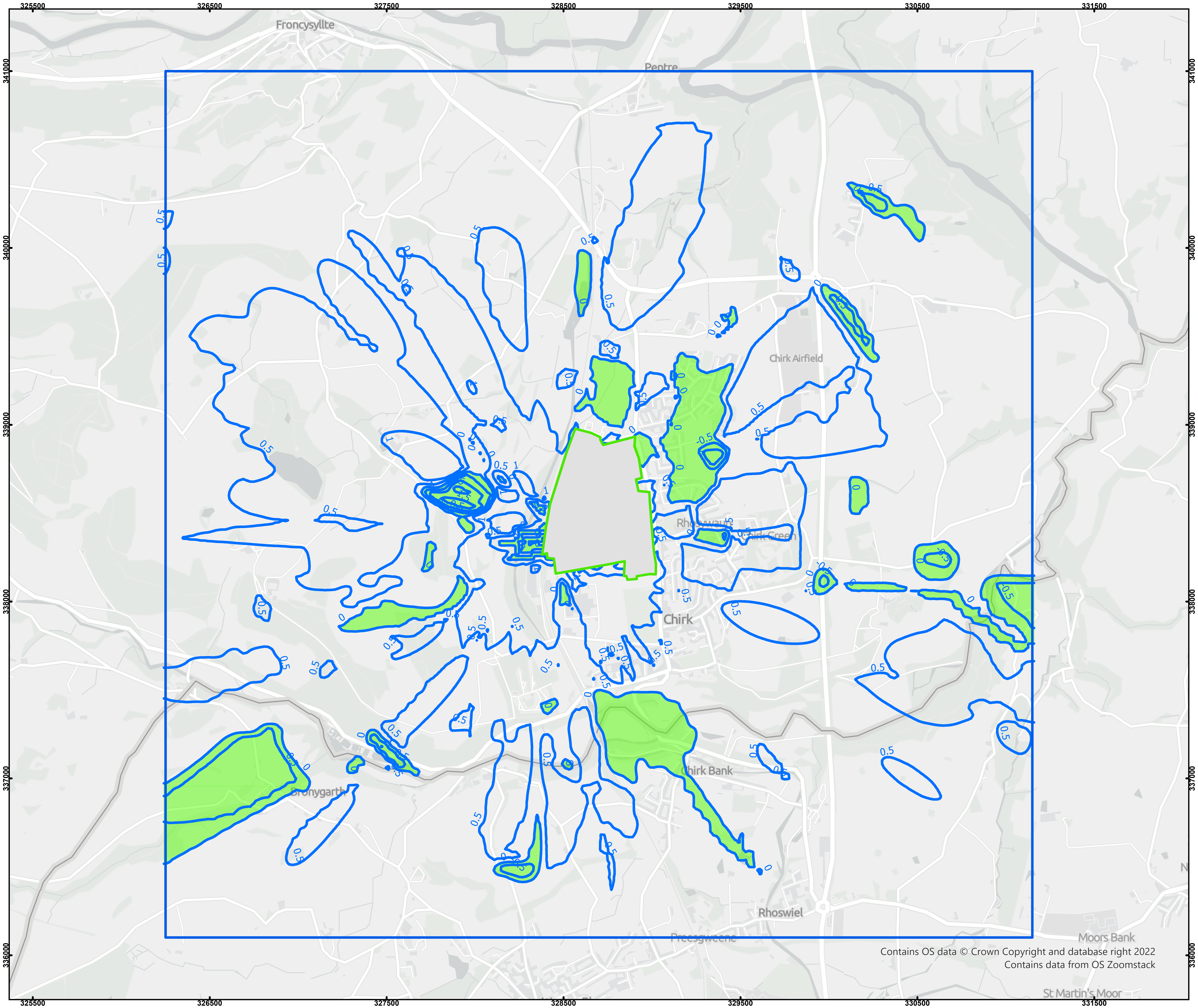


Legend

Main Grid

Change in impact

Value

Decrease

Increase <10%

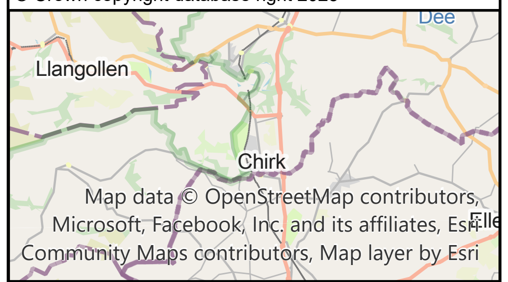
Increase >10%

Impact maximum 30-minute concentrations,
PC as % of AQAL.

Title:

Figure 37 - 30-min Mean CH2O Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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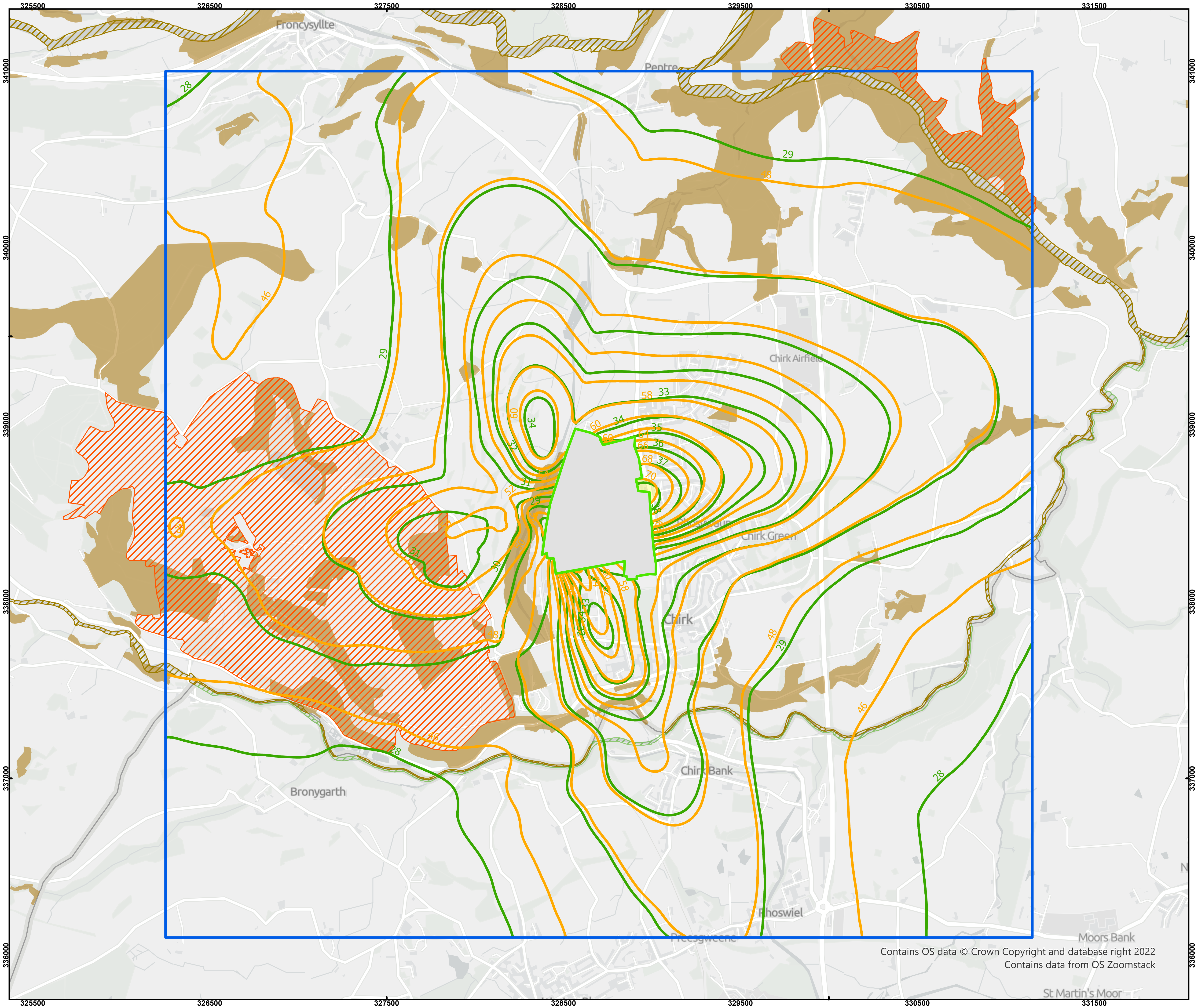


Legend

- Main Grid
- Proposed
- Permitted

Proposed PEC

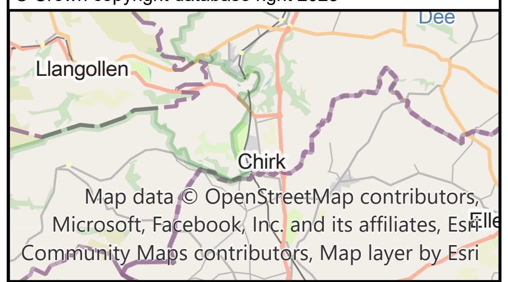
- <70%
- >70%
- >100%
- SAC
- SSSI
- Ancient Woodlands

PEC as % of Cle inclusive of a background concentration of 12.96 ug/m3

Title:

Figure 38 - Annual Mean NOx PEC - Normal Operations

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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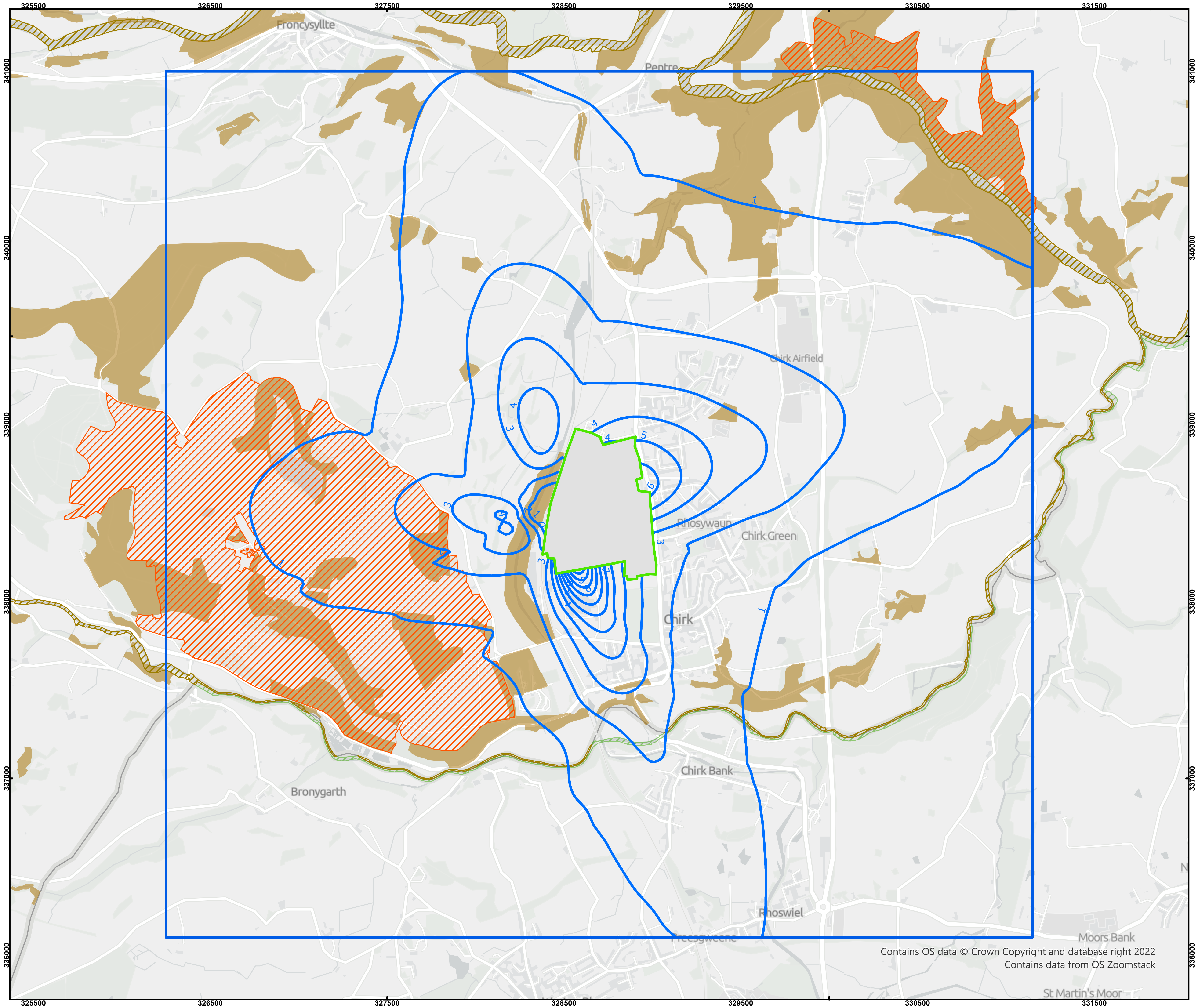


Legend

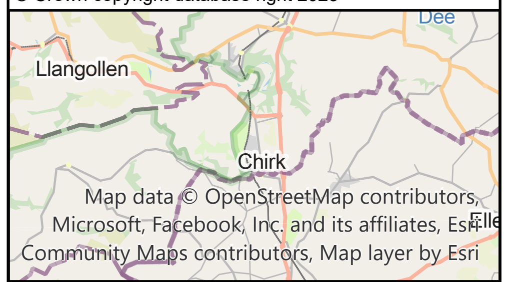
- Main Grid
- Change in impact
- SAC
- SSSI
- Ancient Woodlands

PC as % of Cle

Title:

Figure 39 - Annual Mean NOx Change in Impact - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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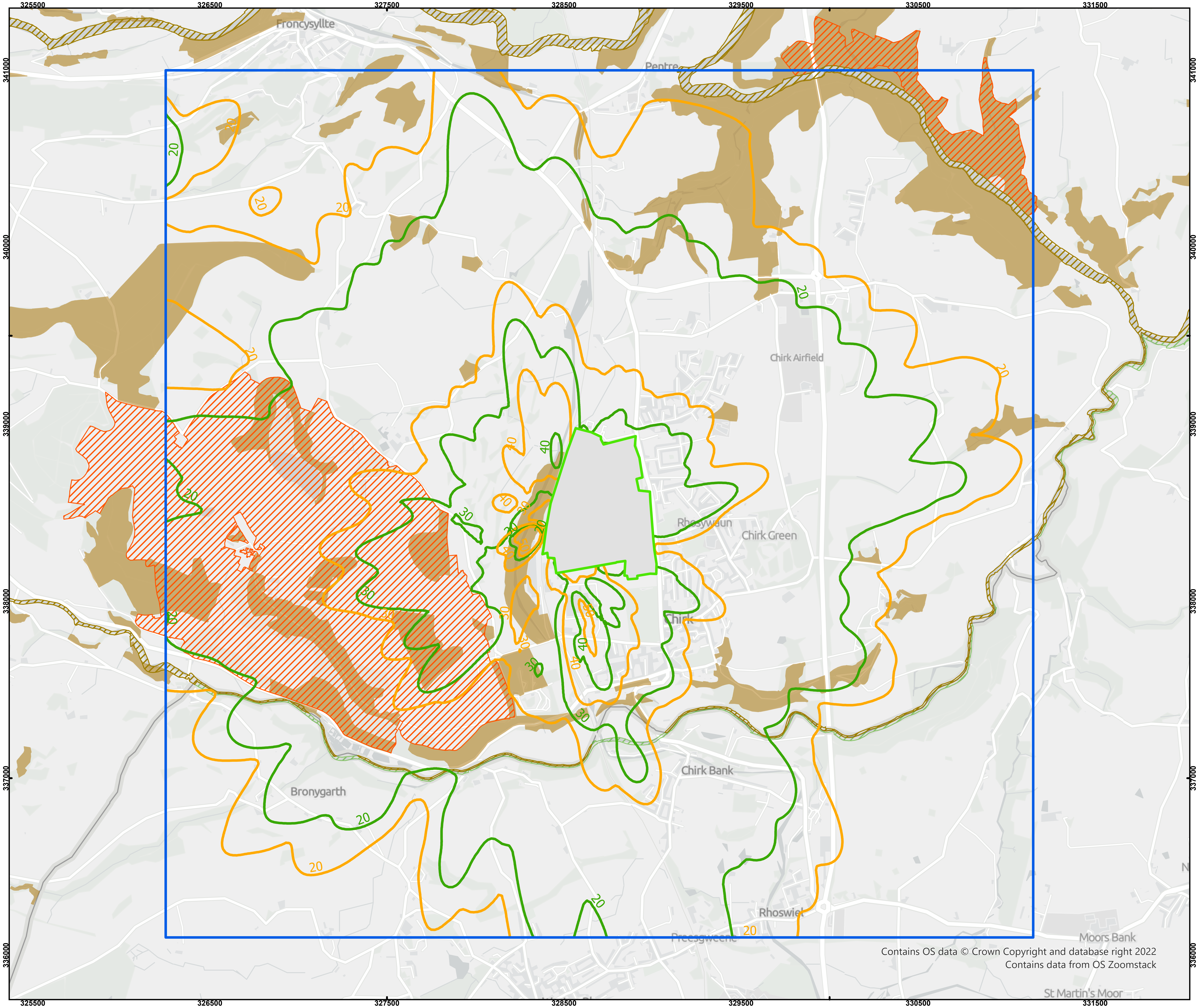


Legend

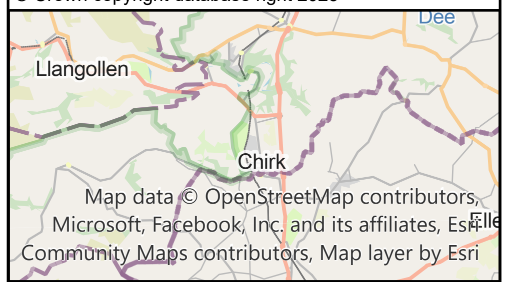
- Main Grid
- Proposed
- Permitted
- SAC
- SSSI
- Ancient Woodlands

PEC as % of Cle inclusive of a background concentration of 25.92 ug/m3

Title:

Figure 40 - Daily Mean NOx PEC - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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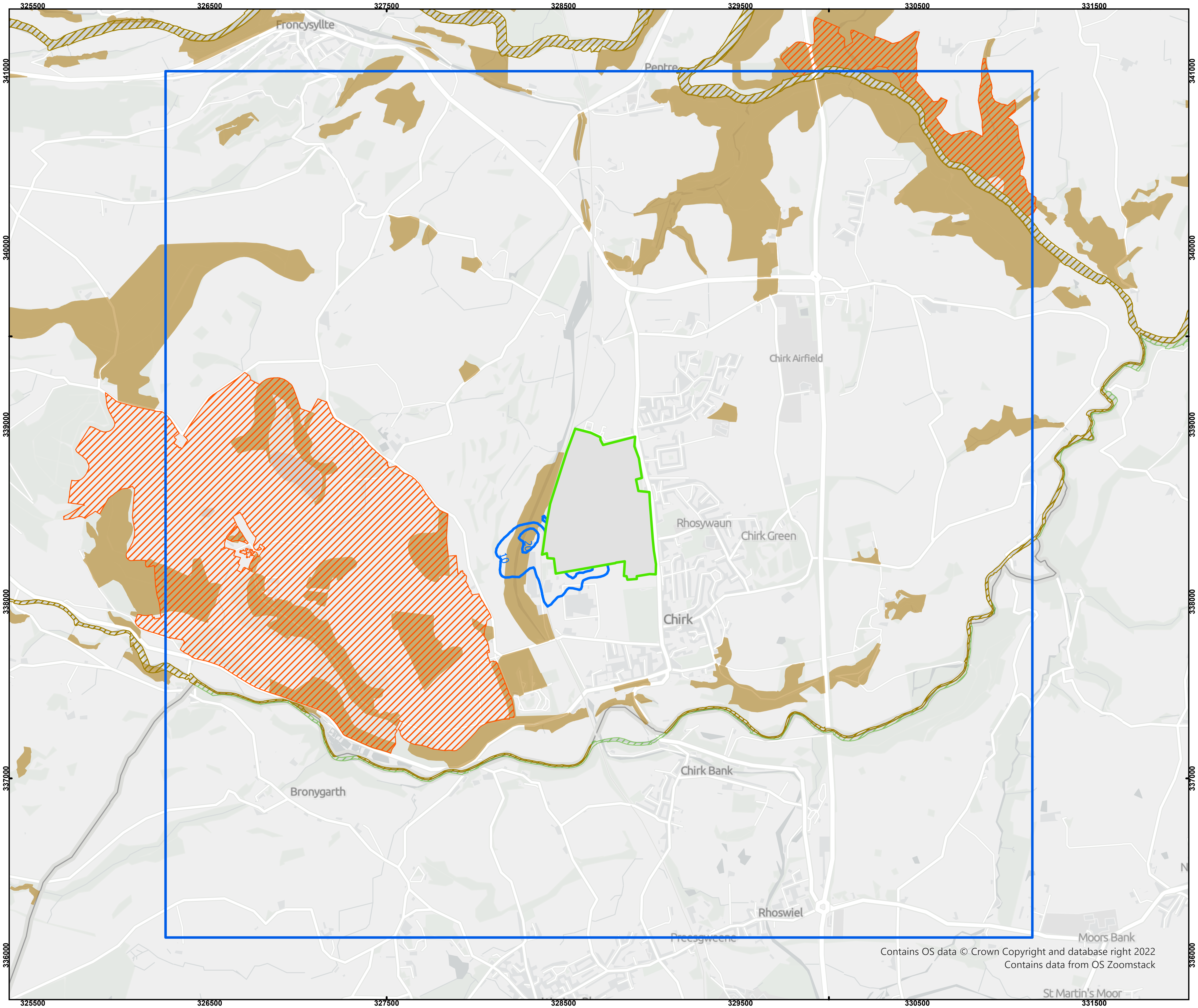


Legend

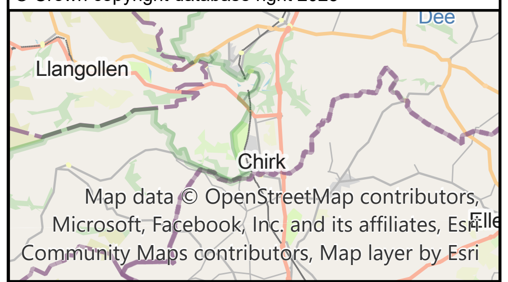
- Main Grid
- Change in impact
- SAC
- SSSI
- Ancient Woodlands

PC as % of Cle

Title:

Figure 41 - Daily Mean NOx Change in Impact - Normal Operations

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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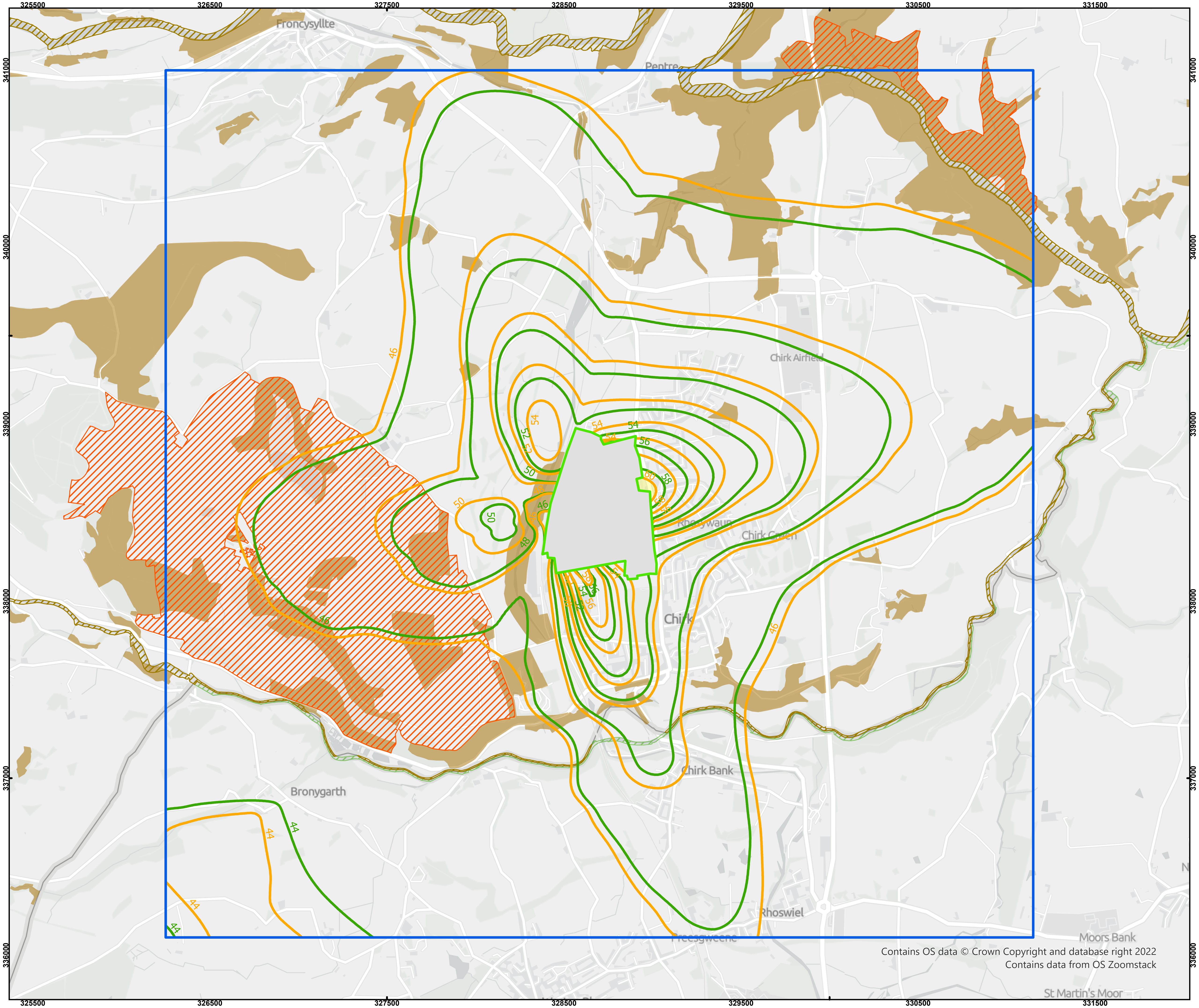


Legend

- Main Grid
- Proposed
- Permitted

Proposed PEC

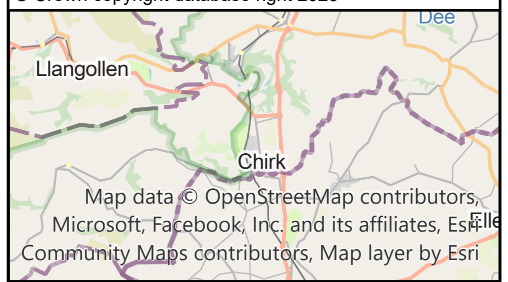
- <70%
- >70%
- >100%
- SAC
- SSSI
- Ancient Woodlands

PEC as % of Cle inclusive of a background concentration of 12.96 ug/m3

Title:

Figure 42 - Annual Mean NOx PEC - MDF 2 Offline

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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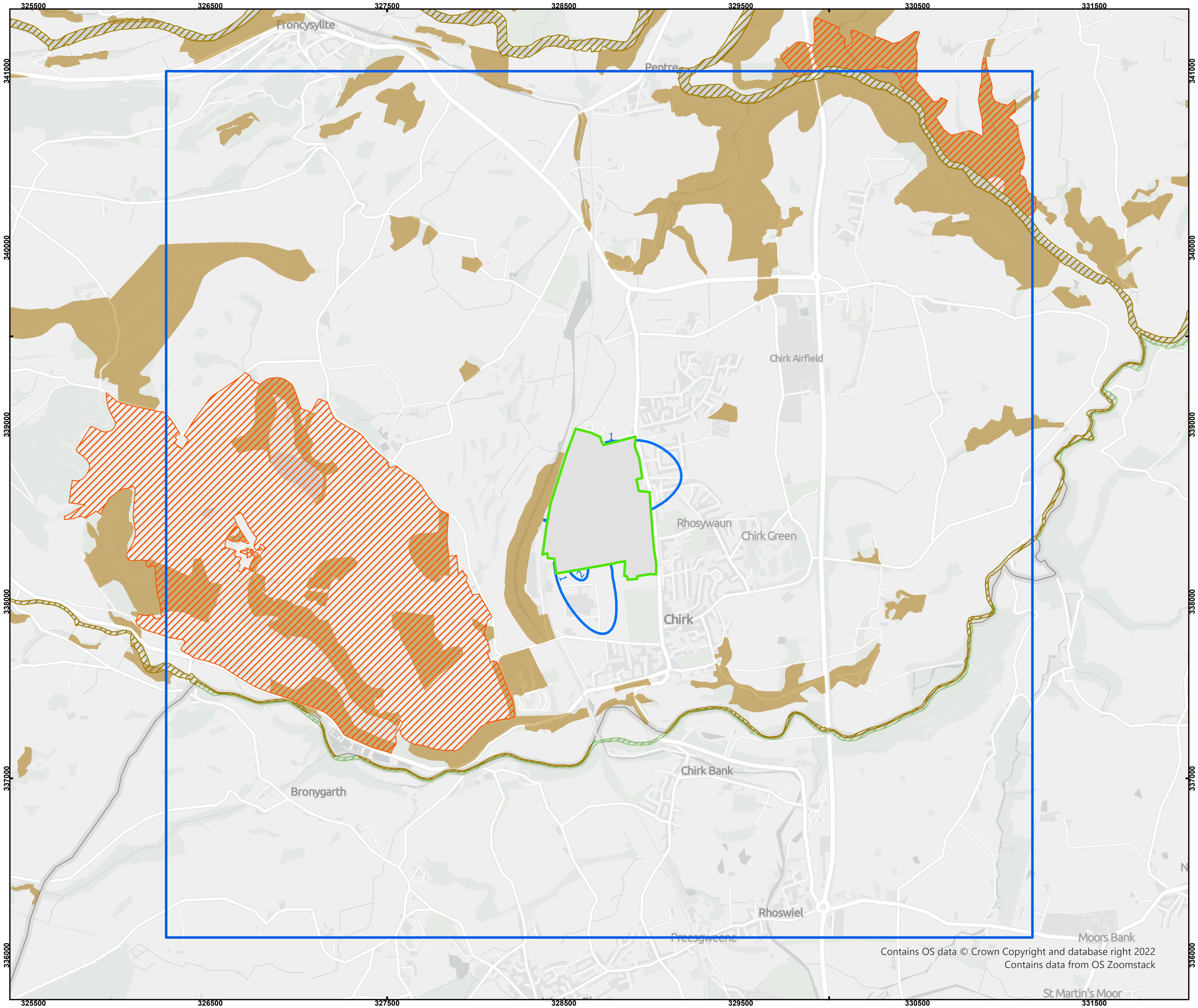


Legend

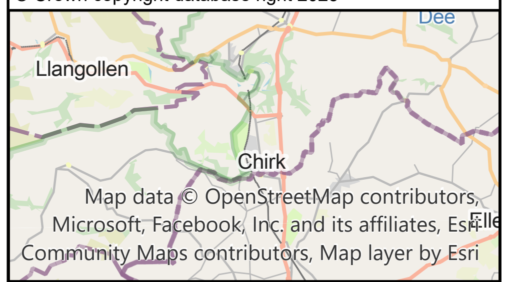
- Main Grid
- Change in impact
- SAC
- SSSI
- Ancient Woodlands

PC as % of Cle

Title:

Figure 43 - Annual Mean NOx Change in Impact - MDF 2 Offline

Drawn by: RSF | Date: 21/02/2023



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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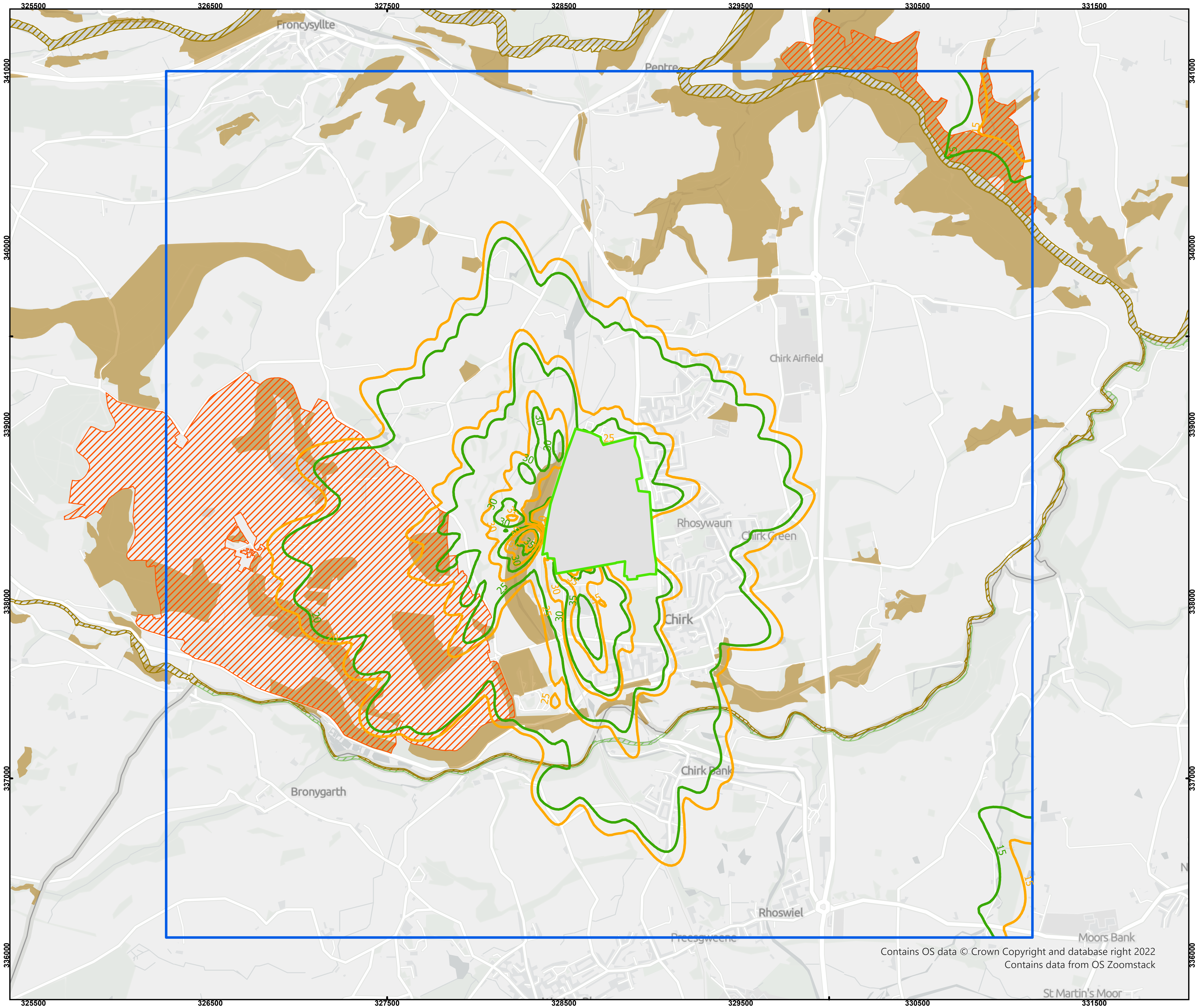


Legend

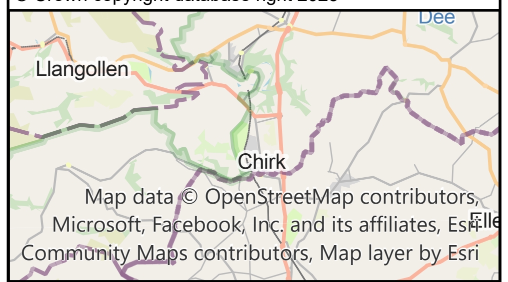
- Main Grid
- Proposed
- Permitted
- SAC
- SSSI
- Ancient Woodlands

PEC as % of Cle inclusive of a background concentration of 25.92 ug/m3

Title:

Figure 44 - Daily Mean NOx PEC - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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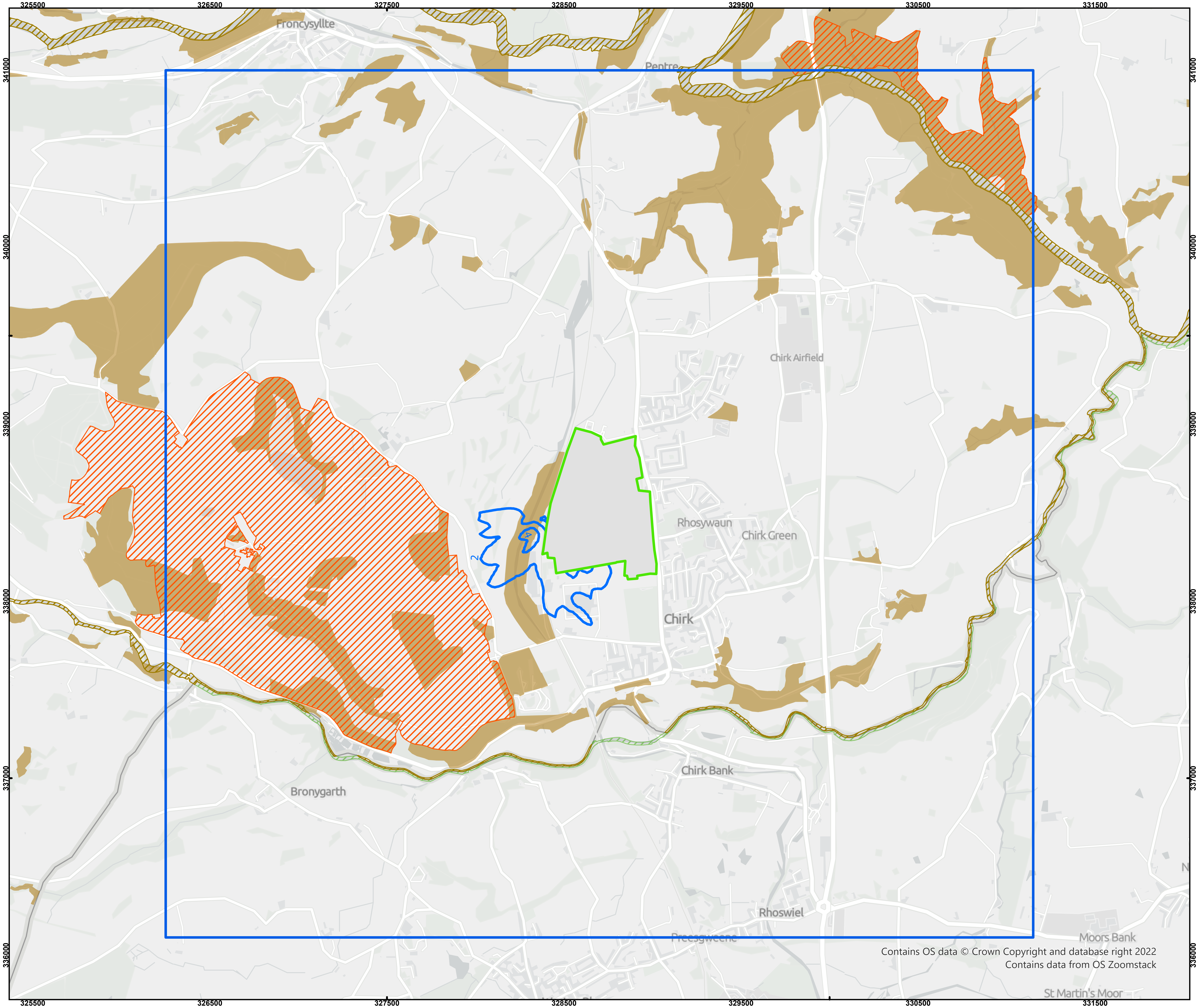

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Contains data from OS Zoomstack

Legend

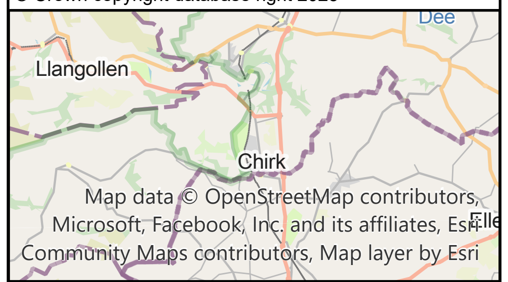
- Main Grid
- Change in impact
- SAC
- SSSI
- Ancient Woodlands

PC as % of Cle

Title:

Figure 45 - Daily Mean NOx Change in Impact - MDF 2 Offline

Drawn by: RSF	Date: 21/02/2023



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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B Source Inputs

The following section details the source input data for each item of plant.

As set out in Section 9.5, the emission rate of HCl and HF from the MDF 2 drier is significantly higher than that from the sources feeding it (namely K7 in normal operation, and K7 and K8 when the MDF 1 drier is offline). As such the emissions of HCl and HF have been taken from the sum of the sources existing to atmosphere via the drier rather than the emission limit on the MDF 2 drier. The emission rate for HCl and HF have been taken from the large combustion BREF as a daily average.

Table 28: Source Data

Parameter	Unit	K1	K5	K6	GE	K7	K8	WESP 21
Height	m	10.2	14.5	21.4	22.0	36.5	70.0	50.0
Internal diameter	m	0.48	1.00	1.60	1.20	1.90	1.70	4.00
Temperature	°C	156.0	279.0	257.0	297.0	312.0	150.9	56.9
Volumetric flow rate	Am^3/s	0.4	8.6	6.5	45.7	55.0	34.5	72.1
Exit velocity	m/s	2.2	10.9	5.8	40.4	19.4	15.2	5.7
Moisture content	%	7.0	5.9	-	9.2	11.6	7.8	15.6
Oxygen content	% dry basis	8.8	4.6	5.1	12.2	15.1	14.1	17.6
Reference oxygen content	% dry basis	3	3	3	3	6	6	18
Volumetric flow rate	Nm^3/s	0.2	3.6	2.8	9.7	8.9	9.4	57.2
Reference conditions	-	NTP 3% O2	NTP 3% O2	NTP 3% O2	NTP 3% O2	NTP 6% O2	NTP 6% O2	NTP 18% O2
ELV								
NOx - Existing	mg/Nm^3	200	200	200	280	250	300	100
NOx – Proposed	mg/Nm^3	200	200	200	280	250	300	200
PM	mg/Nm^3	-	-	-	-	150	75	-
TVOC	mg/Nm^3	-	-	-	-	50	15	20
CH_2O	mg/Nm^3	-	-	-	-	-	15	130
SO_2	mg/Nm^3	-	-	-	-	-	-	10
HCl	mg/Nm^3	-	-	-	-	200	75	-
HF	mg/Nm^3	-	-	-	-	35	15	-
NH_3	mg/Nm^3							
Emission rate								
NOx - Existing	g/s	0.032	0.728	0.556	2.716	2.220	2.820	5.720
NOx – Proposed	g/s	-	-	-	-	-	-	11.440
PM	g/s	-	-	-	-	0.444	0.141	1.144
TVOC	g/s	-	-	-	-	-	0.141	7.436
CH_2O	g/s	-	-	-	-	-	-	0.572
SO_2	g/s	-	-	-	-	1.776	0.705	-
HCl	g/s	-	-	-	-	0.311	0.141	-
HF	g/s	-	-	-	-	0.018	0.028	-
NH_3	g/s	-	-	-	-	-	0.141	-

Table 29: Source Data

Parameter	Unit	A1	A5	A6	Press Abatement	WESP 32	WESP 32 Proposed	MDF 1 (per cyclone - 2 emission points)	MDF2 (per cyclone - 4 emission points)
Height	m	25.0	17.5	16.0	0.0	65.5	65.5	50.0	57.0
Internal diameter	m	0.60	1.65	0.90	0.00	4.80	4.80	1.80	2.96
Temperature	°C	248.4	23.7	34.0	34.6	34.6	34.6	55.4	63.9
Volumetric flow rate	Am^3/s	5.2	28.5	8.9	55.5	55.5	92.9	73.9	77.0
Exit velocity	m/s	18.4	13.3	14.0	-	3.1	5.1	29.0	11.2
Moisture content	%	5.2	2.5	4.8	4.1	4.1	-	9.2	10.4
Oxygen content	% dry basis	6.1	-	-	20.3	20.3	-	20.1	18.7
Reference oxygen content	% dry basis	11	-	-	-	-	-	-	-
Volumetric flow rate	Nm^3/s	2.6	25.5	7.5	47.3	47.3	-	55.8	55.9
Reference conditions	-	STP, dry	STP, dry	STP, dry	STP, dry	Press Abatement only	Press Abatement + A5 and A6	STP, dry	STP, dry
ELV									
NOx - Existing	mg/Nm^3	-	-	-	-	-	-	100	100
NOx – Proposed	mg/Nm^3	-	-	-	-	-	-	-	-
PM	mg/Nm^3	-	20	20	15	Press Abatement only	Press Abatement + A5 and A6	20	20
TVOC	mg/Nm^3	-	30	30	100	Press Abatement only	Press Abatement + A5 and A6	120	120
CH_2O	mg/Nm^3	5	5	5	5	Press Abatement only	Press Abatement + A5 and A6	15	15
SO_2	mg/Nm^3	-	-	-	-	-	-	-	-
HCl	mg/Nm^3	-	-	-	-	-	-	-	30
HF	mg/Nm^3	-	-	-	-	-	-	-	1
NH_3	mg/Nm^3	-	-	-	-	-	-	-	-
Emission rate									
NOx - Existing	g/s	-	-	-	-	-	-	5.580	5.590
NOx – Proposed	g/s	-	-	-	-	-	-	-	-
PM	g/s	-	0.510	0.150	0.710	0.710	1.370	1.116	1.118
TVOC	g/s	-	0.765	0.225	4.730	4.730	5.720	6.696	6.708
CH_2O	g/s	0.013	0.128	0.038	0.237	0.237	0.403	0.837	0.839
SO_2	g/s	-	-	-	-	-	-	-	-
HCl	g/s	-	-	-	-	-	-	-	1.677
HF	g/s	-	-	-	-	-	-	-	0.056
NH_3	g/s	-	-	-	-	-	-	-	-

Table 30: Drier Emissions Scenarios

Scenario		MDF 1 Offline	MDF 2 Offline		MDF 1 and 2 Offline
Parameter	**Unit**	**MDF 2**	**MDF 1**	**Gas Engine x 1**	
Sources		K7, K8 and 4 gas engines	K7, K8 and 2 gas engines	1 engine to dedicated stack	All to own stacks (see Table 28 for inputs)
Height	m	57.0	50.0	22.0	-
Internal diameter	m	2.96	1.80	1.20	-
Temperature	°C	63.9	55.4	297.0	-
Volumetric flow rate	Am^3/s	77.0	73.9	45.7	-
Exit velocity	m/s	11.2	29	40.4	-
Emission rate					-
NOx - Existing	g/s	5.590	5.580	2.716	-
NOx – Proposed	g/s	5.590	5.580	-	-
PM	g/s	1.118	1.116	-	-
TVOC	g/s	6.708	6.696	-	-
CH_2O	g/s	0.839	0.837	-	-
SO_2	g/s	0.620(1)	1.241(2)	-	-
HCl	g/s	1.667	0.226(2)	-	-
HF	g/s	0.056(1)	0.023(2)	-	-
NH_3	g/s	0.035(1)	0.071(2)	-	-

NOTES:
(1) Calculated as emissions from K8 divided by 4
(2) Calculated as emission rate from K7 and K8 divided by 2

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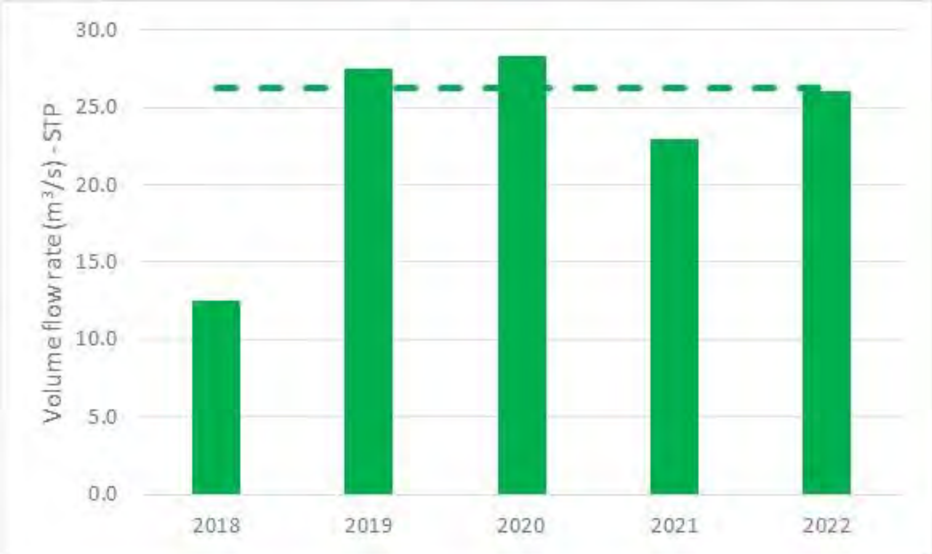
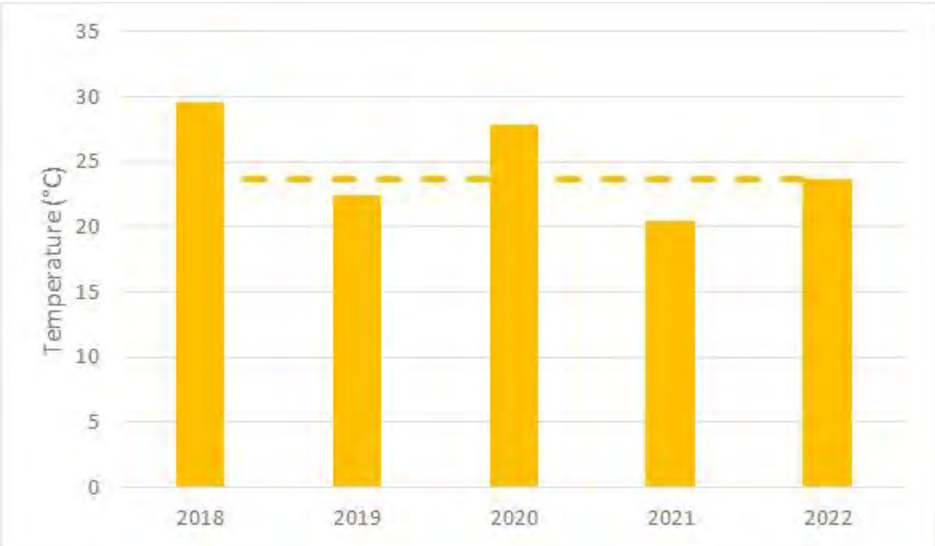
B.1 A5 – Resin VITS – Analysis

Figure 46: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 47: Temperature Analysis

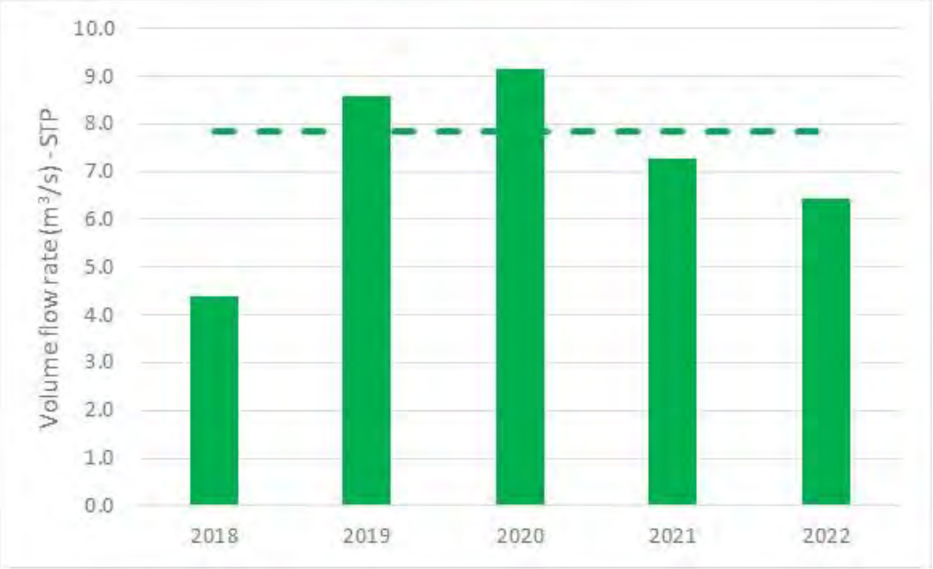


Source: Emissions Monitoring Reports

Value used in the modelling is the average (shown by the dashed line) volumetric flow rate and temperature. As shown the both the temperature and flow rate have fluctuated between years. The average is a good fit to the data and therefore has been used as the inputs for the modelling.

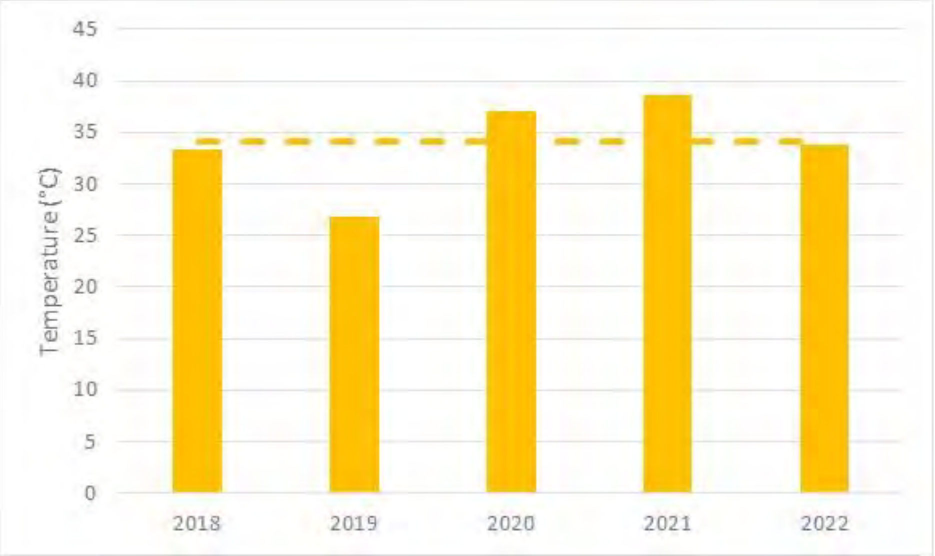
B.2 A6 – Resin – Analysis

Figure 48: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 49: Temperature Analysis

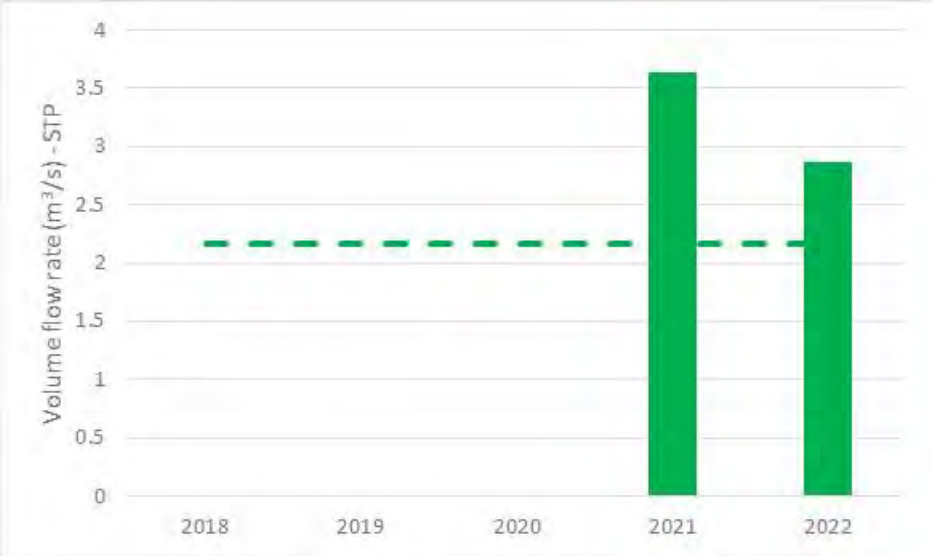


Source: Emissions Monitoring Reports

Value used in the modelling is the average (shown by the dashed line) volumetric flow rate and temperature. As shown the both the temperature and flow rate have fluctuated between years. The average is a good fit to the data and therefore has been used as the inputs for the modelling.

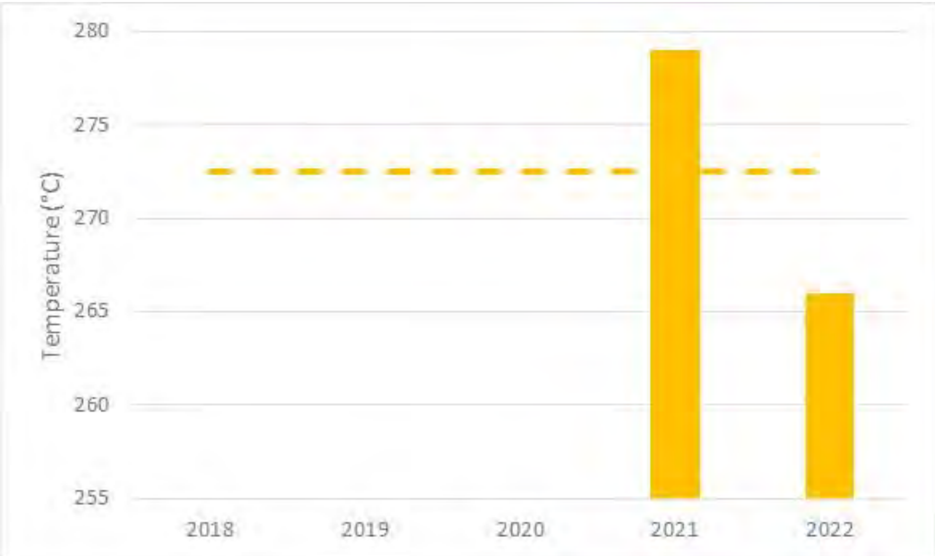
B.3 K5 – Boiler – Analysis

Figure 50: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 51: Temperature Analysis

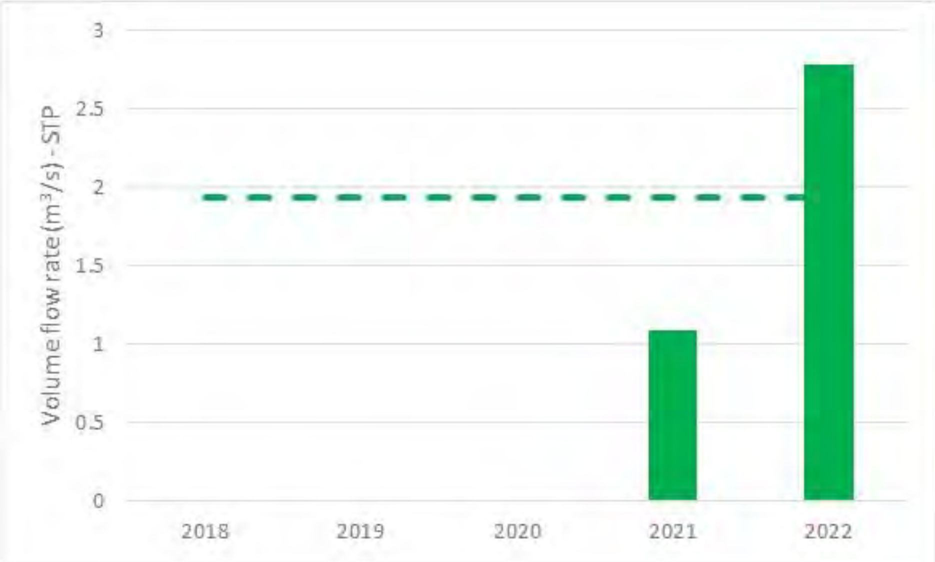


Source: Emissions Monitoring Reports

Value used in the modelling is the recorded flow rate and associated conditions from 2021. The was limited monitoring of this source. The data from 2021 has been used as this has the greatest flow and therefore greatest release rate of emissions when calculated as operating at the ELV.

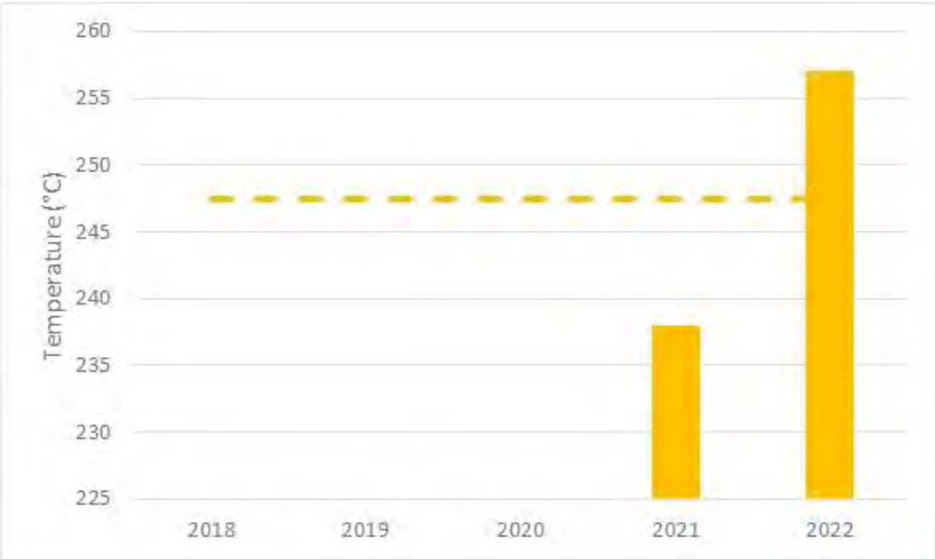
B.4 K6 – Boiler – Analysis

Figure 52: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 53: Temperature Analysis

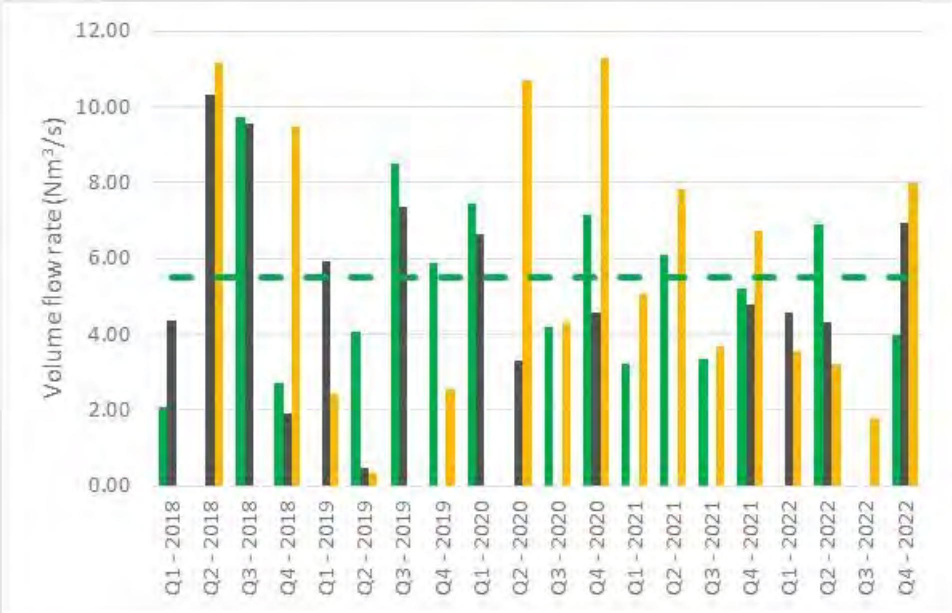


Source: Emissions Monitoring Reports

Value used in the modelling is the recorded flow rate and associated conditions from 2022. The was limited monitoring of this source. The data from 2022 has been used as this has the greatest flow and therefore greatest release rate of emissions when calculated as operating at the ELV.

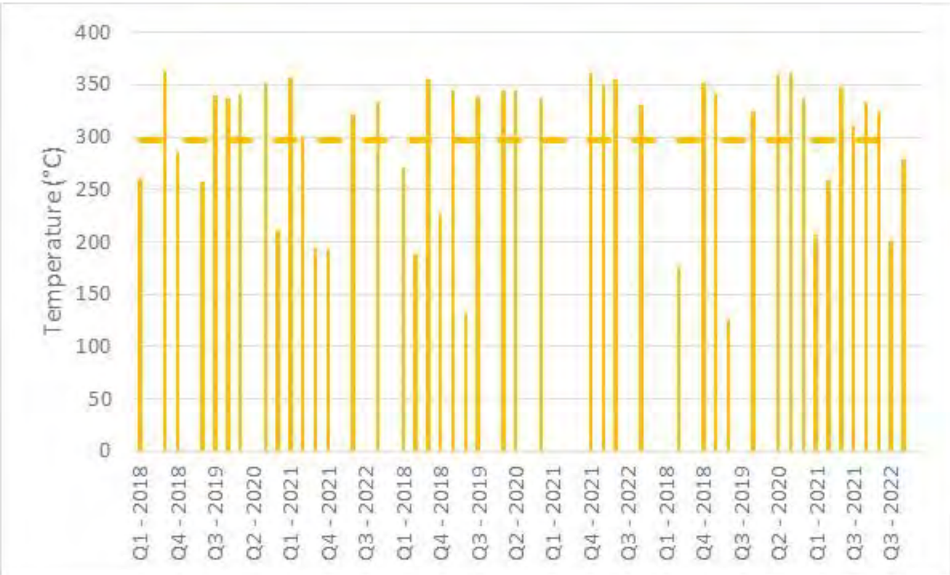
B.5 Gas Engines – Analysis

Figure 54: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 55: Temperature Analysis

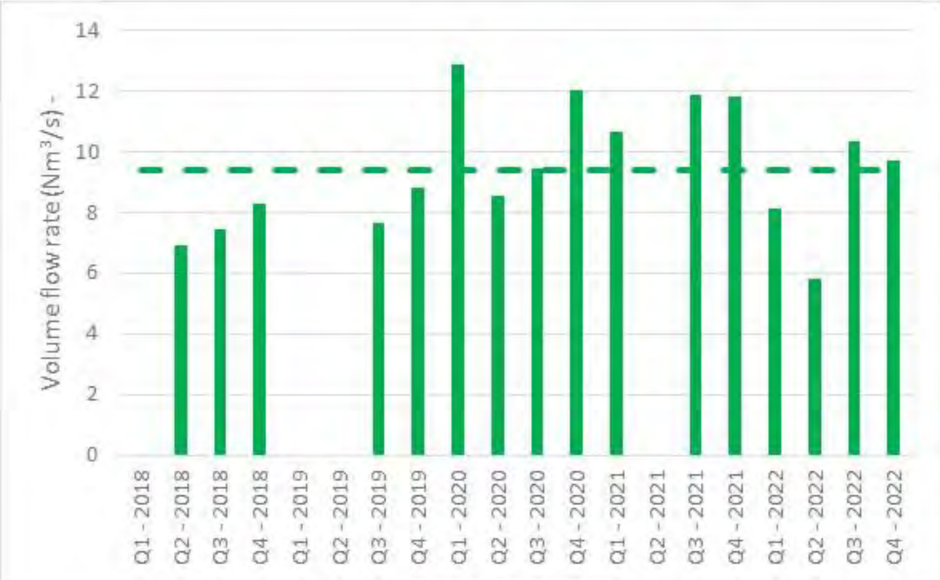


Source: Emissions Monitoring Reports

Value used in the modelling is the 90%ile of the volumetric flow rate and average temperature. The data presented is the data from each engine. As shown the volumetric flow rate varies quite a bit between this is based on the loading of the equipment. As a conservative assumption the 90%ile has been used.

B.6 K8 – Analysis

Figure 56: Vol Flow Analysis



Source: Emissions Monitoring Reports

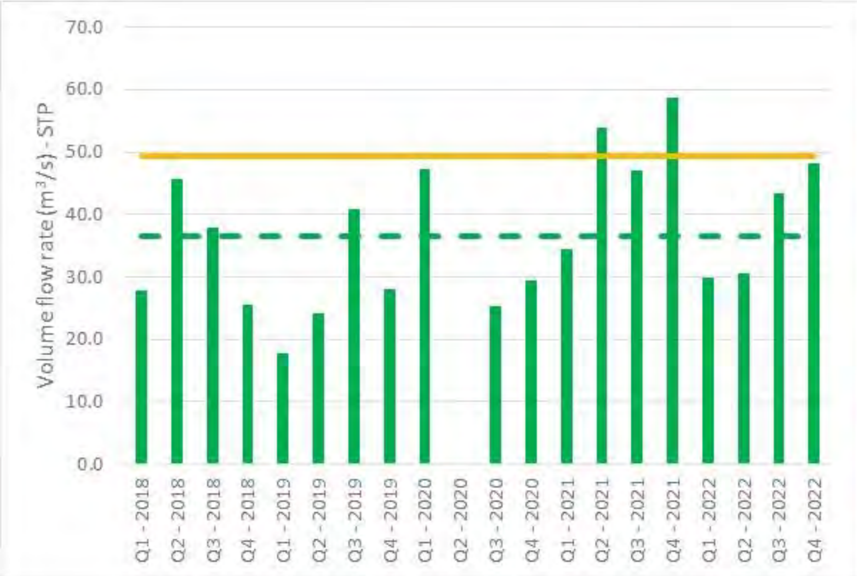
Figure 57: Temperature Analysis

Source: Emissions Monitoring Reports

Value used in the modelling is the average (shown by the dashed line) volumetric flow rate and temperature. As shown the both the temperature and flow rate have fluctuated between years. The average is a good fit to the data and therefore has been used as the inputs for the modelling.

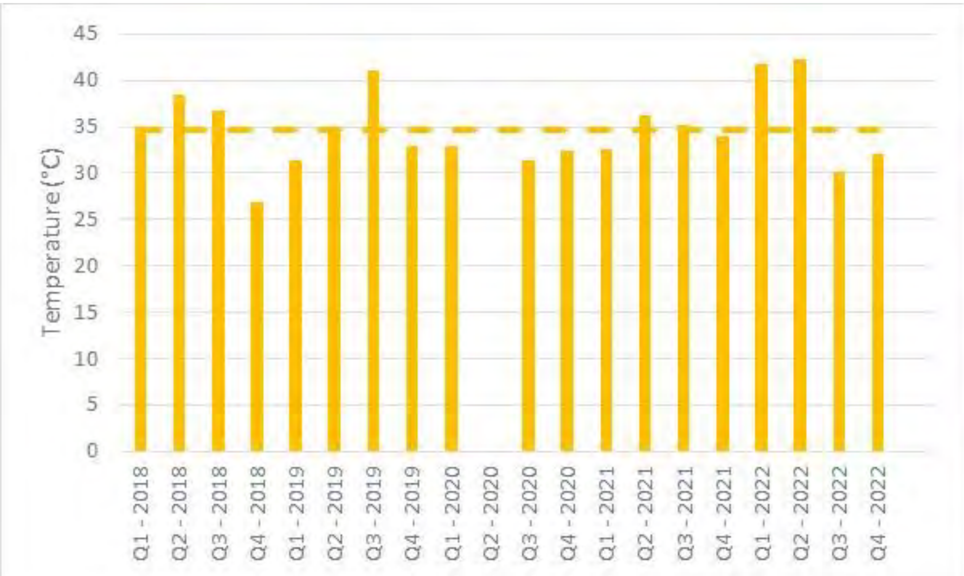
B.7 Press Abatement – Analysis

Figure 58: Vol Flow Analysis



Source: Emissions Monitoring Reports

Figure 59: Temperature Analysis



Source: Emissions Monitoring Reports

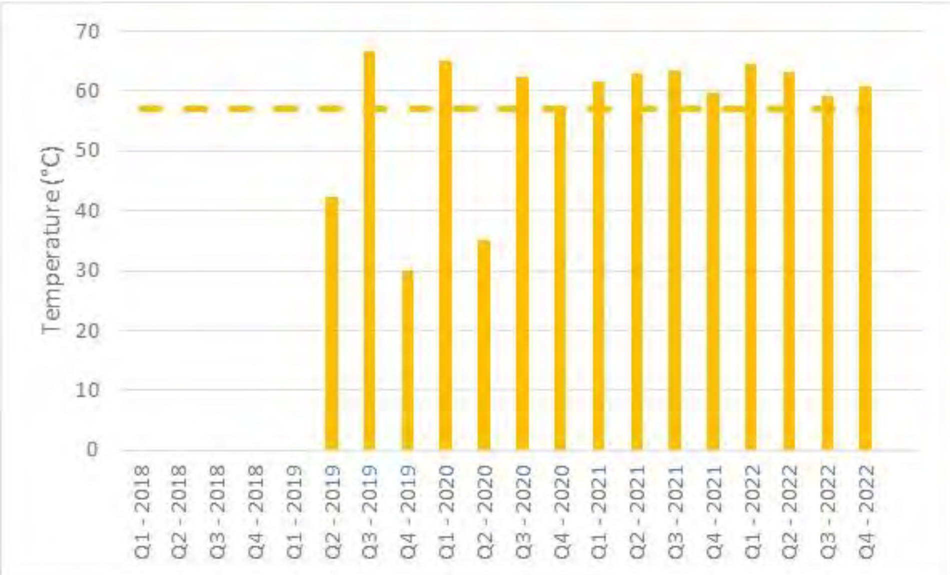
Value used in the modelling is the 90%ile of the volumetric flow rate and average temperature. As shown the volumetric flow rate varies quite a bit between this is based on the loading of the equipment. As a conservative assumption the 90%ile has been used.

B.8 PB WESP 21 – Analysis

Figure 60: Vol Flow Analysis

Source: Emissions Monitoring Reports

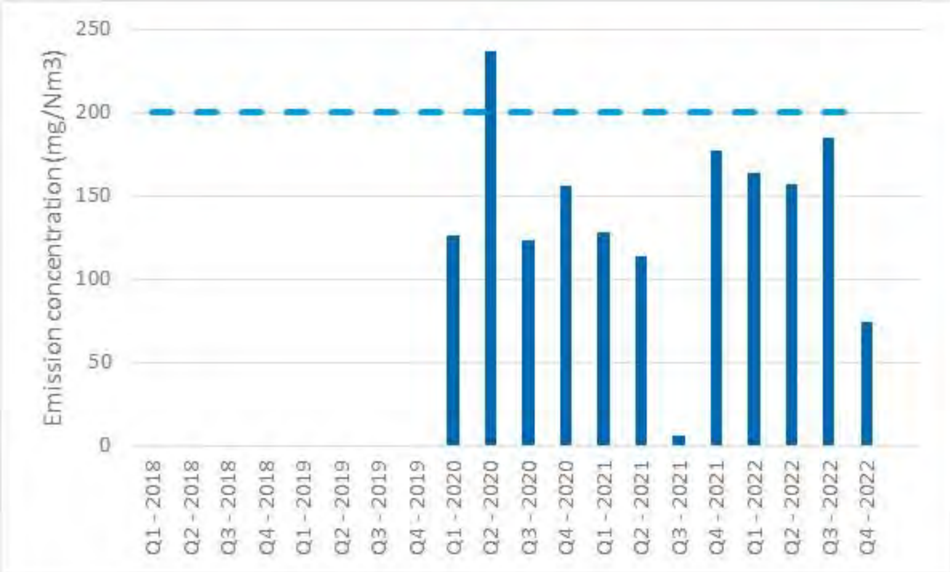
Figure 61: Temperature Analysis



Source: Emissions Monitoring Reports

Value used in the modelling is the 90%ile of the volumetric flow rate and average temperature. As shown the volumetric flow rate varies quite a bit between this is based on the loading of the equipment. As a conservative assumption the 90%ile has been used.

Figure 62: NOx Emissions Analysis

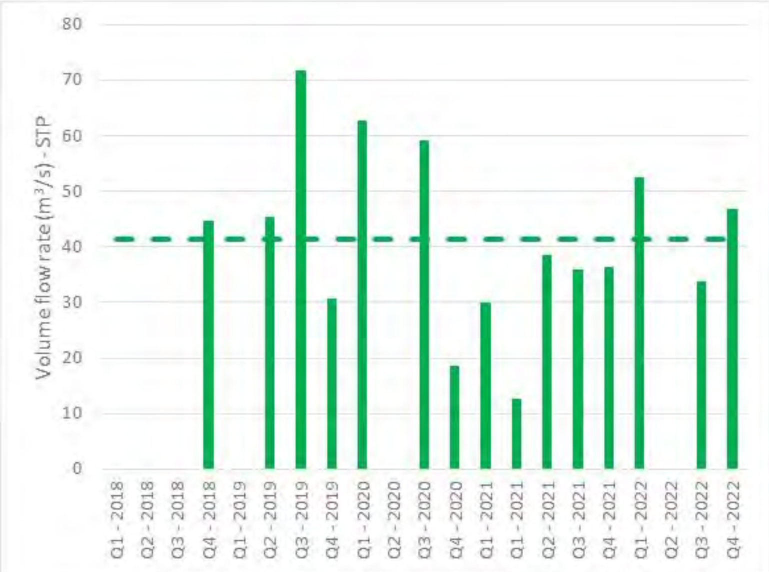


Source: Emissions Monitoring Reports

As shown the emissions of NOx have been below the proposed ELV of 200 mg/Nm^3 in all but one monitoring period. Therefore, assuming continual operation at an ELV of 200 mg/Nm^3 is likely to lead to an overestimate of actual impacts.

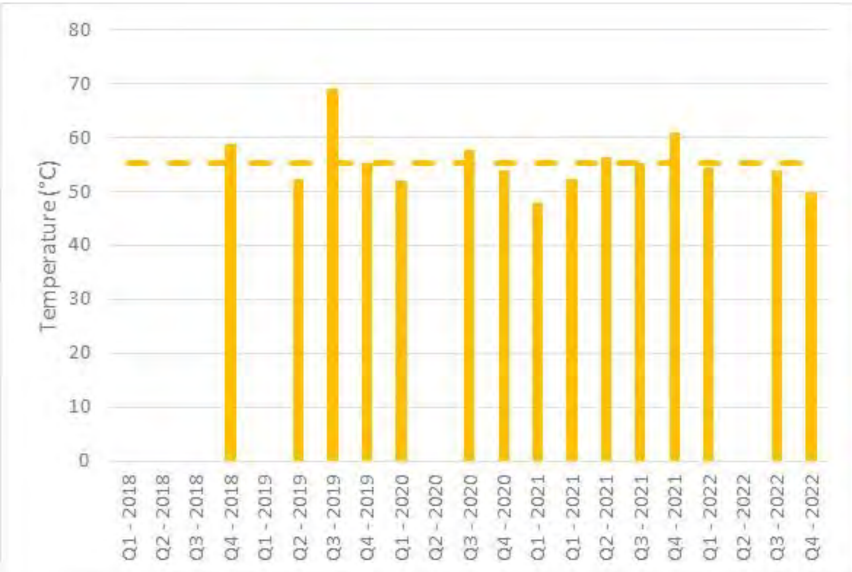
B.9 MDF 1 – Analysis

Figure 63: Vol Flow Analysis



Source: Emissions Monitoring Reports

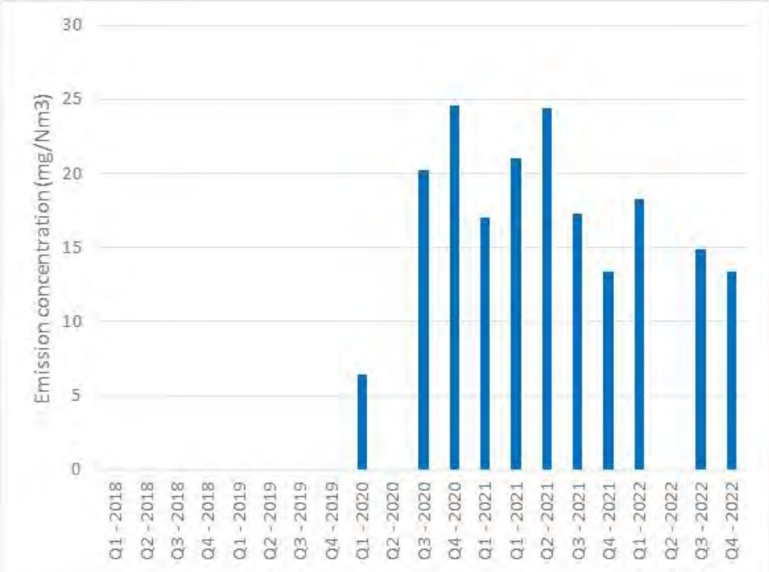
Figure 64: Temperature Analysis



Source: Emissions Monitoring Reports

Value used in the modelling is the 90%ile of the volumetric flow rate and average temperature As shown the volumetric flow rate varies quite a bit between this is based on the loading of the equipment. As a conservative assumption the 90%ile has been used.

Figure 65: NOx Emissions Analysis

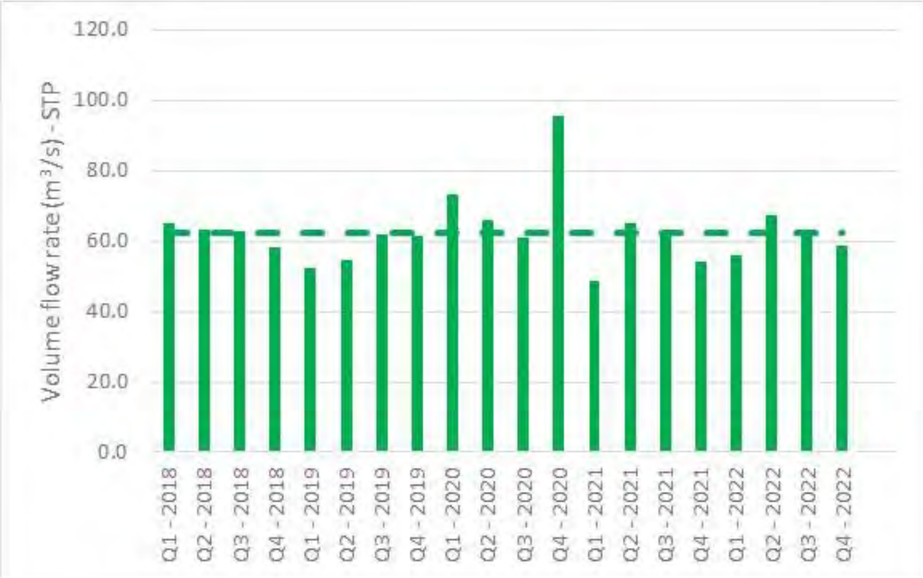


Source: Emissions Monitoring Reports

As shown the emissions of NOx have been well below the ELV of 100 mg/Nm^3. Therefore, assuming continual operation at an ELV is likely to lead to an overestimate of actual impacts.

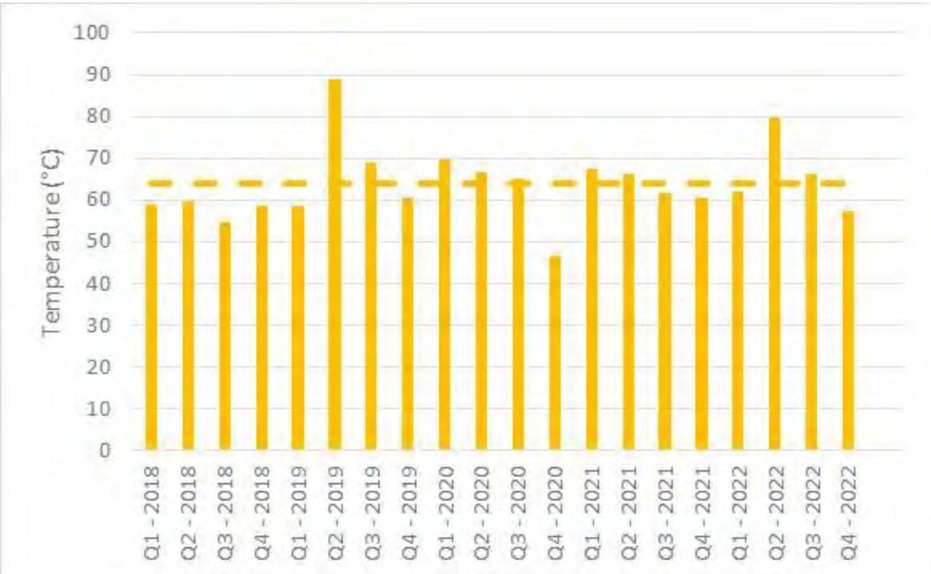
B.10 MDF 2 – Analysis

Figure 66: Vol Flow Analysis



Source: Emissions Monitoring Reports

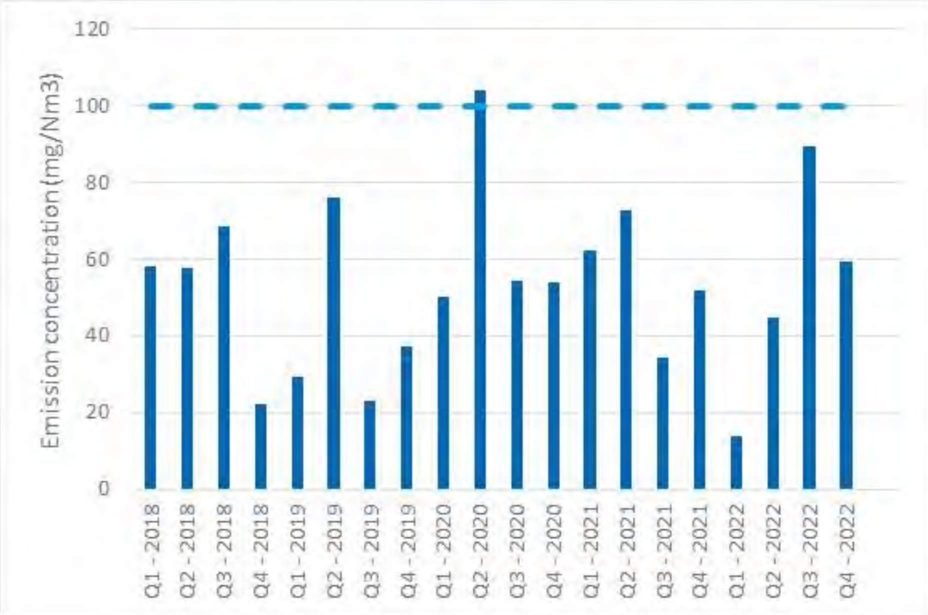
Figure 67: Temperature Analysis



Source: Emissions Monitoring Reports

Value used in the modelling is the average (shown by the dashed line) volumetric flow rate and temperature. As shown the both the temperature and flow rate have fluctuated between years. The average is a good fit to the data and therefore has been used as the inputs for the modelling.

Figure 68: NOx Emissions Analysis



Source: Emissions Monitoring Reports

As shown the emissions of NOx have been well below the ELV of 100 mg/Nm^3, in all but one monitoring period Therefore, assuming continual operation at an ELV is likely to lead to an overestimate of actual impacts.

B.11 K7 – Analysis

Monitoring of K7 was not required as part of the previous EP. As such monitoring is limited. However, the model inputs are based on the monitoring taken out in 2018.

B.12 K1 – Analysis

Monitoring of K1 was not required as part of the previous EP. As such monitoring is limited. However, the model inputs are based on the monitoring taken out in 2022.

Table 31: Source Locations

Source name	X (m)	Y (m)
K1	328725.37	338795.09
A1	328721.59	338581.22
A5	328597.83	338372.29
A6	328604.57	338367.50
WESP 21	328449.10	338471.40
WESP 32	328414.40	338344.20
MDF1 A	328478.94	338231.10
MDF1 B	328484.91	338232.06
MDF2 A	328461.30	338253.40
MDF2 B	328467.17	338254.40
MDF2 C	328468.78	338243.94
MDF2 D	328462.87	338243.04
K5	328530.44	338333.94
K6	328470.32	338308.97
K7	328430.10	338315.50
K8	328504.15	338390.19
Gas Engine 1	328529.18	338422.85
Gas Engine 2	328523.38	338421.97
Gas Engine 3	328517.50	338421.13
Gas Engine 4	328511.70	338420.22
Gas Engine 5	328505.88	338419.36
B01	328641.60	338255.50
B02	328605.10	338247.30
B03	328599.60	338246.60
B04	328594.60	338245.90
B05	328462.50	338229.80
B06	328452.60	338250.50
B07	328502.70	338330.30
B08	328436.40	338362.40
B09	328428.60	338377.20
B10	328427.70	338383.40
B11	328426.80	338388.30
B12	328608.00	338344.10
B13	328614.90	338345.20
B14	328644.10	338350.70
B15	328650.30	338351.60

Source name	X (m)	Y (m)
B16	328722.20	338489.60
B17	328713.50	338488.90
B18	328724.20	338477.10
B19	328717.00	338475.80
B20	328576.20	338525.30
B21	328570.04	338524.20
B22	328499.80	338486.20
B23	328493.00	338520.45
B24	328488.06	338531.92
B25	328481.92	338531.05
B26	328471.78	338529.41
B27	328676.70	338796.90
B28	328674.50	338803.20
B29	328681.60	338809.30
B30	328680.30	338814.60
B31	328682.00	338819.80

C APIS Critical Loads

All data sourced from APIS as accessed on 05/01/2023. Background data from the 3 year average 2018 to 2020.

Table 32: Nitrogen Deposition Critical Loads

Site	NCL class	kgN/ha/yr		
		Lower CL	Upper CL	Background
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79
Chirk Castle SSSI	Fagus Woodland	10	20	39.30
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74
Barracks Field	Low and medium altitude hay meadows	20	30	24.74
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30
Various ancient woodlands	Fagus Woodland	10	20	48.37

Source: APIS

Table 33: Acid Deposition Minimum Critical Loads

Site	Acidity class	KeqN or S /ha/yr		KeqN or S /ha/yr		
		N	S	ClminN	CLmaxN	CLmaxS
River Dee and Bala Lake SAC, SSSI	Not Sensitive	2.05	0.21	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	2.06	0.14	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.178	0.551	0.230
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.321	0.660	0.339
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	0.490	0.882	0.230
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	0.856	4.856	4.000
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.142	0.890	0.605
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.142	1.864	1.722
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.856	4.856	4.000
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.223	1.123	0.900
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.357	1.879	1.522
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	1.071	5.071	4.000
Barracks Field	Acid grassland	1.77	0.16	0.438	2.088	1.650
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.142	1.864	1.722
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.142	1.864	1.722

Source: APIS

Table 34: Acid Deposition Maximum Critical Loads

Site	Acidity class	KeqN or S /ha/yr		KeqN or S /ha/yr		
		N	S	ClminN	CLmaxN	CLmaxS
River Dee and Bala Lake SAC, SSSI	Not Sensitive	2.05	0.21	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	2.06	0.14	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.536	4.358	4.180
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.321	1.367	1.046
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	1.107	5.072	4.180
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	1.214	5.252	4.058
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.500	3.933	3.576
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.142	1.892	1.750
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.856	4.856	4.000
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.223	1.123	0.900
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.357	3.791	2.722
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	1.071	5.071	4.000
Barracks Field	Acid grassland	1.77	0.16	0.438	2.088	1.650
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.142	1.864	1.722
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.142	1.864	1.722

D Detailed Results Tables – Normal Operations

Under normal operating conditions point source emissions to atmosphere from the Facility are from the following sources:

1. K1 boiler;
2. the MDF 1 and MDF 2 cyclones;
3. the WESP 21;
4. A5;
5. A6; and
6. WESP 32.

Noting that it is proposed that emissions from A5 and A6 are ducted into WESP 32 as part of this variation application.

Table 35: Normal Ops - Maximum Impact outside Installation Boundary

Pollutant	Quantity	Scenario	Units	AQAL	Bg Conc	Process Contribution (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC = Bg)	PEC as % of AQAL
						2018	2019	2020	2021	2022	Max			
Nitrogen dioxide	Annual mean	Existing	µg/m^3	40	10.84	3.64	3.80	4.49	3.13	3.27	4.49	11.2%	15.33	38.3%
		Proposed	µg/m^3	40	10.84	4.71	4.90	5.87	4.82	4.30	5.87	14.7%	16.71	41.8%
		Maximum increase	µg/m^3	40	10.84	2.24	1.97	1.47	2.38	2.08	2.38	6.0%	-	-
	99.79%ile of 1-hour means	Existing	µg/m^3	200	21.68	37.27	37.65	39.46	35.02	37.06	39.46	19.7%	61.14	30.6%
		Proposed	µg/m^3	200	21.68	44.39	41.21	41.33	41.80	42.94	44.39	22.2%	66.07	33.0%
		Maximum increase	µg/m^3	200	21.68	21.12	20.31	20.28	20.82	21.32	21.32	10.7%	-	-
Formaldehyde	Annual mean	Existing	µg/m^3	5	1	1.00	1.05	1.19	0.89	0.90	1.19	23.9%	2.19	43.9%
		Proposed	µg/m^3	5	1	1.02	1.06	1.21	0.90	0.91	1.21	24.3%	2.21	44.3%
		Maximum increase	µg/m^3	5	1	0.02	0.02	0.02	0.02	0.02	0.02	0.5%	-	-
	Maximum 30-minute mean	Existing	µg/m^3	100	2	25.50	25.98	29.44	26.17	26.77	29.44	29.4%	31.44	31.4%
		Proposed	µg/m^3	100	2	26.32	26.44	30.14	26.62	27.08	30.14	30.1%	32.14	32.1%
		Maximum increase	µg/m^3	100	2	1.15	1.28	1.03	1.33	1.56	1.56	1.6%	-	-
TVOC	Annual mean	Existing	µg/m^3	-	-	8.82	9.23	10.57	7.84	7.93	10.57	-	-	-
		Proposed	µg/m^3	-	-	8.74	9.13	10.51	7.74	7.85	10.51	-	-	-
		Maximum increase	µg/m^3	-	-	0.02	0.02	0.04	0.01	0.02	0.04	-	-	-
	Maximum daily mean	Existing	µg/m^3	-	-	88.13	93.26	85.75	93.82	83.48	93.82	-	-	-
		Proposed	µg/m^3	-	-	88.61	92.83	85.50	94.25	82.94	94.25	-	-	-
		Maximum increase	µg/m^3	-	-	1.84	0.92	1.18	1.47	1.27	1.84	-	-	-
Particulate matter (as PM_{10}) - excluding dust units	Annual mean	Existing	µg/m^3	40	15.39	2.14	2.25	2.48	2.17	1.99	2.48	6.2%	17.87	44.7%
		Proposed	µg/m^3	40	15.39	2.22	2.33	2.58	2.19	2.02	2.58	6.4%	17.97	44.9%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	7.44	7.32	7.69	8.54	7.56	8.54	17.1%	23.93	47.9%
		Proposed	µg/m^3	50	15.39	7.55	7.61	8.03	8.54	7.72	8.54	17.1%	23.93	47.9%
		Maximum increase	µg/m^3	50	15.39	0.59	0.56	0.54	0.46	0.57	0.59	1.2%	-	-
Particulate matter (as $PM_{2.5}$) - excluding dust units	Annual mean	Existing	µg/m^3	20	10.94	2.14	2.25	2.48	2.17	1.99	2.48	12.4%	13.42	67.1%
		Proposed	µg/m^3	20	10.94	2.22	2.33	2.58	2.19	2.02	2.58	12.9%	13.52	67.6%
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.5%	-	-
Particulate matter (as PM_{10}) - including dust units	Annual mean	Existing	µg/m^3	40	15.39	9.78	10.52	9.21	8.98	9.17	10.52	26.3%	25.91	64.8%
		Proposed	µg/m^3	40	15.39	9.78	10.52	9.21	8.98	9.17	10.52	26.3%	25.91	64.8%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	**115.7%**
		Proposed	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	**115.7%**
		Maximum increase	µg/m^3	50	15.39	0.78	0.66	0.96	1.03	1.14	1.14	2.3%	-	-
Particulate matter (as $PM_{2.5}$) - including dust units	Annual mean	Existing	µg/m^3	20	10.94	9.78	10.52	9.21	8.98	9.17	10.52	52.6%	21.46	**107.3%**
		Proposed	µg/m^3	20	10.94	9.78	10.52	9.21	8.98	9.17	10.52	52.6%	21.46	**107.3%**
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.5%	-	-

Notes:
Change in impact calculated as the maximum change in impact at any grid point, so may be different to the difference between the peak impact for the Existing and Proposed scenario as the peaks may occur in different locations.

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Table 36: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	2.06	5.2%	2.68	6.7%	0.61	1.5%	13.52	33.8%
Lodge Farm	1.50	3.8%	1.91	4.8%	0.41	1.0%	12.75	31.9%
Lodgefield Park	2.05	5.1%	2.64	6.6%	0.59	1.5%	13.48	33.7%
Rhosywaun	4.33	10.8%	5.64	14.1%	1.31	3.3%	16.48	41.2%
Chirk Community Hospital	2.76	6.9%	3.50	8.7%	0.74	1.8%	14.34	35.8%
Chirk Infant School	3.22	8.0%	3.81	9.5%	0.60	1.5%	14.65	36.6%
Highfield Farm	2.48	6.2%	2.97	7.4%	0.49	1.2%	13.81	34.5%
Maes-y-Waun	1.73	4.3%	2.21	5.5%	0.49	1.2%	13.05	32.6%
Collery Road	1.54	3.8%	2.00	5.0%	0.46	1.1%	12.84	32.1%
St Mary's Church	0.53	1.3%	0.65	1.6%	0.12	0.3%	11.49	28.7%
Station Avenue	2.36	5.9%	3.14	7.9%	0.78	2.0%	13.98	35.0%
Llwyn-y-cil	1.44	3.6%	1.80	4.5%	0.35	0.9%	12.64	31.6%
New Hall	0.93	2.3%	1.19	3.0%	0.27	0.7%	12.03	30.1%
Chirk Court	2.15	5.4%	2.69	6.7%	0.54	1.4%	13.53	33.8%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m^3 where appropriate. A background concentration of 10.84 µg/m^3 has been applied to calculate the PEC.

Table 37: Dispersion Modelling Results – Impact at Receptors - 99.79%ile 1-hour Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	16.75	8.4%	20.98	10.5%	4.24	2.1%	42.66	21.3%
Lodge Farm	13.10	6.6%	15.80	7.9%	2.70	1.4%	37.48	18.7%
Lodgefield Park	16.14	8.1%	19.57	9.8%	3.43	1.7%	41.25	20.6%
Rhosywaun	23.57	11.8%	26.48	13.2%	2.91	1.5%	48.16	24.1%
Chirk Community Hospital	15.85	7.9%	18.29	9.1%	2.44	1.2%	39.97	20.0%
Chirk Infant School	21.40	10.7%	23.50	11.7%	2.10	1.0%	45.18	22.6%
Highfield Farm	14.37	7.2%	16.07	8.0%	1.70	0.8%	37.75	18.9%
Maes-y-Waun	24.93	12.5%	27.53	13.8%	2.59	1.3%	49.21	24.6%
Collery Road	25.27	12.6%	28.44	14.2%	3.17	1.6%	50.12	25.1%
St Mary's Church	8.87	4.4%	10.40	5.2%	1.53	0.8%	32.08	16.0%
Station Avenue	28.20	14.1%	31.86	15.9%	3.65	1.8%	53.54	26.8%
Llwyn-y-cil	25.60	12.8%	28.29	14.1%	2.69	1.3%	49.97	25.0%
New Hall	16.08	8.0%	18.79	9.4%	2.71	1.4%	40.47	20.2%
Chirk Court	23.29	11.6%	26.13	13.1%	2.84	1.4%	47.81	23.9%

NOTES:
A comparison made to the annual mean AQAL of 200 µg/m³ where appropriate. A background concentration of 2 x 10.84 µg/m³ has been applied to calculate the PEC.

Table 38: Dispersion Modelling Results – Impact at Receptors - Annual Mean Formaldehyde

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	0.49	9.8%	0.50	10.1%	0.013	0.3%	1.50	30.1%
Lodge Farm	0.35	7.1%	0.36	7.3%	0.010	0.2%	1.36	27.3%
Lodgefield Park	0.48	9.6%	0.50	9.9%	0.013	0.3%	1.50	29.9%
Rhosywaun	1.09	21.9%	1.12	22.3%	0.024	0.5%	2.12	42.3%
Chirk Community Hospital	0.65	13.0%	0.67	13.3%	0.018	0.4%	1.67	33.3%
Chirk Infant School	0.82	16.5%	0.84	16.8%	0.013	0.3%	1.84	36.8%
Highfield Farm	0.60	12.0%	0.62	12.3%	0.015	0.3%	1.62	32.3%
Maes-y-Waun	0.43	8.6%	0.44	8.8%	0.008	0.2%	1.44	28.8%
Collery Road	0.38	7.7%	0.39	7.8%	0.008	0.2%	1.39	27.8%
St Mary's Church	0.13	2.5%	0.13	2.6%	0.003	0.1%	1.13	22.6%
Station Avenue	0.59	11.8%	0.60	12.0%	0.012	0.2%	1.60	32.0%
Llwyn-y-cil	0.36	7.3%	0.37	7.4%	0.008	0.2%	1.37	27.4%
New Hall	0.23	4.5%	0.23	4.7%	0.007	0.1%	1.23	24.7%
Chirk Court	0.54	10.8%	0.55	11.0%	0.008	0.2%	1.55	31.0%

NOTES:

A comparison made to the annual mean AQAL of 5 µg/m³ where appropriate. A background concentration of 1 µg/m³ has been applied to calculate the PEC.

Table 39: Dispersion Modelling Results – Impact at Receptors - Maximum 30-minute Mean Formaldehyde

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	8.90	8.9%	9.17	9.2%	0.27	0.3%	11.17	11.2%
Lodge Farm	13.10	13.1%	9.82	9.8%	-3.28	-3.3%	11.82	11.8%
Lodgefield Park	16.14	16.1%	9.28	9.3%	-6.86	-6.9%	11.28	11.3%
Rhosywaun	23.57	23.6%	13.40	13.4%	-10.17	-10.2%	15.40	15.4%
Chirk Community Hospital	15.85	15.9%	12.60	12.6%	-3.25	-3.2%	14.60	14.6%
Chirk Infant School	21.40	21.4%	11.80	11.8%	-9.60	-9.6%	13.80	13.8%
Highfield Farm	14.37	14.4%	12.66	12.7%	-1.71	-1.7%	14.66	14.7%
Maes-y-Waun	24.93	24.9%	13.94	13.9%	-10.99	-11.0%	15.94	15.9%
Collery Road	25.27	25.3%	14.59	14.6%	-10.68	-10.7%	16.59	16.6%
St Mary's Church	8.87	8.9%	10.40	10.4%	1.54	1.5%	12.40	12.4%
Station Avenue	28.20	28.2%	15.49	15.5%	-12.72	-12.7%	17.49	17.5%
Llwyn-y-cil	25.60	25.6%	14.45	14.5%	-11.14	-11.1%	16.45	16.5%
New Hall	16.08	16.1%	11.83	11.8%	-4.25	-4.3%	13.83	13.8%
Chirk Court	23.29	23.3%	13.38	13.4%	-9.90	-9.9%	15.38	15.4%

NOTES:
A comparison made to the annual mean AQAL of 100 µg/m³ where appropriate. A background concentration of 2 x 1 µg/m³ has been applied to calculate the PEC.

Table 40: Dispersion Modelling Results – Impact at Receptors - Maximum Annual Mean PM (as PM10)

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	2.09	5.2%	2.15	5.4%	0.06	0.1%	17.54	43.8%
Lodge Farm	1.41	3.5%	1.46	3.6%	0.04	0.1%	16.85	42.1%
Lodgefield Park	2.15	5.4%	2.21	5.5%	0.06	0.1%	17.60	44.0%
Rhosywaun	4.97	12.4%	5.08	12.7%	0.11	0.3%	20.47	51.2%
Chirk Community Hospital	2.59	6.5%	2.66	6.7%	0.08	0.2%	18.05	45.1%
Chirk Infant School	3.59	9.0%	3.65	9.1%	0.06	0.2%	19.04	47.6%
Highfield Farm	2.04	5.1%	2.10	5.3%	0.06	0.2%	17.49	43.7%
Maes-y-Waun	2.17	5.4%	2.21	5.5%	0.04	0.1%	17.60	44.0%
Collery Road	1.78	4.5%	1.82	4.5%	0.04	0.1%	17.21	43.0%
St Mary's Church	0.46	1.2%	0.48	1.2%	0.01	0.0%	15.87	39.7%
Station Avenue	2.88	7.2%	2.94	7.3%	0.06	0.1%	18.33	45.8%
Llwyn-y-cil	1.69	4.2%	1.73	4.3%	0.04	0.1%	17.12	42.8%
New Hall	0.99	2.5%	1.02	2.6%	0.03	0.1%	16.41	41.0%
Chirk Court	2.82	7.0%	2.86	7.1%	0.04	0.1%	18.25	45.6%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 15.39 µg/m³ has been applied to calculate the PEC.
Assumes the entire dust emissions consist of only PM_{10}.

Table 41: Dispersion Modelling Results – Impact at Receptors - Maximum 90.41 %ile of Daily Mean PM (as PM10)

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	7.27	14.5%	7.43	14.9%	0.17	0.3%	22.82	45.6%
Lodge Farm	4.36	8.7%	4.49	9.0%	0.12	0.2%	19.88	39.8%
Lodgefield Park	6.57	13.1%	6.78	13.6%	0.21	0.4%	22.17	44.3%
Rhosywaun	13.52	27.0%	13.98	28.0%	0.47	0.9%	29.37	58.7%
Chirk Community Hospital	7.31	14.6%	7.51	15.0%	0.20	0.4%	22.90	45.8%
Chirk Infant School	10.10	20.2%	10.36	20.7%	0.26	0.5%	25.75	51.5%
Highfield Farm	6.19	12.4%	6.26	12.5%	0.07	0.1%	21.65	43.3%
Maes-y-Waun	7.66	15.3%	7.78	15.6%	0.12	0.2%	23.17	46.3%
Collery Road	6.80	13.6%	6.84	13.7%	0.04	0.1%	22.23	44.5%
St Mary's Church	1.69	3.4%	1.76	3.5%	0.07	0.1%	17.15	34.3%
Station Avenue	10.40	20.8%	10.71	21.4%	0.31	0.6%	26.10	52.2%
Llwyn-y-cil	8.16	16.3%	8.58	17.2%	0.42	0.8%	23.97	47.9%
New Hall	3.92	7.8%	3.93	7.9%	0.01	0.0%	19.32	38.6%
Chirk Court	8.55	17.1%	8.61	17.2%	0.06	0.1%	24.00	48.0%

NOTES:
A comparison made to the annual mean AQAL of 50 µg/m^3 where appropriate. A background concentration of 2 x 15.39 µg/m^3 has been applied to calculate the PEC.
Assumes the entire dust emissions consist of only PM_{10}.

Table 42: Dispersion Modelling Results – Impact at Receptors - Maximum Annual Mean PM (as PM2.5)

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	2.09	10.4%	2.15	10.7%	0.06	0.3%	13.09	65.4%
Lodge Farm	1.41	7.1%	1.46	7.3%	0.04	0.2%	12.40	62.0%
Lodgefield Park	2.15	10.8%	2.21	11.0%	0.06	0.3%	13.15	65.7%
Rhosywaun	4.97	24.8%	5.08	25.4%	0.11	0.5%	16.02	80.1%
Chirk Community Hospital	2.59	12.9%	2.66	13.3%	0.08	0.4%	13.60	68.0%
Chirk Infant School	3.59	17.9%	3.65	18.3%	0.06	0.3%	14.59	73.0%
Highfield Farm	2.04	10.2%	2.10	10.5%	0.06	0.3%	13.04	65.2%
Maes-y-Waun	2.17	10.8%	2.21	11.0%	0.04	0.2%	13.15	65.7%
Collery Road	1.78	8.9%	1.82	9.1%	0.04	0.2%	12.76	63.8%
St Mary's Church	0.46	2.3%	0.48	2.4%	0.01	0.1%	11.42	57.1%
Station Avenue	2.88	14.4%	2.94	14.7%	0.06	0.3%	13.88	69.4%
Llwyn-y-cil	1.69	8.5%	1.73	8.7%	0.04	0.2%	12.67	63.4%
New Hall	0.99	5.0%	1.02	5.1%	0.03	0.2%	11.96	59.8%
Chirk Court	2.82	14.1%	2.86	14.3%	0.04	0.2%	13.80	69.0%

NOTES:

A comparison made to the annual mean AQAL of 20 µg/m^3 where appropriate. A background concentration of 10.94 µg/m^3 has been applied to calculate the PEC.

Assumes the entire dust emissions consist of only $PM_{2.5}$.

Table 43: Impact at River Dee and Bala Lake SAC

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.3	2.04	1.72	1.37	2.08	1.84	2.08	6.9%	13.38	44.6%
	Proposed	µg/m³	30	11.3	2.62	2.19	1.74	2.69	2.37	2.69	9.0%	13.99	46.6%
	Maximum increase	µg/m³	30	-	0.58	0.48	0.38	0.61	0.53	0.61	2.0%	-	-
Daily mean	Existing EP	µg/m³	200	22.6	26.43	34.93	25.70	28.09	23.46	34.93	17.5%	57.53	28.8%
	Proposed	µg/m³	200	22.6	31.16	42.13	30.51	32.40	28.57	42.13	21.1%	64.73	32.4%
	Maximum increase	µg/m³	200	-	5.29	7.20	5.56	6.47	5.67	7.20	3.6%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 44: Impact at Johnstown Newt Sites

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.2	0.26	0.28	0.29	0.27	0.31	0.31	1.0%	11.51	38.4%
	Proposed	µg/m³	30	11.2	0.31	0.33	0.34	0.32	0.37	0.37	1.2%	11.57	38.6%
	Maximum increase	µg/m³	30	-	0.05	0.06	0.05	0.05	0.06	0.06	0.2%	-	-
Daily mean	Existing EP	µg/m³	200	22.4	3.22	4.21	2.48	4.42	3.95	4.42	2.2%	26.82	13.4%
	Proposed	µg/m³	200	22.4	3.76	4.75	2.96	5.26	4.67	5.26	2.6%	27.66	13.8%
	Maximum increase	µg/m³	200	-	0.55	0.55	0.48	0.84	0.72	0.84	0.4%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 45: Impact at Berwyn and South Clyde Mountains SAC

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	7.2	0.28	0.26	0.24	0.24	0.29	0.29	1.0%	7.49	25.0%
	Proposed	µg/m³	30	7.2	0.34	0.32	0.29	0.29	0.35	0.35	1.2%	7.55	25.2%
	Maximum increase	µg/m³	30	-	0.06	0.06	0.05	0.05	0.06	0.06	0.2%	-	-
Daily mean	Existing EP	µg/m³	200	14.4	3.54	3.68	4.07	4.03	2.83	4.07	2.0%	18.47	9.2%
	Proposed	µg/m³	200	14.4	4.18	4.63	4.83	4.86	3.50	4.86	2.4%	19.26	9.6%
	Maximum increase	µg/m³	200	-	0.64	0.95	0.76	0.83	0.68	0.95	0.5%	-	-
NOTES: PC calculated for a single point closest to the Facility.													

Table 46: Impact at Berwyn SPA

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	4.5	0.18	0.23	0.17	0.17	0.17	0.23	0.8%	4.73	15.8%
	Proposed	µg/m³	30	4.5	0.22	0.27	0.20	0.20	0.20	0.27	0.9%	4.77	15.9%
	Maximum increase	µg/m³	30	-	0.04	0.05	0.03	0.03	0.03	0.05	0.2%	-	-
Daily mean	Existing EP	µg/m³	200	9.0	2.32	3.35	2.63	2.39	2.49	3.35	1.7%	12.35	6.2%
	Proposed	µg/m³	200	9.0	2.67	4.05	3.18	2.79	2.96	4.05	2.0%	13.05	6.5%
	Maximum increase	µg/m³	200	-	0.35	0.69	0.55	0.40	0.47	0.69	0.3%	-	-
NOTES: PC calculated for a single point closest to the Facility.													

Table 47: Impact at Chirk Castle SSSI

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	2.39	2.53	2.40	2.00	1.84	2.53	8.4%	15.53	51.8%
	Proposed	µg/m³	30	13.0	3.04	3.24	3.06	2.61	2.36	3.24	10.8%	16.24	54.1%
	Maximum increase	µg/m³	30	-	0.77	0.86	0.77	0.66	0.64	0.86	2.9%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	49.37	38.38	42.70	44.41	45.07	49.37	24.7%	75.37	37.7%
	Proposed	µg/m³	200	26.0	53.28	45.99	48.01	52.55	49.17	53.28	26.6%	79.28	39.6%
	Maximum increase	µg/m³	200	-	10.76	11.93	9.92	15.41	14.10	15.41	7.7%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 48: Impact at Nant-Y-Belan and Prynella Woods SSSI

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.3	0.88	0.96	1.05	0.85	0.81	1.05	3.5%	12.35	41.2%
	Proposed	µg/m³	30	11.3	1.11	1.20	1.31	1.07	1.01	1.31	4.4%	12.61	42.0%
	Maximum increase	µg/m³	30	-	0.22	0.24	0.26	0.22	0.20	0.26	0.9%	-	-
Daily mean	Existing EP	µg/m³	200	22.6	8.41	9.28	7.59	6.32	7.39	9.28	4.6%	31.88	15.9%
	Proposed	µg/m³	200	22.6	10.16	11.20	9.02	7.65	8.83	11.20	5.6%	33.80	16.9%
	Maximum increase	µg/m³	200	-	1.75	1.92	1.47	1.67	1.53	1.92	1.0%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 49: Impact at Barracks Fields LWS

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.0	1.63	1.67	1.98	1.41	1.53	1.98	6.6%	12.98	43.3%
	Proposed	µg/m³	30	11.0	2.03	2.10	2.46	1.78	1.92	2.46	8.2%	13.46	44.9%
	Maximum increase	µg/m³	30	-	0.40	0.43	0.48	0.37	0.38	0.48	1.6%	-	-
Daily mean	Existing EP	µg/m³	200	22.0	13.91	12.86	16.59	13.98	13.37	16.59	8.3%	38.59	19.3%
	Proposed	µg/m³	200	22.0	16.90	15.57	19.63	16.87	16.54	19.63	9.8%	41.63	20.8%
	Maximum increase	µg/m³	200	-	2.99	2.71	3.08	2.89	3.19	3.19	1.6%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 50: Impact at Canal Wood

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	3.18	2.91	3.32	3.25	3.64	3.64	12.1%	16.64	55.5%
	Proposed	µg/m³	30	13.0	4.05	3.73	4.28	4.19	4.56	4.56	15.2%	17.56	58.5%
	Maximum increase	µg/m³	30	-	1.13	0.84	1.10	0.94	0.97	1.13	3.8%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	44.59	37.66	39.94	45.02	55.95	55.95	28.0%	81.95	41.0%
	Proposed	µg/m³	200	26.0	89.03	51.03	60.82	89.80	69.84	89.80	44.9%	115.80	57.9%
	Maximum increase	µg/m³	200	-	44.44	15.78	30.33	44.78	28.02	44.78	22.4%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 51: Impact at Ancient Woodlands

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	3.21	3.08	3.70	3.24	2.87	3.70	12.3%	16.70	55.7%
	Proposed	µg/m³	30	13.0	4.10	3.94	4.69	4.20	3.69	4.69	15.6%	17.69	59.0%
	Maximum increase	µg/m³	30	-	0.90	0.87	0.99	0.97	0.82	0.99	3.3%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	48.62	45.46	42.70	44.41	45.07	48.62	24.3%	74.62	37.3%
	Proposed	µg/m³	200	26.0	53.28	54.55	48.86	52.55	49.17	54.55	27.3%	80.55	40.3%
	Maximum increase	µg/m³	200	-	10.76	11.93	9.92	11.32	14.10	14.10	7.0%	-	-

NOTES:
PC calculated as maximum across the grid points within any ancient woodland in the modelling domain.

Table 52: Annual Mean PC for Deposition Analysis

Site	Annual mean Process Contribution (µg/m³)				
	Nitrogen dioxide (existing EP)	Nitrogen dioxide (Proposed ELV)	Sulphur dioxide	Hydrogen chloride	Ammonia
River Dee and Bala Lake SAC, SSSI	1.457	1.885	0.105	0.019	0.009
Johnstown Newt Sites SAC	0.216	0.259	0.018	0.003	0.001
Berwyn and South Clwyd Mountains SAC	0.200	0.243	0.016	0.003	0.001
Berwyn SPA	0.161	0.192	0.013	0.002	0.001
Chirk Castle SSSI	1.769	2.268	0.136	0.025	0.010
Nant-y-belan & Prynella Woods SSSI	0.738	0.918	0.058	0.011	0.004
Barracks Field	1.383	1.722	0.108	0.020	0.007
Ceod-Y-Canal Wood	2.548	3.193	0.193	0.035	0.014
Various Ancient Woodlands	2.588	3.280	0.196	0.036	0.014

Deposition of sulphur, hydrogen chloride and ammonia are the for the existing EP and proposed ELV scenarios. The NOx changes means that the overall N, and acid N deposition changes but acid S deposition remains the same.

Table 53: Deposition Calculation - Grassland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Existing EP							
River Dee and Bala Lake SAC, SSSI	0.210	0.198	0.298	0.046	0.256	0.018	0.021
Johnstown Newt Sites SAC	0.031	0.034	0.050	0.006	0.037	0.003	0.004
Berwyn and South Clwyd Mountains SAC	0.029	0.031	0.046	0.006	0.035	0.002	0.003
Berwyn SPA	0.023	0.025	0.038	0.005	0.028	0.002	0.003
Chirk Castle SSSI	0.255	0.257	0.384	0.052	0.307	0.022	0.027
Nant-y-belan & Prynella Woods SSSI	0.106	0.109	0.162	0.020	0.126	0.009	0.011
Barracks Field	0.199	0.204	0.303	0.036	0.235	0.017	0.021
Ceod-Y-Canal Wood	0.367	0.365	0.544	0.071	0.438	0.031	0.038
Various Ancient Woodlands	0.373	0.371	0.550	0.074	0.446	0.032	0.039
Proposed ELV							
River Dee and Bala Lake SAC, SSSI	0.271	0.198	0.298	0.046	0.317	0.023	0.021
Johnstown Newt Sites SAC	0.037	0.034	0.050	0.006	0.044	0.003	0.004
Berwyn and South Clwyd Mountains SAC	0.035	0.031	0.046	0.006	0.041	0.003	0.003
Berwyn SPA	0.028	0.025	0.038	0.005	0.032	0.002	0.003
Chirk Castle SSSI	0.327	0.257	0.384	0.052	0.378	0.027	0.027
Nant-y-belan & Prynella Woods SSSI	0.132	0.109	0.162	0.020	0.152	0.011	0.011
Barracks Field	0.248	0.204	0.303	0.036	0.284	0.020	0.021
Ceod-Y-Canal Wood	0.460	0.365	0.544	0.071	0.531	0.038	0.038
Various Ancient Woodlands	0.472	0.371	0.550	0.074	0.546	0.039	0.039

Table 54: Deposition Calculation - Woodland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Existing EP							
River Dee and Bala Lake SAC, SSSI	0.420	0.396	0.715	0.069	0.489	0.035	0.045
Johnstown Newt Sites SAC	0.062	0.068	0.121	0.010	0.072	0.005	0.008
Berwyn and South Clwyd Mountains SAC	0.058	0.062	0.111	0.009	0.067	0.005	0.007
Berwyn SPA	0.046	0.051	0.091	0.007	0.053	0.004	0.006
Chirk Castle SSSI	0.509	0.514	0.921	0.078	0.587	0.042	0.058
Nant-y-belan & Prynella Woods SSSI	0.213	0.218	0.389	0.030	0.242	0.017	0.025
Barracks Field	0.398	0.409	0.728	0.054	0.453	0.032	0.046
Ceod-Y-Canal Wood	0.734	0.729	1.305	0.106	0.840	0.060	0.082
Various Ancient Woodlands	0.745	0.741	1.320	0.111	0.856	0.061	0.084
Proposed ELV							
River Dee and Bala Lake SAC, SSSI	0.543	0.396	0.715	0.069	0.612	0.044	0.045
Johnstown Newt Sites SAC	0.075	0.068	0.121	0.010	0.084	0.006	0.008
Berwyn and South Clwyd Mountains SAC	0.070	0.062	0.111	0.009	0.079	0.006	0.007
Berwyn SPA	0.055	0.051	0.091	0.007	0.062	0.004	0.006
Chirk Castle SSSI	0.653	0.514	0.921	0.078	0.731	0.052	0.058
Nant-y-belan & Prynella Woods SSSI	0.264	0.218	0.389	0.030	0.294	0.021	0.025
Barracks Field	0.496	0.409	0.728	0.054	0.550	0.039	0.046
Ceod-Y-Canal Wood	0.920	0.729	1.305	0.106	1.026	0.073	0.082
Various Ancient Woodlands	0.945	0.741	1.320	0.111	1.055	0.075	0.084

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Table 55: Nitrogen Deposition

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Existing EP ELVs									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.256	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.037	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.035	0.7%	0.3%	427.9%	213.9%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.035	0.7%	0.3%	427.9%	213.9%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.035	0.3%	0.2%	213.9%	142.6%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.035	0.3%	0.2%	213.9%	107.0%
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.035	0.2%	0.1%	142.6%	85.6%
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.053	0.5%	0.3%	355.3%	177.7%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.028	0.3%	0.1%	248.2%	124.1%
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.587	5.9%	2.9%	398.9%	199.4%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.307	1.5%	1.0%	125.2%	83.5%
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.242	2.4%	1.2%	479.8%	239.9%
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.235	1.2%	0.8%	124.9%	83.3%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	0.840	8.4%	4.2%	401.4%	200.7%
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	0.856	8.6%	4.3%	492.3%	246.1%
Proposed ELVs									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.317	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.044	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.041	0.8%	0.4%	428.0%	214.0%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.041	0.8%	0.4%	428.0%	214.0%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.041	0.4%	0.3%	214.0%	142.7%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.041	0.4%	0.2%	214.0%	107.0%
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.041	0.3%	0.2%	142.7%	85.6%
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.062	0.6%	0.3%	355.4%	177.7%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.032	0.3%	0.2%	248.2%	124.1%
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.731	7.3%	3.7%	400.3%	200.2%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.378	1.9%	1.3%	125.6%	83.7%
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.294	2.9%	1.5%	480.3%	240.2%
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.284	1.4%	0.9%	125.1%	83.4%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	1.026	10.3%	5.1%	403.3%	201.6%
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	1.055	10.6%	5.3%	494.3%	247.1%

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Change in impact									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.062	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.006	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.006	0.12%	0.06%	-	-
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.006	0.12%	0.06%	-	-
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.006	0.06%	0.04%	-	-
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.006	0.06%	0.03%	-	-
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.006	0.04%	0.02%	-	-
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.009	0.09%	0.05%	-	-
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.005	0.05%	0.02%	-	-
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.173	1.73%	0.87%	-	-
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.087	0.43%	0.29%	-	-
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.052	0.52%	0.26%	-	-
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.049	0.24%	0.16%	-	-
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	0.227	2.27%	1.14%	-	-
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	0.199	1.99%	1.00%	-	-

Table 56: Acid Deposition

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Existing EP									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	0.018	0.021	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	0.003	0.004	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.002	0.003	1.0%	0.1%	307.8%	38.9%
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.002	0.003	0.9%	0.4%	256.9%	124.0%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	0.002	0.003	0.6%	0.1%	192.3%	33.4%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	0.002	0.003	0.1%	0.1%	34.9%	32.3%
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.004	0.006	1.1%	0.2%	314.6%	71.2%
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.042	0.058	5.4%	5.3%	166.8%	164.4%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.022	0.027	1.0%	1.0%	40.7%	40.7%
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.022	0.027	4.3%	4.3%	176.2%	176.2%
Nant-y-Belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.017	0.025	2.2%	1.1%	197.0%	97.6%
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	0.017	0.021	0.8%	0.8%	38.8%	38.8%
Barracks Field	Acid grassland	1.77	0.16	0.017	0.021	1.8%	1.8%	94.3%	94.3%
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.060	0.082	7.6%	7.6%	169.1%	169.1%
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.061	0.084	7.8%	7.8%	206.3%	206.3%
Proposed ELV									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	0.023	0.021	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	0.003	0.004	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.003	0.003	1.1%	0.1%	307.8%	38.9%
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.003	0.003	0.9%	0.5%	257.0%	124.1%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	0.003	0.003	0.7%	0.1%	192.3%	33.4%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	0.003	0.003	0.1%	0.1%	34.9%	32.3%
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.004	0.006	1.1%	0.3%	314.6%	71.2%
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.052	0.058	5.9%	5.8%	167.4%	164.9%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.027	0.027	1.1%	1.1%	40.9%	40.9%
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.027	0.027	4.8%	4.8%	176.7%	176.7%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.021	0.025	2.4%	1.2%	197.2%	97.7%
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	0.020	0.021	0.8%	0.8%	38.9%	38.9%
Barracks Field	Acid grassland	1.77	0.16	0.020	0.021	2.0%	2.0%	94.4%	94.4%
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.073	0.082	8.3%	8.3%	169.8%	169.8%
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.075	0.084	8.5%	8.5%	207.0%	207.0%
Change in impact									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	4.4E-03	0.0E+00	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	4.4E-04	0.0E+00	-	-	-	-

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	4.3E-04	0.0E+00	0.08%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	4.3E-04	0.0E+00	0.07%	0.03%	-	-
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	4.3E-04	0.0E+00	0.05%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	4.3E-04	0.0E+00	0.01%	0.01%	-	-
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	6.5E-04	0.0E+00	0.07%	0.02%	-	-
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	1.2E-02	0.0E+00	0.66%	0.65%	-	-
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	6.2E-03	0.0E+00	0.13%	0.13%	-	-
Chirk Castle SSSI	Acid grassland	1.77	0.16	6.2E-03	0.0E+00	0.55%	0.55%	-	-
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	3.7E-03	0.0E+00	0.20%	0.10%	-	-
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	3.5E-03	0.0E+00	0.07%	0.07%	-	-
Barracks Field	Acid grassland	1.77	0.16	3.5E-03	0.0E+00	0.17%	0.17%	-	-
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	1.6E-02	0.0E+00	0.87%	0.87%	-	-
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	1.4E-02	0.0E+00	0.76%	0.76%	-	-

E Detailed Results Tables – MDF 2 Offline

If the MDF 2 drier is offline:

- the MDF 1 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and two gas engines;
- the electricity needed on site would be reduced so only 3 gas engines would be needed; and
- the exhaust gases of two engines would be used in MDF 1 drier, and one of the engines would need to vent to atmosphere via its own dedicated stack.

Table 57: MDF 2 Offline - Maximum Impact outside Installation Boundary

Pollutant	Quantity	Scenario	Units	AQAL	Bg Conc	Process Contribution (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC = Bg)	PEC as % of AQAL
						2018	2019	2020	2021	2022	Max			
Nitrogen dioxide	Annual mean	Existing	µg/m³	40	10.84	2.84	2.95	3.47	2.80	2.57	3.47	8.7%	14.31	35.8%
		Proposed	µg/m³	40	10.84	3.10	3.20	3.75	3.27	2.90	3.75	9.4%	14.59	36.5%
		Maximum increase	µg/m³	40	10.84	0.45	0.39	0.29	0.48	0.42	0.48	1.2%	-	-
	99.79%ile of 1-hour means	Existing	µg/m³	200	21.68	51.58	54.51	70.91	48.89	54.42	70.91	35.5%	92.59	46.3%
		Proposed	µg/m³	200	21.68	58.90	63.22	82.09	55.50	62.96	82.09	41.0%	103.77	51.9%
		Maximum increase	µg/m³	200	21.68	4.25	4.05	3.99	4.11	4.32	4.32	2.2%	-	-
Formaldehyde	Annual mean	Existing	µg/m³	5	1	0.66	0.67	0.74	0.71	0.65	0.74	14.9%	1.74	34.9%
		Proposed	µg/m³	5	1	0.66	0.69	0.77	0.71	0.65	0.77	15.3%	1.77	35.3%
		Maximum increase	µg/m³	5	1	0.02	0.02	0.02	0.02	0.02	0.02	0.5%	-	-
	Maximum 30-minute mean	Existing	µg/m³	100	2	22.37	20.63	24.38	25.74	25.44	25.74	25.7%	27.74	27.7%
		Proposed	µg/m³	100	2	22.46	20.63	24.50	25.73	25.43	25.73	25.7%	27.73	27.7%
		Maximum increase	µg/m³	100	2	1.11	1.29	1.04	1.34	1.58	1.58	1.6%	-	-
TVOC	Annual mean	Existing	µg/m³	-	-	6.25	6.26	7.14	6.51	6.12	7.14	-	-	-
		Proposed	µg/m³	-	-	6.03	6.17	7.08	6.31	5.95	7.08	-	-	-
		Maximum increase	µg/m³	-	-	0.02	0.02	0.04	0.01	0.02	0.04	-	-	-
	Maximum daily mean	Existing	µg/m³	-	-	64.83	75.67	64.75	66.64	63.03	75.67	-	-	-
		Proposed	µg/m³	-	-	64.76	74.20	63.69	66.73	61.51	74.20	-	-	-
		Maximum increase	µg/m³	-	-	2.15	0.94	1.19	3.08	1.19	3.08	-	-	-
Particulate matter (as PM_{10}) - excluding dust units	Annual mean	Existing	µg/m³	40	15.39	2.01	1.78	1.88	2.13	1.94	2.13	5.3%	17.52	43.8%
		Proposed	µg/m³	40	15.39	2.03	1.83	1.98	2.15	1.96	2.15	5.4%	17.54	43.8%
		Maximum increase	µg/m³	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m³	50	15.39	7.44	7.30	5.73	8.08	7.46	8.08	16.2%	23.47	46.9%
		Proposed	µg/m³	50	15.39	7.43	7.32	6.13	8.42	7.48	8.42	16.8%	23.81	47.6%
		Maximum increase	µg/m³	50	15.39	0.65	0.50	0.55	0.54	0.62	0.65	1.3%	-	-
Particulate matter (as $PM_{2.5}$) - excluding dust units	Annual mean	Existing	µg/m³	20	10.94	2.01	1.78	1.88	2.13	1.94	2.13	10.6%	13.07	65.3%
		Proposed	µg/m³	20	10.94	2.03	1.83	1.98	2.15	1.96	2.15	10.7%	13.09	65.4%
		Maximum increase	µg/m³	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.6%	-	-
Particulate matter (as PM_{10}) - including dust units	Annual mean	Existing	µg/m³	40	15.39	9.77	10.52	9.21	8.97	9.17	10.52	26.3%	25.91	64.8%
		Proposed	µg/m³	40	15.39	9.77	10.52	9.21	8.97	9.17	10.52	26.3%	25.91	64.8%
		Maximum increase	µg/m³	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m³	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	**115.7%**
		Proposed	µg/m³	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	**115.7%**
		Maximum increase	µg/m³	50	15.39	0.84	0.75	0.95	0.81	1.08	1.08	2.2%	-	-
Particulate matter (as $PM_{2.5}$) - including dust units	Annual mean	Existing	µg/m³	20	10.94	9.77	10.52	9.21	8.97	9.17	10.52	52.6%	21.46	**107.3%**
		Proposed	µg/m³	20	10.94	9.77	10.52	9.21	8.97	9.17	10.52	52.6%	21.46	**107.3%**
		Maximum increase	µg/m³	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.6%	-	-

Notes:
Change in impact calculated as the maximum change in impact at any grid point, so may be different to the difference between the peak impact for the Existing and Proposed scenario as the peaks may occur in different locations.

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Table 58: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	1.47	3.7%	1.59	4.0%	0.12	0.3%	12.43	31.1%
Lodge Farm	1.01	2.5%	1.09	2.7%	0.08	0.2%	11.93	29.8%
Lodgefield Park	1.43	3.6%	1.55	3.9%	0.12	0.3%	12.39	31.0%
Rhosywaun	3.26	8.1%	3.52	8.8%	0.26	0.7%	14.36	35.9%
Chirk Community Hospital	1.88	4.7%	2.02	5.1%	0.15	0.4%	12.86	32.2%
Chirk Infant School	1.96	4.9%	2.08	5.2%	0.12	0.3%	12.92	32.3%
Highfield Farm	1.54	3.9%	1.64	4.1%	0.10	0.2%	12.48	31.2%
Maes-y-Waun	1.26	3.2%	1.36	3.4%	0.10	0.2%	12.20	30.5%
Collery Road	1.18	2.9%	1.27	3.2%	0.09	0.2%	12.11	30.3%
St Mary's Church	0.35	0.9%	0.38	0.9%	0.02	0.1%	11.22	28.0%
Station Avenue	1.86	4.6%	2.01	5.0%	0.16	0.4%	12.85	32.1%
Llwyn-y-cil	0.98	2.5%	1.05	2.6%	0.07	0.2%	11.89	29.7%
New Hall	0.66	1.6%	0.71	1.8%	0.05	0.1%	11.55	28.9%
Chirk Court	1.45	3.6%	1.56	3.9%	0.11	0.3%	12.40	31.0%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m^3 where appropriate. A background concentration of 10.84 µg/m^3 has been applied to calculate the PEC.

Table 59: Dispersion Modelling Results – Impact at Receptors - 99.79%ile 1-hour Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	10.70	5.4%	11.56	5.8%	0.85	0.4%	33.24	16.6%
Lodge Farm	7.95	4.0%	8.54	4.3%	0.58	0.3%	30.22	15.1%
Lodgefield Park	10.07	5.0%	10.84	5.4%	0.77	0.4%	32.52	16.3%
Rhosywaun	14.40	7.2%	15.38	7.7%	0.97	0.5%	37.06	18.5%
Chirk Community Hospital	9.38	4.7%	10.07	5.0%	0.68	0.3%	31.75	15.9%
Chirk Infant School	12.44	6.2%	13.25	6.6%	0.82	0.4%	34.93	17.5%
Highfield Farm	8.03	4.0%	8.54	4.3%	0.51	0.3%	30.22	15.1%
Maes-y-Waun	13.80	6.9%	14.57	7.3%	0.77	0.4%	36.25	18.1%
Collery Road	14.22	7.1%	14.99	7.5%	0.76	0.4%	36.67	18.3%
St Mary's Church	5.65	2.8%	6.05	3.0%	0.40	0.2%	27.73	13.9%
Station Avenue	16.53	8.3%	17.60	8.8%	1.07	0.5%	39.28	19.6%
Llwyn-y-cil	14.62	7.3%	15.48	7.7%	0.86	0.4%	37.16	18.6%
New Hall	9.69	4.8%	10.37	5.2%	0.68	0.3%	32.05	16.0%
Chirk Court	14.14	7.1%	14.84	7.4%	0.69	0.3%	36.52	18.3%

NOTES:
A comparison made to the annual mean AQAL of 200 µg/m³ where appropriate. A background concentration of 2 x 10.84 µg/m³ has been applied to calculate the PEC.

Table 60: Impact at River Dee and Bala Lake SAC

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.3	1.46	1.24	0.97	1.50	1.31	1.50	5.0%	12.80	42.7%
	Proposed	µg/m³	30	11.3	1.57	1.33	1.05	1.63	1.42	1.63	5.4%	12.93	43.1%
	Maximum increase	µg/m³	30	-	0.12	0.10	0.08	0.12	0.11	0.12	0.4%	-	-
Daily mean	Existing EP	µg/m³	200	22.6	16.87	23.70	16.25	17.51	15.74	23.70	11.9%	46.30	23.2%
	Proposed	µg/m³	200	22.6	17.93	25.14	17.28	18.80	16.88	25.14	12.6%	47.74	23.9%
	Maximum increase	µg/m³	200	-	1.12	1.44	1.28	1.51	1.14	1.51	0.8%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 61: Impact at Johnstown Newt Sites

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.2	0.15	0.17	0.17	0.16	0.19	0.19	0.6%	11.39	38.0%
	Proposed	µg/m³	30	11.2	0.16	0.18	0.18	0.17	0.20	0.20	0.7%	11.40	38.0%
	Maximum increase	µg/m³	30	-	0.01	0.01	0.01	0.01	0.01	0.01	0.04%	-	-
Daily mean	Existing EP	µg/m³	200	22.4	1.77	2.36	1.45	2.59	2.54	2.59	1.3%	24.99	12.5%
	Proposed	µg/m³	200	22.4	1.88	2.47	1.54	2.76	2.68	2.76	1.4%	25.16	12.6%
	Maximum increase	µg/m³	200	-	0.11	0.11	0.10	0.17	0.14	0.17	0.08%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 62: Impact at Berwyn and South Clyde Mountains SAC

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	7.2	0.17	0.16	0.15	0.15	0.18	0.18	0.6%	7.38	24.6%
	Proposed	µg/m³	30	7.2	0.18	0.17	0.16	0.16	0.19	0.19	0.6%	7.39	24.6%
	Maximum increase	µg/m³	30	-	0.01	0.01	0.01	0.01	0.01	0.01	0.04%	-	-
Daily mean	Existing EP	µg/m³	200	14.4	2.16	2.59	2.36	2.52	1.76	2.59	1.3%	16.99	8.5%
	Proposed	µg/m³	200	14.4	2.32	2.78	2.51	2.69	1.89	2.78	1.4%	17.18	8.6%
	Maximum increase	µg/m³	200	-	0.17	0.19	0.15	0.17	0.14	0.19	0.09%	-	-
NOTES: *PC calculated for a single point closest to the Facility.*													

Table 63: Impact at Berwyn SPA

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	4.5	0.11	0.14	0.10	0.10	0.10	0.14	0.5%	4.64	15.5%
	Proposed	µg/m³	30	4.5	0.12	0.15	0.11	0.11	0.11	0.15	0.5%	4.65	15.5%
	Maximum increase	µg/m³	30	-	0.01	0.01	0.01	0.01	0.01	0.01	0.03%	-	-
Daily mean	Existing EP	µg/m³	200	9.0	1.29	2.08	1.64	1.39	1.52	2.08	1.0%	11.08	5.5%
	Proposed	µg/m³	200	9.0	1.38	2.22	1.75	1.48	1.61	2.22	1.1%	11.22	5.6%
	Maximum increase	µg/m³	200	-	0.09	0.14	0.11	0.09	0.09	0.14	0.07%	-	-
NOTES: *PC calculated for a single point closest to the Facility.*													

Table 64: Impact at Chirk Castle SSSI

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	1.72	1.82	1.72	1.46	1.35	1.82	6.1%	14.82	49.4%
	Proposed	µg/m³	30	13.0	1.86	1.98	1.86	1.59	1.47	1.98	6.6%	14.98	49.9%
	Maximum increase	µg/m³	30	-	0.15	0.17	0.15	0.13	0.13	0.17	0.57%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	24.57	24.39	23.85	25.94	24.58	25.94	13.0%	51.94	26.0%
	Proposed	µg/m³	200	26.0	26.70	26.93	26.08	28.06	27.34	28.06	14.0%	54.06	27.0%
	Maximum increase	µg/m³	200	-	2.96	2.66	2.62	3.32	2.99	3.32	1.66%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 65: Impact at Nant-Y-Belan and Prynella Woods SSSI

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.3	0.58	0.63	0.68	0.56	0.53	0.68	2.3%	11.98	39.9%
	Proposed	µg/m³	30	11.3	0.63	0.68	0.74	0.61	0.57	0.74	2.5%	12.04	40.1%
	Maximum increase	µg/m³	30	-	0.04	0.05	0.05	0.04	0.04	0.05	0.17%	-	-
Daily mean	Existing EP	µg/m³	200	22.6	5.08	4.86	4.33	4.20	4.43	5.08	2.5%	27.68	13.8%
	Proposed	µg/m³	200	22.6	5.43	5.25	4.62	4.54	4.81	5.43	2.7%	28.03	14.0%
	Maximum increase	µg/m³	200	-	0.35	0.38	0.29	0.33	0.38	0.38	0.19%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 66: Impact at Barracks Fields LWS

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	11.0	1.07	1.10	1.27	0.95	1.01	1.27	4.2%	12.27	40.9%
	Proposed	µg/m³	30	11.0	1.15	1.19	1.37	1.02	1.08	1.37	4.6%	12.37	41.2%
	Maximum increase	µg/m³	30	-	0.08	0.09	0.10	0.07	0.08	0.10	0.32%	-	-
Daily mean	Existing EP	µg/m³	200	22.0	8.48	7.69	9.49	8.71	8.68	9.49	4.7%	31.49	15.7%
	Proposed	µg/m³	200	22.0	9.08	8.23	10.10	9.29	9.32	10.10	5.0%	32.10	16.0%
	Maximum increase	µg/m³	200	-	0.60	0.54	0.62	0.58	0.64	0.64	0.32%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 67: Impact at Canal Wood

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	2.64	2.40	2.73	2.67	2.97	2.97	9.9%	15.97	53.2%
	Proposed	µg/m³	30	13.0	2.82	2.57	2.92	2.86	3.16	3.16	10.5%	16.16	53.9%
	Maximum increase	µg/m³	30	-	0.23	0.17	0.22	0.19	0.19	0.23	0.75%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	49.75	32.61	32.67	47.27	34.83	49.75	24.9%	75.75	37.9%
	Proposed	µg/m³	200	26.0	58.60	35.28	38.55	56.08	38.79	58.60	29.3%	84.60	42.3%
	Maximum increase	µg/m³	200	-	8.89	3.81	6.07	8.96	5.60	8.96	4.48%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.

Table 68: Impact at Ancient Woodlands

Quantity	Scenario	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2018	2019	2020	2021	2022	Max			
Annual mean	Existing EP	µg/m³	30	13.0	2.31	2.14	2.51	2.39	2.06	2.51	8.4%	15.51	51.7%
	Proposed	µg/m³	30	13.0	2.49	2.31	2.70	2.58	2.23	2.70	9.0%	15.70	52.3%
	Maximum increase	µg/m³	30	-	0.18	0.17	0.20	0.19	0.16	0.20	0.66%	-	-
Daily mean	Existing EP	µg/m³	200	26.0	25.42	30.73	26.41	26.12	24.58	30.73	15.4%	56.73	28.4%
	Proposed	µg/m³	200	26.0	26.84	32.55	28.00	27.84	27.34	32.55	16.3%	58.55	29.3%
	Maximum increase	µg/m³	200	-	2.93	2.66	2.62	2.66	2.99	2.99	1.49%	-	-

NOTES:
PC calculated as maximum across the grid points within any ancient woodland in the modelling domain.

Table 69: Annual Mean PC for Deposition Analysis

Site	Annual mean Process Contribution (µg/m³)				
	Nitrogen dioxide (existing EP)	Nitrogen dioxide (Proposed ELV)	Sulphur dioxide	Hydrogen chloride	Ammonia
River Dee and Bala Lake SAC, SSSI	1.053	1.138	0.156	0.028	0.009
Johnstown Newt Sites SAC	0.132	0.140	0.021	0.004	0.001
Berwyn and South Clwyd Mountains SAC	0.123	0.132	0.020	0.004	0.001
Berwyn SPA	0.096	0.103	0.016	0.003	0.001
Chirk Castle SSSI	1.274	1.388	0.176	0.032	0.010
Nant-y-belan & Prynella Woods SSSI	0.479	0.515	0.067	0.012	0.004
Barracks Field	0.889	0.957	0.123	0.022	0.007
Ceod-Y-Canal Wood	2.079	2.215	0.240	0.044	0.014
Various Ancient Woodlands	1.755	1.893	0.250	0.046	0.014

Deposition of sulphur, hydrogen chloride and ammonia are the for the existing EP and proposed ELV scenarios. The NOx changes means that the overall N, and acid N deposition changes but acid S deposition remains the same.

Table 70: Deposition Calculation - Grassland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Existing EP							
River Dee and Bala Lake SAC, SSSI	0.152	0.295	0.435	0.046	0.198	0.014	0.031
Johnstown Newt Sites SAC	0.019	0.041	0.060	0.006	0.025	0.002	0.004
Berwyn and South Clwyd Mountains SAC	0.018	0.038	0.056	0.006	0.024	0.002	0.004
Berwyn SPA	0.014	0.030	0.044	0.005	0.019	0.001	0.003
Chirk Castle SSSI	0.184	0.333	0.491	0.052	0.235	0.017	0.035
Nant-y-belan & Prynella Woods SSSI	0.069	0.127	0.188	0.020	0.089	0.006	0.013
Barracks Field	0.128	0.233	0.344	0.036	0.164	0.012	0.024
Ceod-Y-Canal Wood	0.299	0.454	0.670	0.071	0.370	0.026	0.047
Various Ancient Woodlands	0.253	0.473	0.698	0.074	0.326	0.023	0.049
Proposed ELV							
River Dee and Bala Lake SAC, SSSI	0.164	0.295	0.435	0.046	0.210	0.015	0.031
Johnstown Newt Sites SAC	0.020	0.041	0.060	0.006	0.027	0.002	0.004
Berwyn and South Clwyd Mountains SAC	0.019	0.038	0.056	0.006	0.025	0.002	0.004
Berwyn SPA	0.015	0.030	0.044	0.005	0.019	0.001	0.003
Chirk Castle SSSI	0.200	0.333	0.491	0.052	0.252	0.018	0.035
Nant-y-belan & Prynella Woods SSSI	0.074	0.127	0.188	0.020	0.094	0.007	0.013
Barracks Field	0.138	0.233	0.344	0.036	0.174	0.012	0.024
Ceod-Y-Canal Wood	0.319	0.454	0.670	0.071	0.390	0.028	0.047
Various Ancient Woodlands	0.273	0.473	0.698	0.074	0.346	0.025	0.049

Table 71: Deposition Calculation - Woodland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Existing EP							
River Dee and Bala Lake SAC, SSSI	0.303	0.589	1.044	0.069	0.372	0.027	0.066
Johnstown Newt Sites SAC	0.038	0.081	0.144	0.010	0.047	0.003	0.009
Berwyn and South Clwyd Mountains SAC	0.036	0.076	0.134	0.009	0.044	0.003	0.008
Berwyn SPA	0.028	0.060	0.106	0.007	0.035	0.002	0.007
Chirk Castle SSSI	0.367	0.665	1.179	0.078	0.445	0.032	0.075
Nant-y-belan & Prynella Woods SSSI	0.138	0.254	0.450	0.030	0.168	0.012	0.029
Barracks Field	0.256	0.466	0.825	0.054	0.311	0.022	0.052
Ceod-Y-Canal Wood	0.599	0.907	1.607	0.106	0.705	0.050	0.102
Various Ancient Woodlands	0.505	0.946	1.676	0.111	0.616	0.044	0.106
Proposed ELV							
River Dee and Bala Lake SAC, SSSI	0.328	0.589	1.044	0.069	0.397	0.028	0.066
Johnstown Newt Sites SAC	0.040	0.081	0.144	0.010	0.050	0.004	0.009
Berwyn and South Clwyd Mountains SAC	0.038	0.076	0.134	0.009	0.047	0.003	0.008
Berwyn SPA	0.030	0.060	0.106	0.007	0.037	0.003	0.007
Chirk Castle SSSI	0.400	0.665	1.179	0.078	0.477	0.034	0.075
Nant-y-belan & Prynella Woods SSSI	0.148	0.254	0.450	0.030	0.178	0.013	0.029
Barracks Field	0.276	0.466	0.825	0.054	0.330	0.024	0.052
Ceod-Y-Canal Wood	0.638	0.907	1.607	0.106	0.744	0.053	0.102
Various Ancient Woodlands	0.545	0.946	1.676	0.111	0.656	0.047	0.106

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Table 72: Nitrogen Deposition

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Existing EP ELVs									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.198	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.025	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.024	0.5%	0.2%	427.7%	213.8%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.024	0.5%	0.2%	427.7%	213.8%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.024	0.2%	0.2%	213.8%	142.6%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.024	0.2%	0.1%	213.8%	106.9%
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.024	0.2%	0.1%	142.6%	85.5%
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.035	0.3%	0.2%	355.1%	177.6%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.019	0.2%	0.1%	248.1%	124.0%
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.445	4.4%	2.2%	397.4%	198.7%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.235	1.2%	0.8%	124.9%	83.3%
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.168	1.7%	0.8%	479.1%	239.5%
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.164	0.8%	0.5%	124.5%	83.0%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	0.705	7.1%	3.5%	400.1%	200.0%
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	0.616	6.2%	3.1%	489.9%	244.9%
Proposed ELVs									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.210	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.027	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.025	0.5%	0.2%	427.7%	213.8%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.025	0.5%	0.2%	427.7%	213.8%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.025	0.2%	0.2%	213.8%	142.6%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.025	0.2%	0.1%	213.8%	106.9%
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.025	0.2%	0.1%	142.6%	85.5%
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.037	0.4%	0.2%	355.2%	177.6%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.019	0.2%	0.1%	248.1%	124.0%
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.477	4.8%	2.4%	397.8%	198.9%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.252	1.3%	0.8%	125.0%	83.3%
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.178	1.8%	0.9%	479.2%	239.6%
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.174	0.9%	0.6%	124.6%	83.0%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	0.744	7.4%	3.7%	400.4%	200.2%
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	0.656	6.6%	3.3%	490.3%	245.1%

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Change in impact									
River Dee and Bala Lake SAC, SSSI	Not Sensitive	-	-	28.74	0.012	-	-	-	-
Johnstown Newt Sites SAC	Not Sensitive	-	-	28.85	0.001	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.36	0.001	0.02%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.36	0.001	0.02%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.36	0.001	0.01%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.36	0.001	0.01%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Sub-Atlantic semi-dry calcareous grassland	15	25	21.36	0.001	0.01%	0.00%	-	-
Berwyn SPA	Broadleaved deciduous woodland	10	20	35.48	0.002	0.02%	0.01%	-	-
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	24.79	0.001	0.01%	<0.01%	-	-
Chirk Castle SSSI	Fagus Woodland	10	20	39.30	0.035	0.35%	0.17%	-	-
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	24.74	0.017	0.09%	0.06%	-	-
Nant-y-Belan & Prynella Woods SSSI	Fagus Woodland	10	20	47.74	0.010	0.10%	0.05%	-	-
Barracks Field	Low and medium altitude hay meadows	20	30	24.74	0.010	0.05%	0.03%	-	-
Ceod-Y-Canal Wood	Fagus Woodland	10	20	39.30	0.045	0.45%	0.23%	-	-
Various Ancient Woodlands	Fagus Woodland	10	20	48.37	0.040	0.40%	0.20%	-	-

Table 73: Acid Deposition

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Existing EP									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	0.014	0.031	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	0.002	0.004	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.002	0.004	1.0%	0.1%	307.7%	38.9%
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.002	0.004	1.0%	0.1%	307.7%	38.9%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	0.002	0.004	0.9%	0.4%	256.9%	124.0%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	0.002	0.004	0.9%	0.4%	256.9%	124.0%
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.002	0.004	0.6%	0.1%	192.2%	33.4%
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.002	0.004	0.1%	0.1%	34.9%	32.3%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.002	0.007	1.0%	0.2%	314.5%	71.2%
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.032	0.075	5.7%	5.6%	167.2%	164.7%
Nant-y-Belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.017	0.035	1.1%	1.1%	40.8%	40.8%
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	0.017	0.035	4.6%	4.6%	176.4%	176.4%
Barracks Field	Acid grassland	1.77	0.16	0.012	0.029	2.2%	1.1%	196.9%	97.6%
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.012	0.024	0.7%	0.7%	38.8%	38.8%
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.012	0.024	1.7%	1.7%	94.2%	94.2%
Proposed ELV									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	0.015	0.031	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	0.002	0.004	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	0.002	0.004	1.0%	0.1%	307.8%	38.9%
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	0.002	0.004	1.0%	0.1%	307.8%	38.9%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	0.002	0.004	0.9%	0.4%	256.9%	124.0%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	0.002	0.004	0.9%	0.4%	256.9%	124.0%
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	0.002	0.004	0.6%	0.1%	192.3%	33.4%
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.002	0.004	0.1%	0.1%	34.9%	32.3%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	0.003	0.007	1.0%	0.2%	314.5%	71.2%
Chirk Castle SSSI	Acid grassland	1.77	0.16	0.034	0.075	5.8%	5.8%	167.3%	164.8%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	0.018	0.035	1.1%	1.1%	40.8%	40.8%
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	0.018	0.035	4.7%	4.7%	176.5%	176.5%
Barracks Field	Acid grassland	1.77	0.16	0.013	0.029	2.2%	1.1%	197.0%	97.6%
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	0.012	0.024	0.7%	0.7%	38.8%	38.8%
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	0.012	0.024	1.8%	1.8%	94.2%	94.2%
Change in impact									
River Dee and Bala Lake SAC, SSSI	Not sensitive	2.05	0.21	8.8E-04	0.0E+00	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	2.06	0.14	8.9E-05	0.0E+00	-	-	-	-

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Berwyn and South Clwyd Mountains SAC	Montane	1.53	0.16	8.7E-05	0.0E+00	0.02%	0.00%	-	-
Berwyn and South Clwyd Mountains SAC	Bogs	1.53	0.16	8.7E-05	0.0E+00	0.02%	0.00%	-	-
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.53	0.16	8.7E-05	0.0E+00	0.01%	0.01%	-	-
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.53	0.16	8.7E-05	0.0E+00	0.01%	0.01%	-	-
Berwyn SPA	Unmanaged broadleaved / coniferous woodland	2.53	0.26	8.7E-05	0.0E+00	0.01%	0.00%	-	-
Chirk Castle SSSI	Unmanaged broadleaved / coniferous woodland	2.81	0.20	8.7E-05	0.0E+00	0.00%	0.00%	-	-
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.77	0.16	1.3E-04	0.0E+00	0.01%	0.00%	-	-
Chirk Castle SSSI	Acid grassland	1.77	0.16	2.5E-03	0.0E+00	0.13%	0.13%	-	-
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleaved / coniferous woodland	3.41	0.25	1.2E-03	0.0E+00	0.03%	0.03%	-	-
Barracks Field	Calcareous grassland (using base cation)	1.77	0.16	1.2E-03	0.0E+00	0.11%	0.11%	-	-
Barracks Field	Acid grassland	1.77	0.16	7.4E-04	0.0E+00	0.04%	0.02%	-	-
Ceod-Y-Canal Wood	Unmanaged broadleaved / coniferous woodland	2.81	0.20	7.0E-04	0.0E+00	0.01%	0.01%	-	-
Various Ancient Woodlands	Unmanaged broadleaved / coniferous woodland	3.45	0.25	7.0E-04	0.0E+00	0.03%	0.03%	-	-

F Detailed Results Tables – MDF 1 Offline

If the MDF 1 drier is offline:

- the MDF 2 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and four gas engines;
- the electricity needed on site would be reduced so only 4 gas engines would be needed.

Table 74: MDF 1 Offline - Maximum Impact outside Installation Boundary

Pollutant	Quantity	Scenario	Units	AQAL	Bg Conc	Process Contribution (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC = Bg)	PEC as % of AQAL
						2018	2019	2020	2021	2022	Max			
Nitrogen dioxide	Annual mean	Existing	µg/m^3	40	10.84	2.69	2.84	3.39	2.42	2.44	3.39	8.5%	14.23	35.6%
		Proposed	µg/m^3	40	10.84	4.52	4.04	4.77	4.81	4.25	4.81	12.0%	15.65	39.1%
		Maximum increase	µg/m^3	40	10.84	2.24	1.97	1.47	2.38	2.08	2.38	6.0%	-	-
	99.79%ile of 1-hour means	Existing	µg/m^3	200	21.68	23.31	24.04	25.20	22.22	22.87	25.20	12.6%	46.88	23.4%
		Proposed	µg/m^3	200	21.68	42.44	41.17	40.56	41.78	42.94	42.94	21.5%	64.62	32.3%
		Maximum increase	µg/m^3	200	21.68	21.19	20.42	20.28	20.89	21.33	21.33	10.7%	-	-
Formaldehyde	Annual mean	Existing	µg/m^3	5	1	0.79	0.83	0.94	0.71	0.71	0.94	18.7%	1.94	38.7%
		Proposed	µg/m^3	5	1	0.81	0.85	0.96	0.73	0.73	0.96	19.2%	1.96	39.2%
		Maximum increase	µg/m^3	5	1	0.02	0.02	0.02	0.02	0.02	0.02	0.5%	-	-
	Maximum 30-minute mean	Existing	µg/m^3	100	2	22.38	20.63	24.66	25.41	25.35	25.41	25.4%	27.41	27.4%
		Proposed	µg/m^3	100	2	22.47	20.63	25.37	25.40	25.34	25.40	25.4%	27.40	27.4%
		Maximum increase	µg/m^3	100	2	1.20	1.29	1.04	1.32	1.58	1.58	1.6%	-	-
TVOC	Annual mean	Existing	µg/m^3	-	-	7.15	7.55	8.63	6.42	6.47	8.63	-	-	-
		Proposed	µg/m^3	-	-	7.08	7.46	8.57	6.32	6.40	8.57	-	-	-
		Maximum increase	µg/m^3	-	-	0.02	0.02	0.04	0.01	0.02	0.04	-	-	-
	Maximum daily mean	Existing	µg/m^3	-	-	60.95	63.35	61.11	59.57	67.67	67.67	-	-	-
		Proposed	µg/m^3	-	-	60.25	63.10	61.88	59.56	67.15	67.15	-	-	-
		Maximum increase	µg/m^3	-	-	1.66	0.94	1.19	1.73	1.17	1.73	-	-	-
Particulate matter (as PM_{10}) - excluding dust units	Annual mean	Existing	µg/m^3	40	15.39	2.00	1.97	2.14	2.10	1.91	2.14	5.3%	17.53	43.8%
		Proposed	µg/m^3	40	15.39	2.01	2.05	2.24	2.11	1.93	2.24	5.6%	17.63	44.1%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Proposed	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Maximum increase	µg/m^3	50	15.39	0.71	0.50	0.52	0.60	0.69	0.71	1.4%	-	-
Particulate matter (as $PM_{2.5}$) - excluding dust units	Annual mean	Existing	µg/m^3	20	10.94	2.00	1.97	2.14	2.10	1.91	2.14	10.7%	13.08	65.4%
		Proposed	µg/m^3	20	10.94	2.01	2.05	2.24	2.11	1.93	2.24	11.2%	13.18	65.9%
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.6%	-	-
Particulate matter (as PM_{10}) - including dust units	Annual mean	Existing	µg/m^3	40	15.39	9.76	10.51	9.20	8.96	9.16	10.51	26.3%	25.90	64.7%
		Proposed	µg/m^3	40	15.39	9.76	10.51	9.20	8.96	9.16	10.51	26.3%	25.90	64.7%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Proposed	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Maximum increase	µg/m^3	50	15.39	0.90	0.87	0.85	0.78	1.07	1.07	2.1%	-	-
Particulate matter (as $PM_{2.5}$) - including dust units	Annual mean	Existing	µg/m^3	20	10.94	9.76	10.51	9.20	8.96	9.16	10.51	52.5%	21.45	107.2%
		Proposed	µg/m^3	20	10.94	9.76	10.51	9.20	8.96	9.16	10.51	52.5%	21.45	107.2%
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.6%	-	-

Notes:
Change in impact calculated as the maximum change in impact at any grid point, so may be different to the difference between the peak impact for the Existing and Proposed scenario as the peaks may occur in different locations.

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Table 75: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	1.48	3.7%	2.10	5.2%	0.61	1.5%	12.94	32.3%
Lodge Farm	1.09	2.7%	1.50	3.8%	0.41	1.0%	12.34	30.9%
Lodgefield Park	1.51	3.8%	2.11	5.3%	0.59	1.5%	12.95	32.4%
Rhosywaun	3.25	8.1%	4.56	11.4%	1.31	3.3%	15.40	38.5%
Chirk Community Hospital	2.02	5.0%	2.75	6.9%	0.74	1.8%	13.59	34.0%
Chirk Infant School	2.20	5.5%	2.80	7.0%	0.60	1.5%	13.64	34.1%
Highfield Farm	1.71	4.3%	2.20	5.5%	0.49	1.2%	13.04	32.6%
Maes-y-Waun	1.18	3.0%	1.67	4.2%	0.49	1.2%	12.51	31.3%
Collery Road	1.02	2.6%	1.47	3.7%	0.45	1.1%	12.31	30.8%
St Mary's Church	0.36	0.9%	0.48	1.2%	0.12	0.3%	11.32	28.3%
Station Avenue	1.56	3.9%	2.34	5.9%	0.78	2.0%	13.18	33.0%
Llwyn-y-cil	0.98	2.5%	1.34	3.3%	0.35	0.9%	12.18	30.4%
New Hall	0.65	1.6%	0.91	2.3%	0.27	0.7%	11.75	29.4%
Chirk Court	1.52	3.8%	2.06	5.1%	0.54	1.4%	12.90	32.2%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 76: Dispersion Modelling Results – Impact at Receptors - 99.79%ile 1-hour Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	12.05	6.0%	16.18	8.1%	4.13	2.1%	37.86	18.9%
Lodge Farm	9.28	4.6%	12.12	6.1%	2.84	1.4%	33.80	16.9%
Lodgefield Park	11.80	5.9%	15.34	7.7%	3.54	1.8%	37.02	18.5%
Rhosywaun	16.45	8.2%	20.11	10.1%	3.66	1.8%	41.79	20.9%
Chirk Community Hospital	11.06	5.5%	13.89	6.9%	2.82	1.4%	35.57	17.8%
Chirk Infant School	14.79	7.4%	17.30	8.7%	2.51	1.3%	38.98	19.5%
Highfield Farm	9.93	5.0%	11.91	6.0%	1.98	1.0%	33.59	16.8%
Maes-y-Waun	16.18	8.1%	19.03	9.5%	2.85	1.4%	40.71	20.4%
Collery Road	16.34	8.2%	19.46	9.7%	3.13	1.6%	41.14	20.6%
St Mary's Church	5.94	3.0%	7.51	3.8%	1.57	0.8%	29.19	14.6%
Station Avenue	18.16	9.1%	21.67	10.8%	3.51	1.8%	43.35	21.7%
Llwyn-y-cil	16.75	8.4%	20.45	10.2%	3.69	1.8%	42.13	21.1%
New Hall	10.81	5.4%	13.93	7.0%	3.12	1.6%	35.61	17.8%
Chirk Court	15.80	7.9%	18.68	9.3%	2.87	1.4%	40.36	20.2%

NOTES:
A comparison made to the annual mean AQAL of 200 µg/m^3 where appropriate. A background concentration of 2 x 10.84 µg/m^3 has been applied to calculate the PEC.

G Detailed Results Tables – MDF 1&2 Offline

If both MDF driers are offline, the exhaust gases from the biomass plant and gas engines would vent to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Kronospan would not operate the combustion plant in power only generation mode for prolonged periods as the board manufacturing process will not have a significant power demand when the MDF 1 and MDF 2 driers are offline. Therefore, this operating scenario would only occur for short periods. However, results for all averaging periods have been provided for completeness.

Table 77: MDF 1 and 2 Offline - Maximum Impact outside Installation Boundary

Pollutant	Quantity	Scenario	Units	AQAL	Bg Conc	Process Contribution (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC = Bg)	PEC as % of AQAL
						2018	2019	2020	2021	2022	Max			
Nitrogen dioxide	Annual mean	Existing	µg/m^3	40	10.84	7.05	6.40	6.64	7.37	6.62	7.37	18.4%	18.21	45.5%
		Proposed	µg/m^3	40	10.84	7.45	6.78	6.92	7.78	7.00	7.78	19.5%	18.62	46.6%
		Maximum increase	µg/m^3	40	10.84	0.45	0.39	0.29	0.48	0.00	0.48	1.2%	-	-
	99.79%ile of 1-hour means	Existing	µg/m^3	200	21.68	107.42	104.59	114.19	102.46	109.64	114.19	57.1%	135.87	67.9%
		Proposed	µg/m^3	200	21.68	109.82	106.95	116.51	104.95	112.09	116.51	58.3%	138.19	69.1%
		Maximum increase	µg/m^3	200	21.68	3.71	3.33	3.58	3.36	0.00	3.71	1.9%	-	-
Formaldehyde	Annual mean	Existing	µg/m^3	5	1	0.62	0.55	0.51	0.65	0.60	0.65	13.0%	1.65	33.0%
		Proposed	µg/m^3	5	1	0.63	0.55	0.53	0.65	0.60	0.65	13.0%	1.65	33.0%
		Maximum increase	µg/m^3	5	1	0.02	0.02	0.02	0.02	0.02	0.02	0.5%	-	-
	Maximum 30-minute mean	Existing	µg/m^3	100	2	22.36	20.63	24.33	24.98	25.30	25.30	25.3%	27.30	27.3%
		Proposed	µg/m^3	100	2	22.45	20.63	24.33	24.96	25.30	25.30	25.3%	27.30	27.3%
		Maximum increase	µg/m^3	100	2	1.19	1.32	0.96	1.31	1.66	1.66	1.7%	-	-
TVOC	Annual mean	Existing	µg/m^3	-	-	6.03	5.38	5.28	6.26	5.72	6.26	-	-	-
		Proposed	µg/m^3	-	-	5.81	5.17	5.22	6.03	5.51	6.03	-	-	-
		Maximum increase	µg/m^3	-	-	0.02	0.02	0.04	0.01	0.02	0.04	-	-	-
	Maximum daily mean	Existing	µg/m^3	-	-	59.34	63.35	49.39	59.57	53.09	63.35	-	-	-
		Proposed	µg/m^3	-	-	58.39	63.10	48.58	59.56	51.28	63.10	-	-	-
		Maximum increase	µg/m^3	-	-	1.26	0.92	1.18	0.98	0.86	1.26	-	-	-
Particulate matter (as PM_{10}) - excluding dust units	Annual mean	Existing	µg/m^3	40	15.39	2.01	1.74	1.67	2.11	1.92	2.11	5.3%	17.50	43.7%
		Proposed	µg/m^3	40	15.39	2.03	1.75	1.76	2.12	1.94	2.12	5.3%	17.51	43.8%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	7.47	7.07	5.27	7.97	7.48	7.97	15.9%	23.36	46.7%
		Proposed	µg/m^3	50	15.39	7.52	7.17	5.45	8.27	7.45	8.27	16.5%	23.66	47.3%
		Maximum increase	µg/m^3	50	15.39	0.69	0.50	0.54	0.54	0.57	0.69	1.4%	-	-
Particulate matter (as $PM_{2.5}$) - excluding dust units	Annual mean	Existing	µg/m^3	20	10.94	2.01	1.74	1.67	2.11	1.92	2.11	10.5%	13.05	65.2%
		Proposed	µg/m^3	20	10.94	2.03	1.75	1.76	2.12	1.94	2.12	10.6%	13.06	65.3%
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.5%	-	-
Particulate matter (as PM_{10}) - including dust units	Annual mean	Existing	µg/m^3	40	15.39	9.76	10.50	9.20	8.95	9.16	10.50	26.3%	25.89	64.7%
		Proposed	µg/m^3	40	15.39	9.76	10.50	9.20	8.95	9.16	10.50	26.3%	25.89	64.7%
		Maximum increase	µg/m^3	40	15.39	0.09	0.09	0.11	0.08	0.09	0.11	0.3%	-	-
	90.41%ile of 24-hour	Existing	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Proposed	µg/m^3	50	15.39	35.30	42.46	35.59	34.09	34.30	42.46	84.9%	57.85	115.7%
		Maximum increase	µg/m^3	50	15.39	0.78	0.73	0.83	0.78	0.93	0.93	1.9%	-	-
Particulate matter (as $PM_{2.5}$) - including dust units	Annual mean	Existing	µg/m^3	20	10.94	9.76	10.50	9.20	8.95	9.16	10.50	52.5%	21.44	107.2%
		Proposed	µg/m^3	20	10.94	9.76	10.50	9.20	8.95	9.16	10.50	52.5%	21.44	107.2%
		Maximum increase	µg/m^3	20	10.94	0.09	0.09	0.11	0.08	0.09	0.11	0.5%	-	-

Notes:
Change in impact calculated as the maximum change in impact at any grid point, so may be different to the difference between the peak impact for the Existing and Proposed scenario as the peaks may occur in different locations.

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Table 78: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	2.24	5.6%	2.36	5.9%	0.12	0.3%	13.20	33.0%
Lodge Farm	1.54	3.9%	1.62	4.1%	0.08	0.2%	12.46	31.2%
Lodgefield Park	2.28	5.7%	2.40	6.0%	0.12	0.3%	13.24	33.1%
Rhosywaun	6.00	15.0%	6.27	15.7%	0.26	0.7%	17.11	42.8%
Chirk Community Hospital	2.97	7.4%	3.11	7.8%	0.15	0.4%	13.95	34.9%
Chirk Infant School	2.63	6.6%	2.75	6.9%	0.12	0.3%	13.59	34.0%
Highfield Farm	2.13	5.3%	2.23	5.6%	0.10	0.2%	13.07	32.7%
Maes-y-Waun	1.87	4.7%	1.97	4.9%	0.10	0.2%	12.81	32.0%
Collery Road	1.75	4.4%	1.84	4.6%	0.09	0.2%	12.68	31.7%
St Mary's Church	0.45	1.1%	0.48	1.2%	0.02	0.1%	11.32	28.3%
Station Avenue	2.72	6.8%	2.88	7.2%	0.16	0.4%	13.72	34.3%
Llwyn-y-cil	1.40	3.5%	1.47	3.7%	0.07	0.2%	12.31	30.8%
New Hall	0.99	2.5%	1.05	2.6%	0.06	0.1%	11.89	29.7%
Chirk Court	2.11	5.3%	2.22	5.5%	0.11	0.3%	13.06	32.6%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m^3 where appropriate. A background concentration of 10.84 µg/m^3 has been applied to calculate the PEC.

Table 79: Dispersion Modelling Results – Impact at Receptors - 99.79%ile 1-hour Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	15.35	7.7%	16.16	8.1%	0.81	0.4%	37.84	18.9%
Lodge Farm	12.33	6.2%	12.93	6.5%	0.60	0.3%	34.61	17.3%
Lodgefield Park	16.34	8.2%	17.09	8.5%	0.75	0.4%	38.77	19.4%
Rhosywaun	28.58	14.3%	29.76	14.9%	1.18	0.6%	51.44	25.7%
Chirk Community Hospital	15.97	8.0%	16.67	8.3%	0.69	0.3%	38.35	19.2%
Chirk Infant School	24.29	12.1%	25.33	12.7%	1.04	0.5%	47.01	23.5%
Highfield Farm	14.17	7.1%	14.76	7.4%	0.59	0.3%	36.44	18.2%
Maes-y-Waun	24.85	12.4%	26.04	13.0%	1.19	0.6%	47.72	23.9%
Collery Road	19.90	9.9%	20.95	10.5%	1.05	0.5%	42.63	21.3%
St Mary's Church	7.94	4.0%	8.35	4.2%	0.41	0.2%	30.03	15.0%
Station Avenue	21.24	10.6%	22.42	11.2%	1.17	0.6%	44.10	22.0%
Llwyn-y-cil	24.33	12.2%	25.65	12.8%	1.32	0.7%	47.33	23.7%
New Hall	14.65	7.3%	15.47	7.7%	0.82	0.4%	37.15	18.6%
Chirk Court	27.16	13.6%	28.49	14.2%	1.32	0.7%	50.17	25.1%

NOTES:
A comparison made to the annual mean AQAL of 200 µg/m³ where appropriate. A background concentration of 2 x 10.84 µg/m³ has been applied to calculate the PEC.

H Detailed Results Tables – K7 and K8 Biomass Plants Offline

The only change to normal operations would be the removal of emissions from the K7 and K8 biomass plant and the NOx emissions from the K5 and K6 gas heaters. As such results have only been presented for NO_2.

Table 80: K7 and K8 Biomass Plant Offline - Maximum Impact outside Installation Boundary

Pollutant	Quantity	Scenario	Units	AQAL	Bg Conc	Process Contribution (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC = Bg)	PEC as % of AQAL
						2018	2019	2020	2021	2022	Max			
Nitrogen dioxide	Annual mean	Existing	µg/m³	40	10.84	4.32	4.55	5.25	3.81	3.92	5.25	13.1%	16.09	40.2%
		Proposed	µg/m³	40	10.84	4.51	4.75	5.53	4.12	4.10	5.53	13.8%	16.37	40.9%
		Maximum increase	µg/m³	40	10.84	0.45	0.39	0.29	0.48	0.42	0.48	1.2%	-	-
	99.79%ile of 1-hour means	Existing	µg/m³	200	21.68	39.91	40.11	42.88	37.79	40.03	42.88	21.4%	64.56	32.3%
		Proposed	µg/m³	200	21.68	40.76	40.35	42.93	38.52	40.47	42.93	21.5%	64.61	32.3%
		Maximum increase	µg/m³	200	21.68	4.31	3.92	4.01	3.87	3.98	4.31	2.2%	-	-

Notes:
Change in impact calculated as the maximum change in impact at any grid point, so may be different to the difference between the peak impact for the Existing and Proposed scenario as the peaks may occur in different locations.
All other pollutants same as other scenario, i.e. normal operations, MDF 1 offline etc..

Table 81: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL	Conc. (µg/m^3)	as % of AQAL
Afron Bradley Farm	2.30	5.7%	2.42	6.0%	0.12	0.3%	13.26	33.1%
Lodge Farm	1.65	4.1%	1.73	4.3%	0.08	0.2%	12.57	31.4%
Lodgefield Park	2.26	5.7%	2.38	6.0%	0.12	0.3%	13.22	33.1%
Rhosywaun	4.96	12.4%	5.22	13.0%	0.26	0.7%	16.06	40.1%
Chirk Community Hospital	3.02	7.6%	3.17	7.9%	0.15	0.4%	14.01	35.0%
Chirk Infant School	3.74	9.4%	3.86	9.7%	0.12	0.3%	14.70	36.8%
Highfield Farm	2.74	6.9%	2.84	7.1%	0.10	0.2%	13.68	34.2%
Maes-y-Waun	1.99	5.0%	2.09	5.2%	0.10	0.2%	12.93	32.3%
Collery Road	1.72	4.3%	1.81	4.5%	0.09	0.2%	12.65	31.6%
St Mary's Church	0.58	1.5%	0.61	1.5%	0.02	0.1%	11.45	28.6%
Station Avenue	2.66	6.7%	2.82	7.0%	0.16	0.4%	13.66	34.1%
Llwyn-y-cil	1.67	4.2%	1.74	4.4%	0.07	0.2%	12.58	31.5%
New Hall	1.04	2.6%	1.10	2.7%	0.05	0.1%	11.94	29.8%
Chirk Court	2.52	6.3%	2.62	6.6%	0.11	0.3%	13.46	33.7%

NOTES:
A comparison made to the annual mean AQAL of 40 µg/m^3 where appropriate. A background concentration of 10.84 µg/m^3 has been applied to calculate the PEC.

Table 82: Dispersion Modelling Results – Impact at Receptors - 99.79%ile 1-hour Nitrogen Dioxide

Receptor	Existing EP		Proposed		Change in impact		PEC	
	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL	Conc. (µg/m³)	as % of AQAL
Afron Bradley Farm	17.70	8.8%	18.52	9.3%	0.82	0.4%	40.20	20.1%
Lodge Farm	14.02	7.0%	14.48	7.2%	0.46	0.2%	36.16	18.1%
Lodgefield Park	17.34	8.7%	17.94	9.0%	0.60	0.3%	39.62	19.8%
Rhosywaun	25.72	12.9%	25.99	13.0%	0.27	0.1%	47.67	23.8%
Chirk Community Hospital	16.98	8.5%	17.50	8.8%	0.53	0.3%	39.18	19.6%
Chirk Infant School	23.24	11.6%	23.55	11.8%	0.30	0.2%	45.23	22.6%
Highfield Farm	15.33	7.7%	15.64	7.8%	0.31	0.2%	37.32	18.7%
Maes-y-Waun	27.32	13.7%	27.60	13.8%	0.28	0.1%	49.28	24.6%
Collery Road	27.03	13.5%	27.70	13.9%	0.68	0.3%	49.38	24.7%
St Mary's Church	9.42	4.7%	9.65	4.8%	0.23	0.1%	31.33	15.7%
Station Avenue	29.86	14.9%	30.65	15.3%	0.79	0.4%	52.33	26.2%
Llwyn-y-cil	27.25	13.6%	27.86	13.9%	0.62	0.3%	49.54	24.8%
New Hall	16.87	8.4%	17.32	8.7%	0.45	0.2%	39.00	19.5%
Chirk Court	25.35	12.7%	25.84	12.9%	0.49	0.2%	47.52	23.8%

NOTES:
A comparison made to the annual mean AQAL of 200 µg/m³ where appropriate. A background concentration of 2 x 10.84 µg/m³ has been applied to calculate the PEC.

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