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Environmental Statement

Addendum 2020

Volume 2: Appendices

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APPENDIX 7.1

Information on pollutants

Chapter Seven
APPENDIX 1

INFORMATION ON POLLUTANTS

Ammonia

Ammonia is mainly derived from agriculture, primarily livestock manure / slurry management and fertilisers. A small proportion is also derived from a variety of sources including transport and waste disposal. It can lead to damage of terrestrial and aquatic ecosystems through the deposition of eutrophying pollutants and through acidifying pollutants. It is a precursor to secondary particulate matter, and therefore contributes to the ill-health effects caused by PM_{10} and $PM_{2.5}$.

Benzene

Benzene has a variety of sources, but primarily arises from domestic and industrial combustion and road transport. Benzene is a recognised human carcinogen which attacks the genetic material and, as such, no absolutely safe level can be specified in ambient air.

1,3-Butadiene

1,3-Butadiene is mainly emitted as a result of the combustion of petrol, and thus vehicle emissions are the predominant source. 1,3-butadiene is a recognised genotoxic human carcinogen, and as such, no absolutely safe level can be specified in ambient air.

Carbon Dioxide

Levels of Carbon Dioxide are not considered directly by air quality legislation, however they are important due to their contribution to the greenhouse effect. The greenhouse effect is the warming of the earth's atmosphere, due to an increase in certain gases within it. These greenhouse gases are responsible for controlling the levels of radiation allowed into and out of the atmosphere, however an increase in the gases can lead to a reduced release of the radiation, and therefore an increase in the temperature experienced by the earth. Carbon Dioxide is probably the most important of the greenhouse gases as it accounts for the largest proportion of these trace gases, although it does not necessarily have the most significant effect per tonne.

Under steady state conditions, the amount of Carbon Dioxide taken out of the atmosphere by plants is almost perfectly balanced with the amount put back into the atmosphere by respiration and decay. However, small changes as a result of human activities can have a large impact on this delicate balance. The burning of fossil fuels releases the Carbon Dioxide stored within them, and similarly, deforestation releases the Carbon stored in trees. Deforestation also results in less Carbon Dioxide being removed from the atmosphere. Thus, whilst ambient levels of Carbon Dioxide do not have any direct health effects, the effect on the environment and the balances within the world's ecosystem can lead to the indirect health and lifestyle effects of extreme weather, the resultant impacts on disease, and effects on agriculture.

Carbon Monoxide

Carbon Monoxide is formed from the incomplete combustion of Carbon-based fuels. The largest pollutant source is road transport, with residential and industrial combustion also making significant contributions. Carbon Monoxide substantially reduces the capacity of the blood to carry Oxygen to the body's tissues, and blocks important biochemical reactions in cells. People with existing diseases which affect delivery of Oxygen to the heart or brain, such as angina, are at particular risk of adverse side effects, although ambient concentrations in the UK are well below that at which health effects can occur.

Dioxins and Furans

Dioxins are a family of complex chemicals containing chlorine. There are several hundred Polychlorinated-p-Dioxins (PCDDs) and the related Polychlorinated-p-Furans (PCDFs), and some Dioxin-type compounds are toxic at very low levels. The most toxic is 2,3,7,8-TetraChloro-Dibenzo-p-Dioxin, which is often referred to 2,3,7,8-TCDD, or just TCDD.

PCDDs and PCDFs have never been intentionally manufactured but are formed inadvertently by a number of human activities such as the burning of fuels and wastes, metallurgical processing and pulp and paper processing. They are also formed by several natural processes including forest fires and volcanoes. Within anthropogenic combustion processes, Dioxins are formed preferentially in the cooler, post combustion region, between temperatures of 450 – 250 °C, and thus the main control mechanism for minimising the formation of Dioxins is the minimisation of the period at which the flue gases pass through this temperature range. One of the largest sources of Dioxin emissions in the past has been municipal solid waste incineration. However, emissions from this source have fallen by 99.9 % between 1990 and 2017 and in recent years, the main sources of Dioxins have been the domestic combustion of solid fuels like wood and coal (34 % of UK emissions in 2017), accidental fires and small-scale burning of waste such as on garden bonfires and on bonfire night (21 %) and steel production (13 %)[(1)].

Because Dioxins are formed in many types of uncontrolled combustion processes, there have been emissions to the environment throughout geological time, although natural sources are thought to contribute relatively little to present day background levels. Exposure levels have declined considerably in the UK since the 1970s when Dioxins were first recognised as highly toxic chemicals and actions to reduce pollution were introduced. However, they are highly persistent trace chemicals and can be found in soils, sediments in freshwater and the sea, plants and animals, including humans. They belong to the family of chemicals known as 'Persistent Organic Pollutants' (POPs), which are subject to international treaty agreements to reduce exposure. Due to their persistence, Dioxins may be transported for many thousands of kilometres from their original site of release by the processes of evaporation / re-suspension and re-deposition from the atmosphere.

Dioxins bound onto soil particles can be transported large distances in rivers to deposit in freshwater and marine sediments.

Once released into the atmosphere, Dioxins exist both in the gas phase and can be bound to particles. Being highly insoluble in water, Dioxins bound to soils or sediments and are resistant to leaching out, degrading very slowly and so persisting for many years. Dioxins deposited onto grass (and to a lesser extent, soil) may be taken up by livestock and enter the human food chain in milk and meat. Dioxins in aquatic sediments can also enter the human food chain via fish. A wide range of toxicological effects have been observed in wildlife experimentally exposed to Dioxins. They range from chronic to acute effects and include reduction in reproductive success, growth defects, suppression of the immune system and development of cancer.

Heavy Metals

The term 'Heavy Metals' is a general collective term which includes metals such as Cadmium, Chromium, Copper, Mercury, Lead, Zinc, Arsenic and Boron. Combustion processes are the most important sources of Heavy Metals, particularly, power generation, smelting, incineration and the use of internal combustion engines, however they are also used widely in electronic components, machinery and materials.

As Heavy Metals are elements, they do not break down and are therefore persistent in the environment. Unlike many organic pollutants, which eventually degrade to Carbon Dioxide and water, Heavy Metals will tend to accumulate especially in lake, estuarine or marine sediments. Many of the Heavy Metals group are toxic to organisms at low concentrations, however some, such as Copper and Zinc are also essential elements.

Hydrogen Chloride

Hydrogen Chloride occurs both naturally and through anthropogenic activities. The main source of Hydrogen Chloride releases is from coal fired power stations, however, small quantities are also released from waste incineration processes.

Hydrogen Chloride is highly corrosive and attacks many metals, and stones such as limestone, resulting in the corrosion of buildings and other cultural monuments. It is also an irritant. The gas dissolves in water to form a strong acid which at high concentration is toxic to aquatic life. Due to its high solubility, Hydrogen Chloride has a tendency to wash out of the atmosphere in rain thus limiting the distance over which the releases may be spread. Certain types of soil and water bodies may be particularly sensitive to inputs of acid rain above defined critical loads, due to their naturally high acidity. Such sensitive areas are found in Scotland, Wales and other parts of upland Britain.

Hydrogen Fluoride

Hydrogen Fluoride is similar in source and nature to Hydrogen Chloride, being formed both naturally primarily through volcanic activity, and also through anthropogenic sources such as coal fired power stations and other high temperature industrial and combustion processes.

Hydrogen Fluoride is too reactive to persist for prolonged periods in the environment and is rapidly converted to other Fluorides, being neutralised through the formation of inorganic Fluoride salts. It is a strong mineral acid capable of dissolving glass and attacking many metals, minerals and organic substances. Hydrogen Fluoride emissions can cause damage to plants and be harmful to cattle and domestic animals. It is very corrosive in solution. Fluoride accumulates in the teeth and bones of animals and high doses can cause abnormalities such as discoloration of teeth and skeletal deformities.

Oxides of Nitrogen

All combustion processes produce Oxides of Nitrogen (NO_x). NO_x is the term used for a combination of Nitrogen and Oxygen based species, such as Nitrogen Dioxide (NO_2) and Nitric Oxide (NO). NO_x from combustion is formed of approximately 95 % NO, however, this quickly reacts with Ozone in the atmosphere to form NO_2. Road transport is the main source of NO_x pollution, followed by the electricity supply industry and other industrial and commercial sectors.

NO_2 is associated with adverse effects on human health. At high levels NO_2 causes inflammation of the airways, and long-term exposure may affect lung function and respiratory symptoms. NO_2 also enhances the response to allergens in sensitive individuals.

High levels of NO_x can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from NO_x emissions contribute to the acidification and / or eutrophication of sensitive habitats leading to a loss of biodiversity, often at locations far removed from the original emissions. NO_x also contributes to the formation of secondary particles and ground level ozone, both of which are associated with ill-health effects.

Ozone

Ozone is not emitted directly from any human-made source, arising instead from chemical reactions between various air pollutants, primarily NO_x and Volatile Organic Compounds (VOCs), initiated by strong sunlight. Formation can take place over several hours or days and may have arisen from emissions many hundreds, or even thousands of kilometres away.

Exposure to high concentrations may cause irritation to eyes and nose. Very high levels can damage airways leading to inflammatory reactions. Ozone reduces lung function and increases incidence of respiratory symptoms. Ground level Ozone can also cause damage to many plant species leading to the loss of yield and quality of crops, damage to forests and impacts on biodiversity.

Particulate Matter

Particulate matter (PM) is categorised on the basis of the size of the particles (for example $PM_{2.5}$ refers to particles with a diameter of less than 2.5 µm). PM is made up of a wide range of materials and arise from a variety of sources. Concentrations of PM comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles formed by chemical reactions in the air.

Particulate matter derives from both human-made and natural sources (such as sea spray and Saharan dust). Between 1990 and 2017, UK emissions of PM_{10} have decreased by 55 %[(1)] and the contribution of large industrial sources such as power stations declined from about a quarter of the UK total in 1990 to about 4 % in 2017. The mass emitted from road transport has also fallen since 1990, but the contribution in percentage terms has increased from 9 % in 1990 to 12 % in 2017. Similarly, emissions from industrial processes have almost halved since 1990, yet the contribution that the sector makes to the UK total has increased, from 27 % in 1990 to 30 % in 2017. More than 50 % of the emissions within the industrial processes group are from construction and quarrying. Emissions from residential sector combustion have grown both in real terms and in terms of the contribution to the UK total due to the strong growth in the use of wood as a domestic fuel, which has offset reductions that have occurred due to decreasing use of coal and other solid mineral fuels. Emissions of finer particulates ($PM_{2.5}$) follow a similar trend to those of PM_{10}.

Road transport also gives rise to primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions. Other primary sources include quarrying, construction and non-road mobile sources. Secondary PM is formed from emissions of Ammonia, Sulphur Dioxide and Oxides of Nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.

Both short-term and long-term exposure to ambient levels of PM are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. The associations are believed to be causal. It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health.

PM_{10} roughly equates to the mass of particles less than 10 µm in diameter that are likely to be inhaled into the thoracic region of the respiratory tract. Reviews by the World Health Organisation (WHO) and Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill health effects, although the more coarse fraction between (PM_{10} – $PM_{2.5}$) also has some effects on health[(2)].

Poly Aromatic Hydrocarbons

There are many different Poly Aromatic Hydrocarbons (PAHs) emanating from a variety of sources, although Benzo[a]Pyrene (B[a]P) is often used as a marker for the most hazardous PAHs. The main sources of B[a]P in the UK are domestic coal and wood burning, fires (e.g. accidental fires, bonfires, forest fires, etc), and industrial processes such as coke production. Since 2000, UK emissions of B[a]P have increased by 11 % due largely to emissions from residential sector combustion which have grown due to the increasing use of wood as a domestic fuel.

Studies of occupational exposure to PAHs have shown an increased incidence of tumours of the lung, skin and possibly bladder and other sites. Lung cancer is most obviously linked to exposure to PAHs through inhaled air. Individual PAHs vary in their ability to induce tumours in animals or humans.

The carcinogenic potency of some PAHs is unknown or uncertain. Individual PAHs have been classified by the International Agency for Research on Cancer, and range in classification from group 1 – Carcinogenic which includes B[a]P, to group 3 – not classifiable.

Poly Chlorinated Biphenyls

Poly Chlorinated Biphenyls (PCBs) are a family of substances which are good electrical insulators. They are chemically stable, fire resistant and don't easily generate a vapour. PCBs were used as dielectric filler liquids in some types of electrical equipment such as transformers, switchgear, capacitors and in the starter units of fluorescent lights and fractional horsepower motors. They belong to the family of chemicals known as 'Persistent Organic Pollutants' (POPs), which are subject to international treaty agreements to reduce exposure. Due to their persistence, they break down slowly and can enter food chains. PCBs can cause a skin condition called Chloracne, which produces pustules, blackheads and cysts(3). In animals, PCBs can cause damage to the liver, reduce the ability to fight infection, as well as other effects.

Sulphur Dioxide

UK emissions of Sulphur Dioxide (SO_2) have historically been dominated by combustion of fuels containing sulphur, such as coal and heavy oils by power stations and refineries. The main sources of SO_2 emissions are electricity generation, industrial and domestic fuel combustion, although total SO_2 emissions have decreased substantially, by 95 % since 1990, in line with changes in fuel use and commitments to international agreements. Exposure to significant levels of SO_2 causes constriction of the airways of the lung. This effect is particularly likely to occur in people suffering from asthma and chronic lung disease.

Sulphur Dioxide is also a precursor to secondary Particulate Matter and therefore can contribute to the ill-health effects caused by PM_{10} and $PM_{2.5}$. It has the potential to damage ecosystems at high levels, including through the degradation of chlorophyll, reduced photosynthesis, raised respiration rates and changes in protein metabolism. Deposition of pollution derived from SO_2 emissions also contribute to the acidification of soils and waters and the subsequent loss of biodiversity, often at locations far removed from the original emissions.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are a group of hydrocarbon based compounds which can be released from natural sources such as trees, vegetation, biomass, volcanoes, springs etc., or man-made emissions, such as domestic and industrial activities, road, marine and air transport. Emissions of some VOCs e.g. Benzene and 1,3-Butadiene may have significant health consequences, due to their toxicity or carcinogenic characteristics, however VOCs in general have been associated with various atmospheric effects.

The main effect is of Ozone formation in the troposphere, known as ground level Ozone. In the presence of ultra-violet radiation from the sun, NO_x can react to form Ozone, and the presence of

VOCs in the atmosphere accelerates this reaction. Ozone can cause damage to human and animal health, vegetation, and building materials when present at prolonged elevated concentrations.

REFERENCES

1. National Atmospheric Emissions Inventory. Pollutant Information. Overview. https://naei.beis.gov.uk/overview/pollutants

2. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. DEFRA, Scottish Executive, Welsh Assembly Government, Department of the Environment. Published by TSO (The Stationery Office). ISBN Number 978-0-10-171692-5

3. HSE Website - http://www.hse.gov.uk/pubns/msa19.htm

APPENDIX 7.2

Information on background concentrations of pollutants

Chapter Seven
APPENDIX 2

INFORMATION ON BACKGROUND CONCENTRATIONS OF POLLUTANTS

The information contained within this Appendix presents data on the background concentrations of pollutants monitored within the Rhondda Cynon Taf County Borough Council, where available and relevant, or as obtained from the uk-air.defra.gov.uk website where no local monitoring data is available.

Arsenic

Rhondda Cynon Taf County Borough Council does not currently monitor for Arsenic within the local area. Background maps indicate levels of Arsenic within the Borough will remain within the Environmental Assessment Level of 6 ng m^{-3}, with an estimated background concentration close to the Enviroparks site, of less than 0.6 ng m^{-3} estimated in 2018.

Benzene for VOCs

Rhondda Cynon Taf County Borough Council does not currently monitor for Benzene or any Volatile Organic Compounds (VOCs) within the local area. Background maps indicate levels of Benzene within the Borough will remain within the National Air Quality Standard of 5 µg m^{-3} with an estimated background concentration close to the Enviroparks site, of less than 0.2 µg m^{-3} in 2020.

Benzo[a]Pyrene for PCBs

Rhondda Cynon Taf County Borough Council does not currently monitor for Benzo[a]Pyrene (B[a]P) or any PolyChlorinated Biphenyls (PCBs) within the local area. Background maps indicate levels of B[a]P within the Borough will remain within the Environmental Assessment Level of 0.25 ng m^{-3}, with an estimated background concentration close to the Enviroparks site, of less than 0.1 ng m^{-3} in 2018.

Cadmium

Rhondda Cynon Taf County Borough Council does not currently monitor for Cadmium within the local area. Background maps indicate levels of Cadmium will remain within the Environmental Assessment Level of 5 ng m^{-3}, with an estimated background concentration close to the Enviroparks site, of less than 0.1 ng m^{-3} in 2018.

Carbon Monoxide

Rhondda Cynon Taf County Borough Council does not currently monitor for Carbon Monoxide. Background maps indicate that current (2020) levels of Carbon Monoxide in the area do not exceed the National Air Quality Standards, with an estimated annual average concentration in the vicinity of the Enviroparks site of less than 0.1 mg m^{-3} and a maximum 8 hourly mean of 1.6 mg m^{-3} against an AQS of 10 mg m^{-3}.

Lead

The initial air quality assessment undertaken by Rhondda Cynon Taf County Borough Council concluded that the risk of exceeding the National Air Quality Standard for Lead was negligible due to the lack of relevant industrial sources in the area and due to the ban on the sale of leaded petrol since 2000. As such, no monitoring is undertaken of the ground level concentrations of Lead in the County. Background maps indicate that levels of Lead in 2018 within the vicinity of the Enviroparks site were estimated at less than 10 ng $m^{-3,}$ which is well within the 250 ng m^{-3} (0.25 µg m^{-3}) AQS objective.

Nickel

Rhondda Cynon Taf County Borough Council does not currently monitor for Nickel within the local area. Background maps indicate levels of Nickel will remain within the Environmental Assessment Level of 20 ng m^{-3}, with an estimated background concentration close to the Enviroparks site, of less than 2 ng m^{-3} in 2018.

Oxides of Nitrogen

Monitoring for NO_2 has been undertaken across the Rhondda Cynon Taf County Borough for more than 20 years in some places, and suggests that the annual average National Air Quality Standard for NO_2 can be exceeded at times. Monitoring of NO_2 is currently undertaken at 57 locations across the county, and in previous years, monitoring has been undertaken in Hirwaun, although these locations have not been monitored in recent years. The nearest monitoring point to the Enviroparks site is located at Woodland Park, Penderyn.

Examination of monitoring data[1 and 2] confirms that the urban background environment within the Rhondda Cynon Taf County Borough Council observes low levels of Nitrogen Dioxide (NO_2) and has a generally stable trend. There appears to be an overall historic improving situation for both NO_2 and PM_{10}, which is consistent to some extent with national expectation. The apparent low levels and stability in the trend, indicates Rhondda Cynon Taf will be influenced, to some extent, by regional sources of NO_2 and PM_{10} but where elevated levels are observed this is likely to be as a result of specific local influences.

Detailed analysis of the results identifies that, throughout the monitoring, elevated levels of NO_2 are more prevalent in the winter, during Monday to Friday and at 8am and 5pm. These patterns are widely observed with air quality, often underlining the anthropogenic nature of the pollutant and its synergy with naturally occurring cyclical events. The shortest-term trend fluctuations in NO_2 levels are associated with rush-hour and are heavily influenced by commuter road traffic, as opposed to industrial or domestic sources, although the mid-term weekly trends are clearly influenced by both traffic and industrial sources. In contrast, the natural influence of sunlight on NO_2 as a precursor to Ozone creation, clearly influences the apparent seasonal cycle with lower concentrations of NO_2 recorded during longer summer days when sunlight is often most prevalent.

Table 9.1 below presents the most recently available (2018) data from the County's urban background monitoring points, along with the 10 preceding years' worth of data.

Table 9.1 Ap 2: Measured Concentrations of Nitrogen Dioxide from Urban Background Sites Across Rhondda Cynon Taf. Results are Presented in µg m^{-3}

Site	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Penderyn	9.2	10.5	9.7	9.9	8.3	10.2	8.0	8.1	8.6	7.1	6.6
Blaenllechau	11.4	10.6	10.0	10.0	8.2	10.6	7.4	7.6	9.4	7.3	6.9
Efail Isaf	10.6	12.1	14.0	11.1	9.4	11.5	8.4	8.9	11.7	7.3	8.9
Glyncoch	11.6	13.1	13.0	12.0	10.1	11.5	9.5	9.0	11.2	8.8	9.1

The data presented in the 2019 Progress Report(1) shows an apparent gradual reduction in NO_2 levels at urban background sites throughout the Local Authority albeit with a fluctuating trend observed at all sites.

Currently Rhondda Cynon Taf has sixteen Air Quality Management Areas (AQMA) for breaches of the NO_2 Air Quality Objective. However, the majority of the AQMAs are of limited size, being associated with busy urban road junctions, the regional road network or specific local sources, and are distributed throughout the Borough. The nearest AQMA to the Enviroparks site is located in Aberdare town centre, and the annual average concentrations of NO_2 at this AQMA have demonstrated a consistent long-term improving trend.

Particulate Matter

Monitoring of PM_{10} across the Rhondda Cynon Taf County Borough is associated with specific local influences, namely, the operation of the Craig Yr Hesg Quarry in Glyncoch, and the heavy and often congested traffic experienced on key roads in Nantgraw. Although particulate matter has been measured at both Glyncoch and Nantgarw in previous years, the automatic monitoring site at Nantgraw has now been removed and monitoring was only undertaken on Garth Avenue in Glyncoch during 2018. Located more than 20 km to the South-East of the Enviroparks site, and being specifically associated with a localised industrial operation, it is not appropriate to consider the monitored concentrations of particulate matter at Glyncoch in relation to the Enviroparks site. As there are no monitoring stations local to the Enviroparks site, DEFRA background mapping has been used to estimate the current (2020) ambient levels of particulate matter in the vicinity. The background maps suggest PM_{10} levels of 10.34 µg m^{-3} against an annual average AQS of 40 µg m^{-3}, and $PM_{2.5}$ levels which are approximately one third of the target value of 20 µg m^{-3}, estimated to be 6.31 µg m^{-3}.

Sulphur Dioxide

Assessments by Rhondda Cynon Taf County Borough Council have concluded that the risk of exceeding the National Air Quality Standard for SO_2 is negligible. No monitoring is undertaken of the ground level concentrations of SO_2 in the County. Background maps indicate levels of Sulphur Dioxide within the Borough will remain within the most stringent Environmental Assessment Level of 20 µg m^{-3} for the protection of ecosystems, with an estimated background concentration close to the Enviroparks site, of approximately 2.8 µg m^{-3} (2001 data).

Summary of Pollutant Concentrations

The table below presents a comparison of the annual predicted concentrations of pollutants, measured concentrations, and the National Air Quality Standards

Table 9.2 Ap 2: Background Concentrations of Pollutants Close to the Enviroparks Site. Results are Presented in µg m^{-3}

Pollutant	Estimated	Measured 2018	Air Quality Standard*
Arsenic	<0.0006	-	0.006
Benzene	0.16	-	5
Benzo[a]Pyrene	<0.0001	-	0.25
Cadmium	<0.0001	-	0.005
Carbon Monoxide	1,600	-	10,000
Lead	<0.01	-	0.25
Nickel	<0.002	-	0.02
Nitrogen Dioxide	6.16	6.6	40
Particulate Matter (PM_{10})	10.34	-	40
Particulate Matter ($PM_{2.5}$)	6.31	-	20
Sulphur Dioxide	2.79	-	20

* Air Quality Standard (limit values or targets) / Environmental Assessment Level
All data is presented as the annual average concentration, with the exception of the National Air Quality Standard for Carbon Monoxide, which is stated as maximum-rolling 8 hour average.

Predicted data is taken from the Air Quality Archive Background Pollution Maps, with adjustment from base year data to 2020 as required. The chosen data point for the is National Grid reference 293500 206500, and is representative of the South-Western corner of the Enviroparks site. Where data is only available from DEFRA's interactive ambient air quality map, background concentrations are provided as a range or a 'less than' figure for 2018, and the maximum of the range is included here. Measured data from Rhondda Cynon Taf's monitoring network is included where available.

Information on Local Committed Developments

Within the Rhondda Cynon Taf Local Air Quality Management Progress Report of July 2019(1), details were provided on the planning applications under consideration or approved in 2018 where an Air Quality Assessment was desired or demanded by the Council. None of the proposed developments are local to the Enviroparks site, and Rhondda Cynon Taff County Borough Council considered that, none of the new local development applications received or granted would likely unduly impact upon local air quality in a significant way.

REFERENCES

1. Rhondda Cynon Taff County Borough Council. 2019 Air Quality Progress Report. In fulfilment of Part IV, Environment Act 1995; Local Air Quality Management. June 2019

2. Rhondda Cynon Taff County Borough Council. Part IV, Environment Act 1995; Local Air Quality Management. Updating and Screening Assessment and Detailed and Further Assessments of Nitrogen Dioxide and Air Quality Action Plan Progress Report. October 2015

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APPENDIX 7.3

OMS Dust Management Plan

1. Introduction

This Dust Management Plan forms part of the Integrated Management Plan and associated management systems for Enviroparks (Wales) Limited (EWL). It identifies potential sources of dust and risks to receptors; actions to minimise the risk of pollution from dust and the procedures to follow should dust be detected off site in order to prevent or minimise the emissions.

The Plan contains the following Appendices:

- Appendix A – Main Building Layout (includes details of waste processing and storage areas);
- Appendix B – Sensitive Receptors Map
- Appendix C – Copy of Dust Assessment Form (Doc Ref: GMS1.5.3.3).

This plan will be reviewed and updated annually or following a significant dust release at site.

2. Overview of site activities

The Enviroparks (Wales) Limited site is located on Ninth Avenue, Hirwaun Industrial Estate, Hirwaun. It lies in an industrial area with industrial buildings to the south and east, and open land to the west. The Penderyn Reservoir is located to the north of the site.

The site will be permitted to pre-treat non-hazardous waste to produce a Refuse Derived Fuel (RDF) to a set specification. The RDF will be used at the site to fuel three gasifiers to produce renewable energy. All site activities, from the receipt of wastes to its treatment and storage will be included within the site Environmental Permit. Directly Associated activities include the discharge of potentially contaminated drainage to sewer, the storage and use of diesel fuel, oils and greases, and as required, the storage and use of dust and odour suppressant chemicals.

The site will principally be operated by Enviroparks (Wales) Limited, although operations and maintenance may be subcontracted if appropriate, and will treat mainly commercial and industrial wastes to extract ferrous metal, fines, and inert aggregate for recycling. The site will also receive other pre-treated wastes, such as RDF produced by third parties. Once recyclable materials have been removed, the residual material will be processed and prepared to a specified fuel for use in the three gasifier lines proposed for installation at the site. The site targets delivery of up to 97.5 % diversion from landfill of materials entering the site, and the energy produced by the waste processing will be traded to a high-energy demand commercial operation, co-located with the facility on suitable commercial terms, with excess energy being sold to the National Grid.

All incoming wastes will be unloaded, stored and treated within the Fuel Preparation Hall, and loose recyclates will be stored and loaded for dispatch from within the building. Incoming feedstocks will be separated into recyclates, gasifier fuel and aggregates. As far as practical, the building's roller shutter doors will be kept closed, except for when vehicles are entering or exiting the building, to contain any odour, dust or litter. Discharges to atmosphere from the gasification lines will be from a 90 m high chimney. There are no other point source emissions to air from the site apart from building ventilation. The only emission to surface water is from roofs and clean landscaped areas. All waste processing and plant wash down areas drain to the foul water system.

As part of the Integrated Management Plan, the Company maintains a detailed Site Accident and Incident Management Plan which includes full consideration of the potential for accidents and incidents to occur at the site, the possible resultant impact of such incidents, and the control measures employed to guard against and deal with such incidents should they occur. Additionally, a Non-Conformance reporting and investigation procedure is used for all incidents and supports the continual review and development of the Accident and Incident Management Plan. The information collated and regularly reviewed through this system, results in relevant emergency procedures, which specify the actions to be taken in the event of any such incident, e.g. fire, spill, flooding etc. occurring.

3. Potential sources of dust and receptors at risk

The site is permitted to receive and store the following wastes:

- Paper / Cardboard;
- Plastics / Rubber;
- Wood / Plant Tissue Waste;
- Textiles / Clothes;
- Metals;
- Refuse Derived Fuel (RDF) / Solid Recovered Fuel (SRF);
- Biodegradable Waste.

All have the potential to generate dust if not managed correctly.

Other potential sources of dust include:

- Yard areas;
- Access roads.

Off-site potential dust sources include:

- Industry / Manufacturing in the nearby industrial estate;
- Roads – the A465 runs close to the site;
- Farms – agricultural activities could result in dust during dry periods.

The map in Appendix B shows sensitive receptors within a 1.5 km radius of the site. Sensitive receptors are identified as residential dwellings, ecologically designated sites, and commercial buildings / businesses.

Sensitive receptors include:

- human: schools, hospitals, nursing and care homes, residential areas, workplaces;
- critical infrastructure: roads, railways, bus stations, pylons, utilities, airports;
- environmental: surface and groundwater, protected habitats and air quality management areas.

Within the 1.5 km radius, the following receptors have been identified:

Receptor	Approximate distance from site boundary (m)	Direction
Eden Trading	10	E
Penderyn Reservoir	60	N
Businesses South of Fifth Avenue	40-100	S
Cors Bryn-Y-Gaer SSSI / SAC	135	ESE
Businesses on Hirwaun Ind. Est. (South of A465)	250-700	SW/S/SE
House at Penderyn Reservoir	375	NNE
Trebanog Uchaf Farm	380	NNE
Tai-Cwpla Farm	420	WNW
Ty Newydd Country Hotel	600	NE
Caradogs Restaurant	600	NE
Blaen Cynon Pontpren SSSI / SAC	710	ENE
Blaen Cynon Woodland Park 1 SSSI / SAC	740	NE
Castell Farm	820	SW
Blaen Cynon Woodland Park 2 SSSI / SAC	830	NE
Nearest residential properties at Pontbren Llwyd	1000	NE
Nearest residential properties at Hirwaun	1300	SE
Nearest residential properties at Rhigos	1350	SSW

4. Waste Quantities and Storage

The currently permitted site capacity is for the receipt of up to 238,000 tonnes of waste per annum and this will comprise commercial and industrial (C and I) waste and pre-treated RDF. Acceptable C and I wastes will primarily be from commercial and industrial operations, along with some construction and demolition waste. The site will also accept pre-treated waste for use in the gasification process. There is no daily maximum throughput specified on the site Permit, however the site will receive no more than 550 tonnes of waste on any one day. The majority of wastes will be processed for use as gasifier fuel, once recyclates and aggregates are removed, with a minimal rate of rejection to landfill. An insignificant quantity of material may require returning to the waste producer via the quarantine procedure, where these are not acceptable to the process, e.g. gas bottles.

Waste delivery and dispatch is restricted to 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturday. In accordance with the planning conditions on the site, there are no waste movements on Sundays or bank holidays. Waste will not be accepted if for any reason there is insufficient storage capacity available or if the site is inadequately staffed.

During operational hours, the main gates are open and the site is manned with sufficient staff for the operations. Outside of operational hours the gates are shut and locked, and the site employs a security guard and recorded CCTV surveillance.

Waste and feedstocks arriving at site are checked visually for quality assurance purposes and unacceptable wastes / feedstocks will be refused entry if they fail this initial inspection and screening process. Acceptable wastes / feedstocks are then weighed on a weighbridge and directed to the delivery area.

All incoming wastes (including pre-processed Refuse Derived Fuel) are unloaded and stored within the Fuel Preparation Hall where they are screened and segregated before either being stored or loaded into the production process and primary shredder. Operations that occur once the waste has been received are:

- Sorting of incoming Waste to separate out recyclates (Ferrous and non-ferrous metals).
- Separation of fines and further processing to remove biogenic mater for the reintroduction of the organic fines fraction to gasifier fuel.
- Shredding of the RDF waste to a gasifier fuel specification.
- Storage of loose recyclates and landfill materials in bunkers prior to dispatch off-site. These are stored at the far end of the building from the reception area.

Waste delivery vehicles reverse into the building through fast acting roller shutter doors. In total, there are four delivery access doors**,** allowing more than one vehicle to enter the waste reception area simultaneously. The fast-acting roller shutter doors are automatically controlled, closing behind delivery vehicles wherever possible, whilst they discharge their loads. On entering the waste reception area, vehicles discharge their payload onto a flat impermeable reception slab surrounded by concrete push walls to a height of 5m. The building's roller shutter doors are, as far as practical, kept closed, except for when vehicles are entering or exiting the building, to contain any odour, dust or litter.

Upon tipping, a wheeled front end loader(s) and 360^0 grab(s) are employed to manage the incoming waste. The waste will be sorted into appropriate fractions as detailed above. Inerts, heavy residues and recyclates will be segregated and sorted. Segregated wastes are directed immediately into appropriate bunkers or containers ready for collection from site. The quantity of material in the bunkers and containers is monitored and they are emptied and exchanged as necessary to ensure adequate storage space for the incoming materials. The residual waste will be shredded to < 75 mm particle sizes and sent via conveyor to the fuel storage building where it will be stored in bunkers prior to being used in the gasification process.

The Fuel Preparation Hall has been designed to ensure ease of access and to allow the most efficient delivery of waste to the site. Sufficient space is available to store two day's waste inputs prior to processing. Because waste is only accepted between the hours of 08:00 and 18:00 Monday to Friday and on Saturday mornings, the reception area will be completely cleared before the end of each day's operations. The reception area will be inspected, and if necessary cleaned, prior to the start of the next day's deliveries. It is the intention that waste is not stored in the reception hall for more than 24 hours but that waste received each day will be processed by the end of the evening shift wherever possible. Sufficient capacity does exist within the reception area for three days' waste storage (approximately 2,800 tonnes) should this be required as a contingency. Once processed, the gasifier fuel is transported internally into the Fuel Storage Hall, which can store sufficient fuel for a maximum of five days' operation.

A safe and secure quarantine area will be used for the storage of any inadvertently received non-permitted or unsuitable waste, pending its collection and removal from the site to a suitably authorised facility. This will be within a designated quarantine bay inside the waste reception area. The Fuel Preparation building has distinct, clearly defined areas to ensure that incoming waste, recyclates and RDF are stored separately and cannot become cross contaminated.

Waste is collected promptly following processing, generally within 24 hours. Maximum storage times of treated wastes will be as shown below:

Type of Product	Maximum Storage Time
Refuse Derived Fuel	5 Days
Metals and inert materials	1 Week
Fine organics	2 Days

Storage amounts at any one time are as follows:

Type of Product	Maximum Storage Volumes (m^3)
Unsorted Commercial and Industrial Waste	784
Unsorted Municipal Solid Waste	448
Unsorted Carpets / Mattresses	336
Unsorted Construction and Demolition Waste	336
Ferrous	24
Non-Ferrous	27
Fines	140
Inert Landfill	72
Landfill Residue	72
Organic	216
Plastics / PVC	180

All materials are removed to specialist recyclers or landfill within the acceptable hours of transportation from the site, and thus some segregated materials may be retained on site until the next delivery and dispatch period.

As the hours for waste delivery and dispatch are limited by the planning permissions whilst waste treatment continues for up to 18 hours a day, trailers loaded with waste may be parked on site overnight, pending dispatch the following morning, or on a Monday following Saturday morning operations.

Waste receipt and processing takes place inside the building, thus keeping the waste dry and minimising the possibility of fugitive emissions. Waste is received in enclosed or covered vehicles and is unloaded inside the building. As far as practical, the doors to the building are kept closed, other than when vehicles are entering or exiting the site.

5. Dust Prevention and Abatement

The main source of dust is likely to be from waste receipt, and the storage and treatment areas. To prevent and minimise the risk of a dust emission, all wastes are deposited and treated in the building. The building doors will be kept closed at all times possible except for when vehicles are tipping.

Incoming waste will be checked and assessed upon delivery for any dust and if found will be treated as priority to minimise any potential impacts. Waste will be covered when arriving at site and again this will minimise any dust emissions.

Waste is dosed with a BeeFoam additive after shredding. BeeFoam can capture dust and floating airborne particles and thus is used to reduce potential dust and odour emissions at site. The foam adheres to the dust and makes it heavier, such that no further dust is created.

Site staff will carry out assessments for dust outside the operational building and during a walk around survey of the site boundary, as part of the daily checks, these will be recorded in the site diary and on the Daily / Weekly Check Sheet (Doc Ref: OMS2.6). If dust is detected, a senior Manager will be notified and an investigation will be carried out as detailed below. No active dust monitoring will be carried out at the site unless identified as necessary through a number of complaints being received or identifying persistent issues at site. If dust is found to be a problem at the site, further abatement techniques will be reviewed and considered for use in discussion with Natural Resources Wales.

Yard areas and haul roads will be dampened down and cleaned when necessary to minimise any dust emissions. There are no additional dust control measures in place at the site, however the daily noise, odour and housekeeping checks would identify any areas of concern where additional measures may be required. Any complaints received would be investigated comprehensively, with full consideration given to any additional control or abatement necessary.

6. Dust Complaint Response

See EWL Complaints Procedure (Document Ref: GMS1.5.3) for further details. A summary of the procedure is below:

- Where a complaint is received, a record of the following details will be taken:
  - ❖ The name and contact details of the complainant;
  - ❖ The details of the complaint – nature, date, circumstances etc.
- Where sufficient detail can be obtained at the time of the complaint, any staff member receiving a complaint should complete a Complaint Form and these will be logged within the Complaints File.
- Once completed, the Complaint Form must be forwarded to the Manufacturing Manager who will investigate the issue.
- The Manufacturing Manager will make an initial assessment of the nature of the complaint, and will pass details of the complaint on to the Managing Director where a significant incident has occurred or if there is a pattern of repeated complaints.
- The Manufacturing Manager or another trained member of staff will investigate each and every complaint.
- The investigation may include consideration of the nature of incoming or treated wastes at the time of the complaint, the vehicles attending site at the time, the weather during the day of the complaint, or any other site factors, e.g. plant breakdown etc. which may have impacted on the site's ability to operate without causing a nuisance or annoyance (see below for further details of investigation specific to dust).
- Where remedial actions are considered appropriate, the Manufacturing Manager must instigate them within the site operations, and ensure that the results of any action are monitored and recorded.
- No later than 10 working days from the initial complaint, the QSE Manager or the Managing Director will contact the complainant to advise of the results of the investigation and the action taken unless they have requested that the Company does not contact them.
- Where investigations are on-going, the QSE Manager should offer to contact the complainant again after an agreed period, to update them on the investigation, and such contact must continue until the complaint is closed out, or until the complainant confirms that they do not require any further correspondence regarding the issue.
- Once remedial action is completed, the QSE Manager will record this in the Complaints File and the incident is considered to be closed, with a summary of the remedial action being provided to the Managing Director as appropriate.
- The QSE Manager, the Manufacturing Manager and Managing Director will assess the complaints logged at least annually, to review trends and to ensure that operational procedures are revised where required.

Further details of investigation of dust complaints:

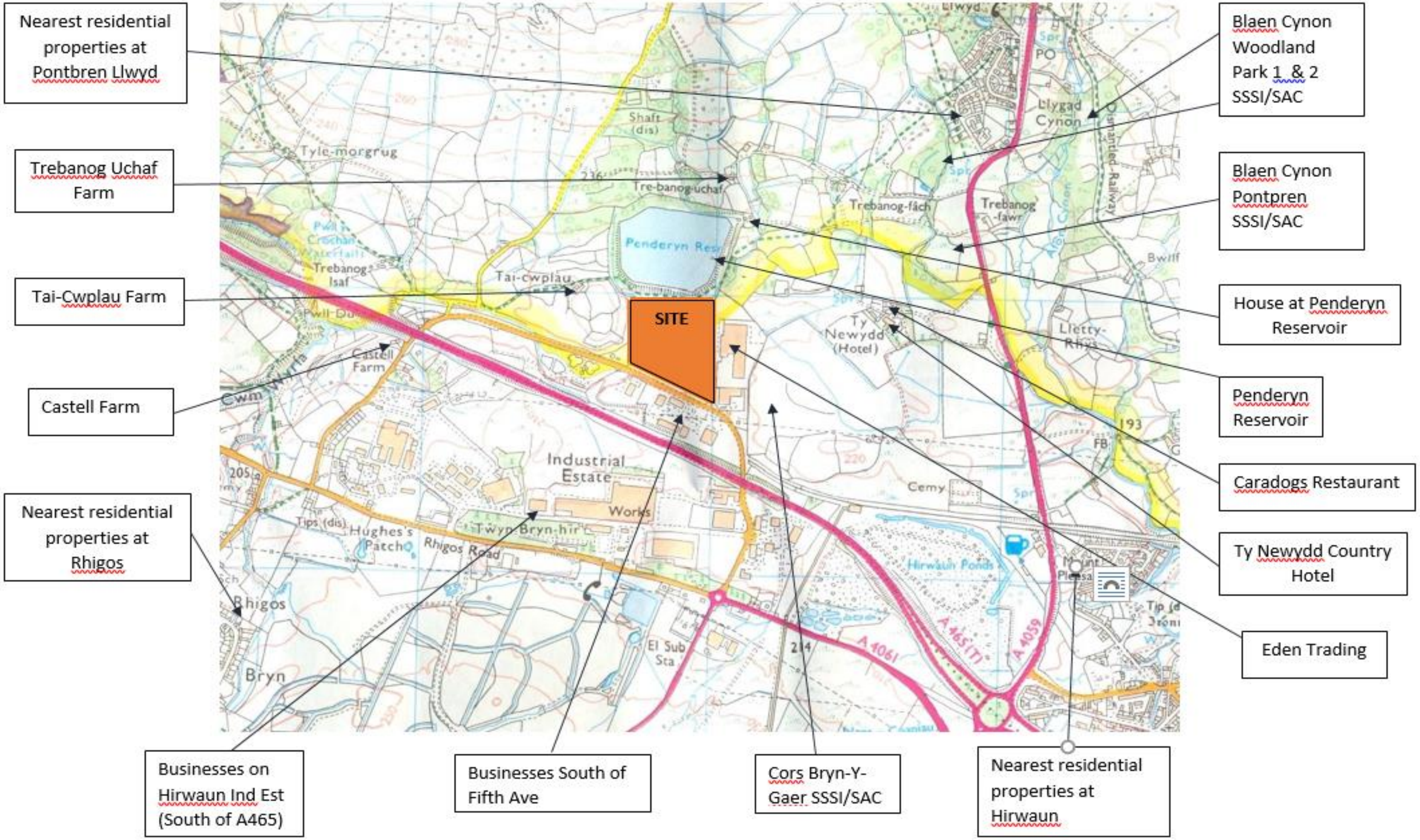
In order to investigate a dust complaint further, staff may need to complete off–site monitoring to confirm the presence of dust, its impact and potential sources. If deemed necessary, a trained staff member will carry out visual assessments at dedicated locations off site as well as at the complainant's location. A Dust Assessment Form (see Appendix C) will be completed and reported to the QSE Manager. The site will reduce or stop the activities that are causing the dust until either the circumstances have changed or other appropriate measures have been put in place to allow the operations to re-commence without causing offence. Where no evidence of dust can be found, or where it is determined not to be caused by the site processes, the QSE Manager will log their findings, and will report to the Local Authority / Natural Resources Wales / complainant as appropriate.

All complaints and investigations are recorded and are reported to the Site Manager, who is responsible for ensuring that any complaint is investigated and documented comprehensively.

A weather station is located on site to predict potential impacts on identified receptors. Neighbours are encouraged to contact the site directly to report any impacts from the site.

<u>Appendix A – Main Building Layout (includes details of waste processing and storage areas)</u>

Appendix B – Sensitive Receptors Map



Appendix C – Copy of Dust Assessment Form (Doc Ref: GMS1.5.3.3)

Enviroparks (Wales) Ltd. Dust Assessment Form

This form is to be completed when a Dust Assessment is carried out following a complaint of dust received by the site.

Assessment will be carried out at the following receptors/locations:

- Perimeter of Operational Building / Site Entrance / Site Exit / Complainants Location / Other locations TBC

Name of person carrying out assessment:	
Company role:	
Date & time of assessment:	
Location of assessment - Address/NGR	
Weather conditions:	
Wind direction:	
Details of complaint – location, nature of dust detected etc:	
Description of dust (fine / dark etc.):	
Potential source of dust	
Comments (e.g. is the source of dust evident and is it from EWL, is the dust constant or intermittent, can the dust be seen to be settling on surfaces such as cars and window sills?):	
Signed:	
Date:	

enviroparks

APPENDIX 7.4

OMS Odour Management Plan

1. Introduction

This Odour Management Plan forms part of the Integrated Management Plan and associated management systems for Enviroparks (Wales) Limited (EWL). It has been based on the Environment Agency guidance document (H4 Odour Management). It identifies potential sources of odour and risks to receptors; actions to minimise the risk of pollution from odour and procedures to follow should odour be detected off site in order to prevent or minimise the odour.

The site Environmental Permit states that Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable to minimise the odour.

The Plan also contains the following Appendices:

- Appendix A – Main Building Layout (includes details of waste processing and storage areas);
- Appendix B – Sensitive Receptors Map;
- Appendix C – Copy of Odour Assessment Form (Doc Ref: GMS1.5.3.2).

This plan will be reviewed and updated annually or following a significant odour release at site.

2. Overview of site activities

The Enviroparks (Wales) Limited site is located on Ninth Avenue, Hirwaun Industrial Estate, Hirwaun. It lies in an industrial area with industrial buildings to the south and east, and open land to the west. The Penderyn Reservoir is located to the north of the site.

The site will be permitted to pre-treat non-hazardous waste to produce a Refuse Derived Fuel (RDF) to a set specification. The RDF will be used at the site to fuel three gasifiers to produce renewable energy. All site activities, from the receipt of wastes to its treatment and storage will be included within the site Environmental Permit. Directly Associated activities include the discharge of potentially contaminated drainage to sewer, the storage and use of diesel fuel, oils and greases, and as required, the storage and use of dust and odour suppressant chemicals.

The site will principally be operated by Enviroparks (Wales) Limited, although operations and maintenance may be subcontracted if appropriate, and will treat mainly commercial and industrial wastes to extract ferrous metal, fines, and inert aggregate for recycling. The site will also receive other pre-treated wastes, such as RDF produced by third parties. Once recyclable materials have been removed, the residual material will be processed and prepared to a specified fuel for use in the three gasifier lines proposed for installation at the site. The site targets delivery of up to 97.5 % diversion from landfill of materials entering the site, and the energy produced by the waste processing will be traded to a high-energy demand commercial operation, co-located with the facility on suitable commercial terms, with excess energy being sold to the National Grid.

All incoming wastes will be unloaded, stored and treated within the Fuel Preparation Hall, and loose recyclates will be stored and loaded for dispatch from within the building. Incoming feedstocks will be separated into recyclates, gasifier fuel and aggregates. As far as practical, the building's roller shutter doors will be kept closed, except for when vehicles are entering or exiting the building, to contain any odour, dust or litter. Discharges to atmosphere from the gasification lines will be from a 90 m high chimney. There are no other point source emissions to air from the site apart from building ventilation. The only emission to surface water is from roofs and clean landscaped areas. All waste processing and plant wash down areas drain to the foul water system.

As part of the Integrated Management Plan, the Company maintains a detailed Site Accident and Incident Management Plan which includes full consideration of the potential for accidents and incidents to occur at the site, the possible resultant impact of such incidents, and the control measures employed to guard against and deal with such incidents should they occur. Additionally, a Non-Conformance reporting and investigation procedure is used for all incidents and supports the continual review and development of the Accident and Incident Management Plan. The information collated and regularly reviewed through this system, results in relevant emergency procedures, which specify the actions to be taken in the event of any such incident, e.g. fire, spill, flooding etc. occurring.

3. Potential Sources of Odours and receptors at risk

The site is permitted to receive and store the following potentially odorous wastes:

- Wood / Plant Tissue Waste;
- Refuse Derived Fuel (RDF) / Solid Recovered Fuel (SRF);
- Biodegradable Waste.

The amounts of biodegradable wastes should be minimal due to the nature of the wastes being accepted at the site.

Other potential sources of odours:

- Fuels / Chemical storage;
- Leachate / contaminated run-off.

Off Site potential odour sources:

- Hirwaun Waste Water Treatment Works – located off Ninth Avenue approximately 50 metres from site boundary;
- Farms – As identified in receptors table below.

The map in Appendix B shows sensitive receptors within a 1.5 km radius of the site. Sensitive receptors are identified as residential dwellings, ecologically designated sites, and commercial buildings/businesses.

Sensitive receptors include:

- human: schools, hospitals, nursing and care homes, residential areas, workplaces;
- critical infrastructure: roads, railways, bus stations, pylons, utilities, airports;
- environmental: surface and groundwater, protected habitats and air quality management areas.

Within the 1.5 km radius, the following receptors have been identified:

Receptor	Approximate distance from site boundary (m)	Direction
Eden Trading	10	E
Penderyn Reservoir	60	N
Businesses South of Fifth Avenue	40-100	S
Cors Bryn-Y-Gaer SSSI / SAC	135	ESE
Businesses on Hirwaun Ind. Est. (South of A465)	250-700	SW/S/SE
House at Penderyn Reservoir	375	NNE
Trebanog Uchaf Farm	380	NNE
Tai-Cwpla Farm	420	WNW
Ty Newydd Country Hotel	600	NE
Caradogs Restaurant	600	NE
Blaen Cynon Pontpren SSSI / SAC	710	ENE
Blaen Cynon Woodland Park 1 SSSI / SAC	740	NE
Castell Farm	820	SW
Blaen Cynon Woodland Park 2 SSSI / SAC	830	NE
Nearest residential properties at Pontbren Llwyd	1000	NE
Nearest residential properties at Hirwaun	1300	SE
Nearest residential properties at Rhigos	1350	SSW

The site will proactively engage with all sensitive receptors through their Community Interest Company, and encourage discussions should there be any concerns or issues with the site activity.

4. Waste Quantities and Storage

The currently permitted site capacity is for the receipt of up to 238,000 tonnes of waste per annum and this will comprise commercial and industrial (C and I) waste and pre-treated RDF. Acceptable C and I wastes will primarily be from commercial and industrial operations, along with some construction and demolition waste. The site will also accept pre-treated waste for use in the gasification process. There is no daily maximum throughput specified on the site Permit, however the site will receive no more than 550 tonnes of waste on any one day. The majority of wastes will be processed for use as gasifier fuel, once recyclates and aggregates are removed, with a minimal rate of rejection to landfill. An insignificant quantity of material may require returning to the waste producer via the quarantine procedure, where these are not acceptable to the process, e.g. gas bottles.

Waste delivery and dispatch is restricted to 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturday. In accordance with the planning conditions on the site, there are no waste movements on Sundays or bank holidays. Waste will not be accepted if for any reason there is insufficient storage capacity available or if the site is inadequately staffed.

During operational hours, the main gates are open and the site is manned with sufficient staff for the operations. Outside of operational hours the gates are shut and locked, and the site employs a security guard and recorded CCTV surveillance.

Waste and feedstocks arriving at site are checked visually for quality assurance purposes and unacceptable wastes / feedstocks will be refused entry if they fail this initial inspection and screening process. Acceptable wastes / feedstocks are then weighed on a weighbridge and directed to the delivery area.

All incoming wastes (including pre-processed Refuse Derived Fuel) are unloaded and stored within the Fuel Preparation Hall where they are screened and segregated before either being stored or loaded into the production process and primary shredder. Operations that occur once the waste has been received are:

- Sorting of incoming Waste to separate out recyclates (Ferrous and non-ferrous metals).
- Separation of fines and further processing to remove biogenic mater for the reintroduction of the organic fines fraction to gasifier fuel.
- Shredding of the RDF waste to a gasifier fuel specification.
- Storage of loose recyclates and landfill materials in bunkers prior to dispatch off-site. These are stored at the far end of the building from the reception area.

Waste delivery vehicles reverse into the building through fast acting roller shutter doors. In total, there are four delivery access doors**,** allowing more than one vehicle to enter the waste reception area simultaneously. The fast-acting roller shutter doors are automatically controlled, closing behind delivery vehicles wherever possible, whilst they discharge their loads. On entering the waste reception area, vehicles discharge their payload onto a flat impermeable reception slab surrounded by concrete push walls to a height of 5m. The building's roller shutter doors are, as far as practical, kept closed, except for when vehicles are entering or exiting the building, to contain any odour, dust or litter.

Upon tipping, a wheeled front end loader(s) and 360^0 grab(s) are employed to manage the incoming waste. The waste will be sorted into appropriate fractions as detailed above. Inerts, heavy residues and recyclates will be segregated and sorted. Segregated wastes are directed immediately into appropriate bunkers or containers ready for collection from site. The quantity of material in the bunkers and containers is monitored and they are emptied and exchanged as necessary to ensure adequate storage space for the incoming materials. The residual waste will be shredded to < 75 mm particle sizes and sent via conveyor to the fuel storage building where it will be stored in bunkers prior to being used in the gasification process.

The Fuel Preparation Hall has been designed to ensure ease of access and to allow the most efficient delivery of waste to the site. Sufficient space is available to store two day's waste inputs prior to processing. Because waste is only accepted between the hours of 08:00 and 18:00 Monday to Friday and on Saturday mornings, the reception area will be completely cleared before the end of each day's operations. The reception area will be inspected, and if necessary cleaned, prior to the start of the next day's deliveries. It is the intention that waste is not stored in the reception hall for more than 24 hours but that waste received each day will be processed by the end of the evening shift wherever possible. Sufficient capacity does exist within the reception area for three days' waste storage (approximately 2,800 tonnes) should this be required as a contingency. Once processed, the gasifier fuel is transported internally into the Fuel Storage Hall, which can store sufficient fuel for a maximum of five days' operation.

A safe and secure quarantine area will be used for the storage of any inadvertently received non-permitted or unsuitable waste, pending its collection and removal from the site to a suitably authorised facility. This will be within a designated quarantine bay inside the waste reception area. The Fuel Preparation building has distinct, clearly defined areas to ensure that incoming waste, recyclates and RDF are stored separately and cannot become cross contaminated.

Waste is collected promptly following processing, generally within 24 hours. Maximum storage times of treated wastes will be as shown below:

Type of Product	Maximum Storage Time
Refuse Derived Fuel	5 Days
Metals and inert materials	1 Week
Fine organics	2 Days

Where operations stop for more than 24 hours, such as at weekends, waste will be turned prior to re-starting operations. This prevents hotspots from developing within the waste and reduces the potential for anaerobic and potentially odorous conditions to develop. It also ensures that material is processed on a first-in, first-out basis, and avoids fresh waste being stored on top of stored waste, as the waste is moved forwards within the bunker, enabling fresh waste to be stored behind.

Storage amounts at any one time are as follows:

Type of Product	Maximum Storage Volumes (m^3)
Unsorted Commercial and Industrial Waste	784
Unsorted Municipal Solid Waste	448
Unsorted Carpets / Mattresses	336
Unsorted Construction and Demolition Waste	336
Ferrous	24
Non-Ferrous	27
Fines	140
Inert Landfill	72
Landfill Residue	72
Organic	216
Plastics / PVC	180

All materials are removed to specialist recyclers or landfill within the acceptable hours of transportation from the site, and thus some segregated materials may be retained on site until the next delivery and dispatch period.

As the hours for waste delivery and dispatch are limited by the planning permissions whilst waste treatment continues for up to 18 hours a day, trailers loaded with waste may be parked on site overnight, pending dispatch the following morning, or on a Monday following Saturday morning operations.

Waste receipt and processing takes place inside the building, thus keeping the waste dry and minimising the possibility of fugitive emissions. Waste is received in enclosed or covered vehicles and is unloaded inside the building. As far as practical, the doors to the building are kept closed, other than when vehicles are entering or exiting the site.

5. Odour Prevention/Abatement

The main source of odours at the site is likely to be from waste receipt, and the storage and treatment areas. Elements of biodegradable / putrescible materials may be included with the waste, and these can lead to odour if not treated in a timely manner. The main odour prevention technique will be through management, with all wastes being deposited and treated in the Fuel Preparation Hall. The building doors will be kept closed at all times possible except for when vehicles are tipping. Systems of suitable and sufficient ventilation, coupled with fast acting roller shutter doors will minimise the potential release of odour.

Incoming waste will be checked and assessed upon delivery for any odorous materials and if found will be treated as a priority to minimise any potential impacts. Waste will be covered when arriving at site and again this will minimise odours.

Waste is dosed with a BeeFoam additive after shredding. BeeFoam can capture dust and floating airborne particles and thus is used to reduce potential dust and odour emissions at site. The foam adheres to the dust and makes it heavier, such that no further dust is created, and thereby also minimises the release of odours.

Wastes that are considered to have the potential to cause odours will be stored at the site for no longer than 2 days, and to avoid situations that favour anaerobic breakdown and odours, the waste will be frequently turned. Once separated, the waste is stored in bunkers within the building.

Air from the Fuel Storage hall will be extracted and used as a combustion gas in the gasification process. As such, the Fuel Storage Hall will be under negative pressure and thus will reduce the potential for fugitive odorous emissions.

Site staff will carry out odour assessments outside the operational buildings and during a walk around survey of the site boundary, as part of the daily checks, these will be recorded in the site diary and on the Daily / Weekly Check Sheet (Doc Ref: OMS2.6). If odours are detected, a senior Manager will be notified and an investigation will be carried out as detailed below. No active odour monitoring will be carried out at the site unless identified as necessary through a number of complaints being received or identifying persistent issues at site. Where persistent or repeated complaints are received, complainants will be asked to keep an odour diary in an attempt to identify the cause of the odour. If odour is found to be a problem at the site, further abatement techniques will be reviewed and considered for use in discussion with Natural Resources Wales.

There are no additional odour control measures in place at the site, however the daily noise, odour and housekeeping checks would identify any areas of concern where additional measures may be required. Any odour complaints received would be investigated comprehensively, with full consideration given to any additional control or abatement techniques necessary.

6. Odour Complaint Response

Enviroparks (Wales) Ltd operate a complaints reporting procedure, and all complaints are logged and investigated. This procedure applies to complaints of any nature, including those relating to odour issues.

See EWL Complaints Procedure (Document REF: GMS1.5.3) for further details. A summary of the procedure is below:

- Where a complaint is received, a record of the following details will be taken:
  - ❖ The name and contact details of the complainant;
  - ❖ The details of the complaint – nature, date, circumstances etc.
- Where sufficient detail can be obtained at the time of the complaint, any staff member receiving a complaint should complete a Complaint Form and these will be logged within the Complaints File.
- Once completed, the Complaint Form must be forwarded to the Manufacturing Manager who will investigate the issue.

- The Manufacturing Manager will make an initial assessment of the nature of the complaint, and will pass details of the complaint on to the Managing Director where a significant incident has occurred or if there is a pattern of repeated complaints.
- The Manufacturing Manager or another trained member of staff will investigate each and every complaint.
- The investigation may include consideration of the nature of incoming or treated wastes at the time of the complaint, the vehicles attending site at the time, the weather during the day of the complaint, or any other site factors, e.g. plant breakdown etc. which may have impacted on the site's ability to operate without causing a nuisance or annoyance (see below for further details of investigation specific to odour)
- Where remedial actions are considered appropriate, the Manufacturing Manager must instigate them within the site operations, and ensure that the results of any action are monitored and recorded.
- No later than 10 working days from the initial complaint, the QSE Manager or the Managing Director will contact the complainant to advise of the results of the investigation and the action taken unless they have requested that the Company does not contact them.
- Where investigations are on-going, the QSE Manager should offer to contact the complainant again after an agreed period, to update them on the investigation, and such contact must continue until the complaint is closed out, or until the complainant confirms that they do not require any further correspondence regarding the issue.
- Once remedial action is completed, the QSE Manager will record this in the Complaints File and the incident is considered to be closed, with a summary of the remedial action being provided to the Managing Director as appropriate.
- The QSE Manager, the Manufacturing Manager and Managing Director will assess the complaints logged at least annually, to review trends and to ensure that operational procedures are revised where required.

Further details of investigation of odour complaints:

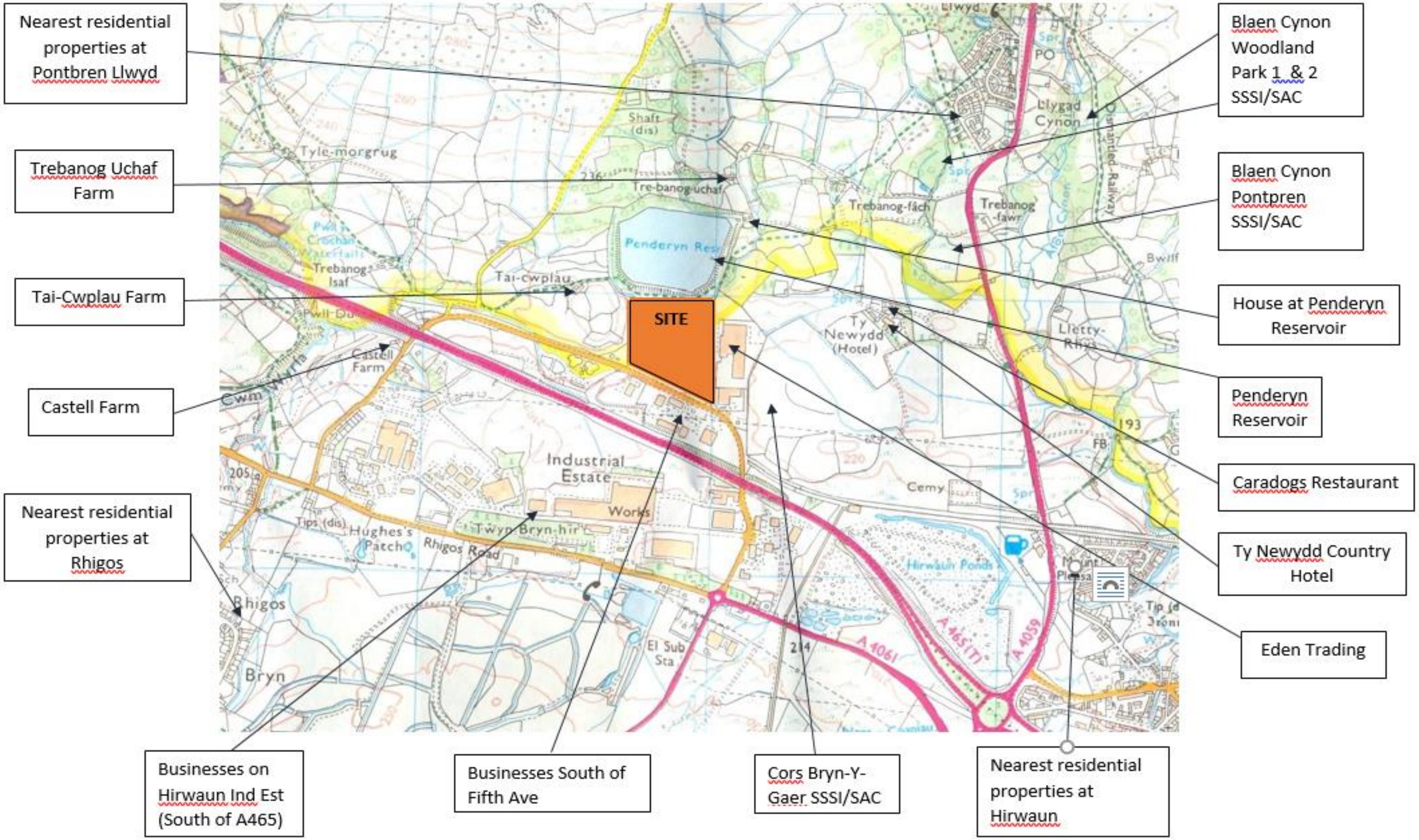
In order to investigate an odour complaint further, staff may need to complete off–site monitoring to confirm the presence of an odour, its impact and potential sources. If deemed necessary, a trained staff member will carry out olfactory assessments at dedicated locations off site as well as at the complainant's location. An Odour Assessment Form (see Appendix C) will be completed and reported to the QSE Manager. The site will reduce or stop the activities that are causing odour until either the circumstances have changed or other appropriate measures have been put in place to allow the operations to re-commence without causing offence. Where no evidence of odour can be found, or where it is determined not to be caused by the site processes, the QSE Manager will log their findings, and will report to the Local Authority / Natural Resources Wales / complainant as appropriate.

All complaints and investigations are recorded and are reported to the Site Manager, who is responsible for ensuring that any complaint is investigated and documented comprehensively.

A weather station is located on site to predict potential impacts on identified receptors. Neighbours are encouraged to contact the site directly to report any odour impacts from the site.

Appendix A – Site Layout (includes details of waste processing and storage areas)

Appendix B – Sensitive Receptors Map



Appendix C - Copy of Odour Assessment Form (Doc Ref: GMS1.5.3.2)

Enviroparks (Wales) Ltd. Odour Assessment Form

This form is to be completed when an Odour Assessment is carried out following a complaint of odour is received by the site.

Assessment will be carried out at the following receptors/locations:

- Perimeter of Operational Building / Site Entrance / Site Exit / Complainants Location / Other locations TBC

Name of person carrying out assessment:	
Company role:	
Date and time of assessment:	
Location of assessment - Address/NGR	
Weather conditions:	
Wind direction:	
Details of complaint - location, nature of odour detected etc:	
Time odour first detected:	
Description of odour:	
Intensity of odour (0 No odour **1** Very faint odour **2** Faint odour **3** Distinct odour **4** Strong odour **5** Very strong odour **6** Extremely strong odour**)**	
Odour intensity characteristics – Is the odour a consistent strength or does it vary?	
Time odour no longer detected:	
Comments (e.g. what does it smell like, is the source evident, is it constant or intermittent?):	
Signed:	
Date:	

enviroparks

APPENDIX 7.5

Dispersion Modelling Report

Environmental Visage

ATMOSPHERIC DISPERSION MODELLING ASSESSMENT OF PROPOSED EMISSIONS FROM ENVIROPARKS (WALES) LIMITED HIRWAUN INDUSTRIAL ESTATE

Report Issue No: 1
Report Date: May 2020
Report Author: Amanda Owen

Executive Summary

Enviroparks (Wales) Limited (EWL) has planning consent for the development of a resource recovery and energy production plant at their site in Hirwaun, South Wales. The site is located partly within the Rhondda Cynon Taf County Borough Council's jurisdiction, and partly within that of the Brecon Beacons National Park Authority. Since the original consent was granted by both Councils (2010), the specific technologies to be employed at the site have changed, although the fundamental processes of the operation remain the same, and the 2010 consent was amended by Brecon Beacons National Park Authority in 2019 to account for changes in both the nature of the materials to be treated at the site, and in the number of different technologies used to treat them. A revised dispersion model and Air Quality Assessment was produced to account for the revisions to the scheme which included, for example, the lack of a requirement for a flare at the site. Subsequent amendments have since been made to the planning consents, although none have required further consideration of the impacts on air quality.

Additional changes are now proposed at the site, largely due to the requirement to ensure that the chosen technology type is guaranteed to provide sufficient protection of the sensitive ecological receptors in the immediate vicinity of the site. Emissions to atmosphere from the gasification process could have a significant impact on the local ecological sites if the plant is not appropriately designed and controlled, and as such, further design work has continued to ensure that the Best Available Techniques, which progress over time, are being employed at the site and can provide the best possible protection for human health and the environment. Hence, although there are no fundamental changes proposed to the basic site processes, variations and improvements in available technologies now require changes to the site design, and in this instance, the proposal is to increase the stack height to 90 m in order to ensure the lowest possible contributions to the local environment through effective and thorough dispersion of the emissions to atmosphere from the chosen technology. The emissions data applied are in line with proposals from a credible technology provider, which has confirmed that the process can meet the discharge rate releases proposed, using available technologies.

As such, EWL is requesting an amendment to their planning permission, and provides an Addendum to the earlier Environmental Statement and supporting studies (ES Addendum). This dispersion modelling assessment is submitted in support of both the ES Addendum and a Shadow Habitat Regulations Assessment Stage 1: Screening and Stage 2: Appropriate Assessment report which will also be provided with the planning application. Where appropriate, results of the modelling exercise have been compared with the current Air Quality Standards and Objectives, or, to the relevant Environmental Assessment Level (EAL), collectively referred to as Environmental Quality Standards (EQS).

This assessment considers releases to atmosphere from a three-line gasification plant, with three individual flues routed through a single, 90 m tall chimney stack. The location of the proposed stack has also moved in order to provide ease of sampling which is required on both a continuous and frequent extractive basis, and to avoid the sampling gantry from overhanging the main access route through the site.

The results of the modelling exercise have demonstrated that when discharging the proposed emissions through 90 m high flues, co-located within a single chimney structure, the potential impact of the Enviroparks facility has been reduced dramatically, and can be screened as insignificant at the modelled receptor points. Emissions to atmosphere from the plant, have been considered against assessment levels both for the protection of human health and sensitive ecological receptors, applying the assessment methodologies advised by Natural Resources Wales.

Contents

Issue and Revision Record

Issue	Date	Author	Review / Authorise	Description
DRAFT	05/05/2020	A. Owen	ENVISAGE	Initial Draft for Client Comment
DRAFT V2	22/05/2020	A. Owen	ENVISAGE	Final Draft
1	11/06/2020	A. Owen	ENVISAGE	Issue 1

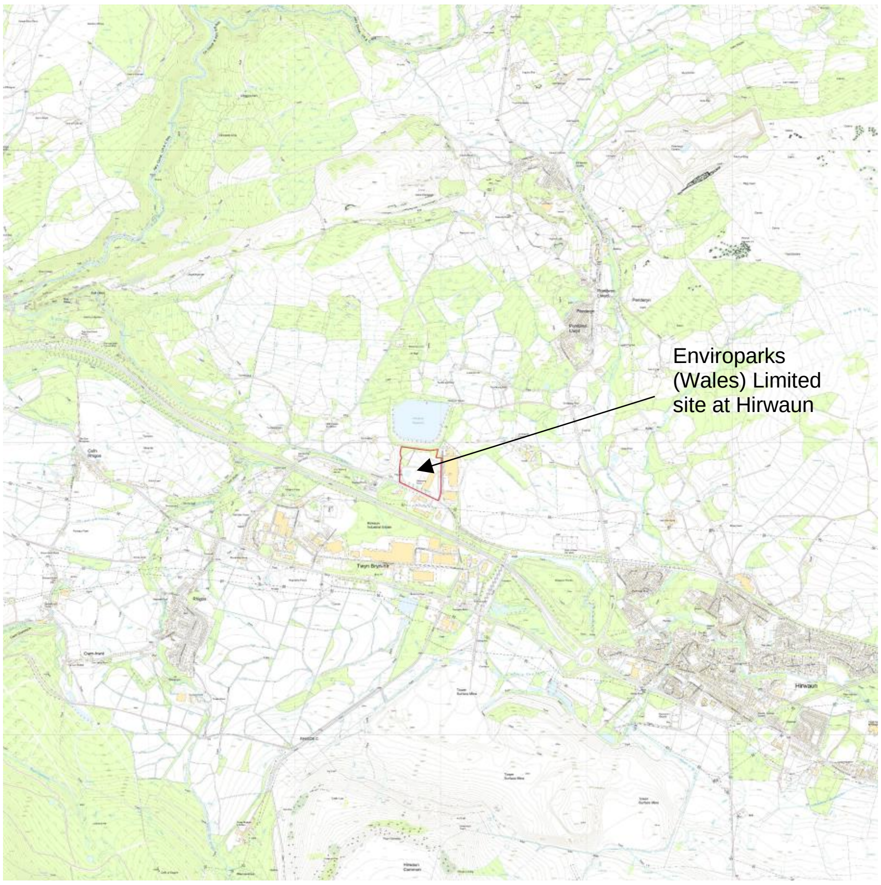
1. Introduction

Enviroparks (Wales) Limited (EWL) are in the process of developing a site on the Hirwaun Industrial Estate in Hirwaun, Aberdare. The company plans to operate a resource recovery and energy production plant using Refuse Derived Fuel (RDF) and Commercial and Industrial waste in an advanced thermal treatment process. The site will receive up to 238,000 tonnes of incoming material each year. After the initial removal of any recyclates, the residual fuel will amount to 180,000 tonnes which will be prepared and processed through three gasification lines. The proposed development will create 86,724 MW of electrical energy each year, some of which will be used by a 'high energy user' – a manufacturing facility with high energy needs, occupying an industrial unit proposed in the northern part of the site, with the remainder being exported to the grid.

Point source emissions to atmosphere include three flue discharge points, one for each gasification line, which are all located within a single chimney stack, discharging at 90 m high. Other releases of warm air will occur across the site, including from air cooled condensers, and building ventilation. Consideration was given to all release points across the site in earlier reported modelling studies and demonstrated no impact from releases of warm air and ventilation sources on the main discharge point, due to the height of the release. Hence these warm air releases have not been considered again during this study. However, similarly to previous modelling reports, consideration has been given to the cumulative effects of other, third party plant in the area which are planned but not yet, or only recently in-situ.

This report details the modelling work undertaken and presents the findings of the study. A location plan of the site is shown in Figure 1 below.

Figure 1 Location of the Proposed Development



2. Principal Objectives and Scope of Work

The principal aim of the work undertaken was to determine the nature of the dispersion of air borne pollutants from the proposed EWL site, in order to predict the environmental impact of the development on the surrounding area. The site already holds planning consent for operations proposed by the Company, however changes to the technologies now planned for the site, and the intention to install a 90 m chimney stack to ensure minimal impact on the local sensitive ecological features, will modify the dispersion of the pollutant releases somewhat. As such, the key concern of this study is to detail the likely impact of discharges to atmosphere from the site, when considering both human health and ecological receptors, and to demonstrate an acceptable level of potential impact on the closest European designated sites. The local area includes a number of sensitive receptors including Blaen Cynon, Coedydd Nedd a Mellte, and Cwm Cadlan which are all Special Areas of Conservation (SACs); a number of Sites of Special Scientific Interest (SSSI), ancient woodlands and the Penderyn Reservoir; as well as human workplaces and residences. As such, the impact of the proposed operations must be sufficiently small to ensure the continued protection of human health, and the protection of sensitive ecological sites.

Each of the SAC sites is located within 3 km of the Enviroparks site, with Blaen Cynon located less than 300 m from the discharge stack at the SAC's nearest point. Coedydd Nedd a Mellte is located approximately 1.37 km from the discharge stack at its nearest point, and Cwm Cadlan is approximately 2.56 km distant.

The sensitive ecological status of these sites results in the designation of stringent Critical Loads. A Critical Load is defined as "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"(1). A Shadow Habitat Regulations Assessment Stage 1: Screening and Stage 2: Appropriate Assessment report has been developed by Middlemarch Environmental Limited, which considers these three sensitive sites, and data from the modelling work reported here has been used to inform an update to that assessment.

It is recognised that there will always be a level of emission from an installation which is so small such that the resultant impact would constitute an 'inconsequential effect', and this is deemed to be 1 % of the long-term Critical Level or Critical Load, or 10 % of any short-term level. Hence, in order to present a precautionary approach to the consideration of impacts on the SACs, the ability of the discharges from the installation to result in an inconsequential effect, is considered.

The only definitive means of quantifying the impact of process emissions on air quality and the surrounding area is to undertake a comprehensive programme of environmental monitoring around the site in question. As an alternative, atmospheric dispersion modelling provides a means of estimating the potential impacts of emissions with a reasonable degree of confidence, by modelling the dispersion of a plume or plumes exiting a chimney in relation to a number of key parameters. This enables the calculation of an estimated contribution to ground level pollutant concentrations arising from the releases, prior to the development of new, or modification of existing plant.

For the purpose of this study, the latest version of the UK Atmospheric Dispersion Modelling System was used (ADMS 5.2). The ADMS model is one of the leading atmospheric dispersion models available in the UK and can be used to assess ambient pollutant concentrations from a wide variety of emissions sources associated with an industrial installation.

3. Study Parameters

Details of the release characteristics to be considered were supplied by the technology providers, via the Enviroparks design team. The technology providers are committed to attaining the release levels stated and have demonstrated their ability to meet such levels at other sites. The proposed emission limit values are either in line with, or below, the Best Available Technique Achievable Emission Levels (BAT-AELs) specified in the recently revised Waste Incineration Best Available Techniques Reference Note (WI-BREF) and the associated Best Available Techniques Conclusions (BAT-C) document. The BAT-AELs specified by the BAT-C are more stringent than previously acceptable emissions concentrations, demonstrating the development in the technologies associated with waste incineration and advanced thermal processes designed to produce energy from residual wastes. Enviroparks is committed to operate within the emission limit values placed upon them, either through the Industrial Emissions Directive and the associated WI-BREF and BAT-C document, or through their commitment to site specific BAT which may be more stringent still.

Modelling a proposed site which is not yet built and operational enables full consideration to be given to the potential for dispersion, and thus enables the design of the chimney structure and process equipment to take the results of the modelling work into account. It does however also mean that all of the input data is calculated rather than being drawn from actual measured values, and some additional assumptions may also have to be made.

3.1 Modelling Uncertainty

Atmospheric dispersion modelling is not a precise science and results can be impacted by a variety of factors such as:

- Model uncertainty - due to limitations in the dispersion algorithms incorporated into the model and their ability to replicate “real life” situations;
- Data uncertainty - due to potential errors associated with emission estimates, discharge characteristics, land use characteristics and the relevance of the meteorological data to a particular location; and,
- Variability - randomness of measurements used.

CERC models are continually validated against available measured data obtained from real world situations, field campaigns and wind tunnel experiments. Validation of the ADMS dispersion models has been performed using many experimental datasets that test different aspects of the models, for instance: ground / high level sources, passive and buoyant releases, buildings, complex terrain, chemistry, deposition and plume visibility. These studies are both short-term as well as annual, and involve tracer gases or specific pollutants of interest.

Potential uncertainties in model results derived from the current study have been minimised as far as practicable, and a series of worst-case assumptions have been applied to the input data in order to provide a robust assessment. This included the following:

- Selection of the dispersion model - ADMS 5.2 is a commonly used atmospheric dispersion model and results have been verified through a number of inter-comparison studies to ensure that model predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using hourly average meteorological data from the Sennybridge measurement station which is considered to be the most representative of local conditions;
- Plant operating conditions – Operating conditions were based upon process information provided by Zeus Renewables Limited, and Harris Pye Limited, technology providers to Enviroparks (Wales) Limited;
- Receptor locations - A 6 km x 6 km Cartesian Grid with 30 metre grid spacing was utilised in the model in order to calculate the maximum predicted pollutant concentrations in the vicinity of the proposed gasification plant. Specific receptor locations were also included in the model to provide detailed assessment at key sensitive points; and,

- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

Results were considered in the context of AQS objective values and relevant Environmental Assessment Levels recommended by the Natural Resources Wales. The application of the above measures to reduce uncertainty and the use of a series of worst-case assumptions relating to the operational performance of the process should result in model accuracy of an acceptable level.

3.2 Emission Parameters

Under the proposed revised scheme, the main pollutant releases will discharge through a 90 m stack. Three individual flues will each serve a gasification line, and will be routed through a single chimney stack. The characteristics of the individual release points have been modelled as presented in Tables 1 to 3.

Table 1 Stack Central Grid References, Enviroparks (Wales) Limited

Reference Number	Grid Reference X (m)	Grid Reference Y (m)
A1	293872.5	206729
A2	293873	206730.5
A3	293874	206729.8

Table 2 Emission Point Parameters, Enviroparks (Wales) Limited

Release Points A1 – A3	Stack Design Data
Internal Flue Diameter (m)	1.379
Stack Height (m)	90
Temperature of Release (K)	413
Actual Flow Rate (m^3/s at 9 % Oxygen)	26.9
Emission Velocity at Stack Exit (m/s)	18.01

Table 3 Modelled Emissions to Atmosphere, Enviroparks (Wales) Limited

Emission Concentration (Daily Average)	**At 11 % O_2 (mg/Nm^3)**	**Emissions at stack Conditions**	**A1 - A3 Release Rate (g/s)**
HCl	5	3.42	9.19E-02
HF	1	0.683	1.84E-02
SO_2	10	6.83	1.84E-01
NH_3	0.5	0.342	9.19E-03
NO_x	40	27.33	7.35E-01
Particulate Matter (as PM_{10})	5	3.42	9.19E-02
Total Organic Carbon (TOC)	10	6.83	1.84E-01
CO	50	34.17	9.19E-01
Group I (Cd, Tl)	0.02	0.014	3.68E-04
Group II (Hg)	0.02	0.014	3.68E-04
Group III (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.3	0.205	5.51E-03
Dioxins and Furans (2,3,7,8 TCDD TEQ)	0.00000004	0.00000003	7.35E-10
PCB (combined with Dioxins and Furans)	0.00000006	0.00000004	1.10E-09
PAHs (as B[a]P)	0.001	0.00068	1.84E-05

The emission concentrations provided are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in the Waste Incineration BAT-Conclusions document. Important notes on the emissions include:

- Emissions of Total Organic Carbon (TOC) have been modelled within this study and can be compared with the AQS / EAL for Benzene and / or 1,3-Butadiene. However, the TOC release will comprise a combination of Volatile Organic Compounds (VOCs) including Benzene, 1,3-Butadiene and others, and therefore, the Process Contribution predicted by the model will provide a very conservative assessment of the contribution of any individual species, which cannot be more accurately considered without detailed information on the composition of the TOC.
- Similarly, the metal groups are released and modelled as the sum of their constituent parts, rather than, for example, 0.000368 g s^{-1} Cadmium and 0.000368 g s^{-1} Thallium. Where the resultant concentrations of these pollutants are reported in Appendix A, the concentration stated is the total pollutant level of the group, and not the pollutant concentration of any one of the substances, unless otherwise calculated and stated as such.
- Dioxins and Furans have been modelled as 2,3,7,8 TCDD TEQ, and in combination with PCBs. Therefore, and as with other combined releases, the resultant PCB concentration reported in Appendix A is actually the combined release of Dioxins, Furans and Poly Chlorinated Biphenyls, and would not be additional to the Dioxin and Furan release modelled individually.
- The mass release of some pollutants from the process differ from the BAT-AELs, and demonstrate the ability to attain far more stringent discharge conditions. The ability of the revised technology systems to meet the specified pollutant discharge concentrations is assured.

Emissions concentration data was provided as per the BAT-AEL reference conditions for waste incineration plant, although was input into the model, along with details of the emission flow rate at stack conditions, specifically at measured temperature and pressure, 14 % moisture and 9 % Oxygen. Hence, the emitted concentration appears to suggest a lower discharge than that specified at the reference conditions, but results in the same mass release (g/s) as would otherwise be calculated.

NO_x or NO_2

Emissions of NO_x will comprise contributions of Nitric Oxide (NO) and Nitrogen Dioxide (NO_2). Air quality assessments are made against the concentration of NO_2, although assessments for the impact on vegetation are made against the concentrations of NO_x as NO_2. As emissions of NO_2 are only ever a proportion of the total emissions of NO_x, an allowance for the quantity of NO_2 in NO_x has to be made.

Natural Resources Wales adopts the Environment Agency guidance(2) which states that:

Emissions of Oxides of Nitrogen should be recorded as Nitrogen Dioxide because Nitrogen Oxide converts to Nitrogen Dioxide over time:

- For short-term Process Contributions (PC) and Predicted Environmental Concentrations (PEC), assume only 50 % of emissions of Oxides of Nitrogen convert to Nitrogen Dioxide in the environment;
- For long-term PCs and PECs, assume all Oxides of Nitrogen convert to Nitrogen Dioxide.

Deposition Factors

Rates of dry deposition were included and were based on the following parameters, specified by the Regulator for habitat appropriate assessment modelling(3).

Table 4 Recommended Deposition Factors

Pollutant	Recommended Deposition Velocity (m s^{-1})	
Nitrogen Dioxide	Grassland	0.0015
	Forest	0.003
Sulphur Dioxide	Grassland	0.012
	Forest	0.024
Hydrogen Chloride	Grassland	0.025
	Forest	0.06
Ammonia	Grassland	0.020
	Forest	0.030

The sensitive ecological receptors in the local area comprise both grassland and woodland or forest receptors, and as such, models have been run twice, applying grassland and forest deposition factors respectively, to ensure that appropriate consideration is given to the potential impact on each sensitive ecological receptor.

Where a dry deposition velocity cannot be specified, pollutants are identified as reactive or un-reactive depending on whether or not the gas will undergo a significant chemical reaction with the surface of the ground. For the purpose of this study, all pollutants without a specific deposition factor were assumed to be unreactive, except for HF which is considered to be reactive. Although some volatile organic compounds would generally be considered to be reactive, Benzene, which is the specific pollutant referred to by the Air Quality Standard, has a low solubility and hence was assumed to be a less reactive compound.

Information from Cambridge Environmental Research Consultants (CERC), the company which developed the ADMS model, specifies that for SO_2, NO_2, and NH_3, wet deposition from a short-range plume is much less significant compared with dry deposition, and therefore does not usually need to be considered. Wet deposition due to a primary release of Sulphur Trioxide or Sulphuric Acid would need to be considered if the release were significant, however this does not apply in this instance. This is supported by the Regulators guidance(3) which states that "It is considered that the wet deposition of SO_2, NO_2 and NH_3 is not significant within a short range. However, wet deposition for HCl and HNO_3 should be considered where a process emits these species." In the absence of any additional data, it is generally considered acceptable that total deposition (wet and dry) comprises 3 x dry deposition, where it is required to be included, and this is the methodology applied in this study when considering deposition from HCl and HF.

3.3 Background

Background concentrations of pollution have been included within the assessment where these are available and are required to calculate the new ground level concentration of each pollutant. By including a background concentration of pollution, existing facilities in the area are accounted for by the modelling exercise, although it is noted that a number of relatively new installations are operational in the area and another is expected to be commissioned in the near future, in the vicinity of the Enviroparks site. The cumulative effect of these has therefore been considered by the modelling assessment.

Background data was sourced from the UK Air Quality Archive (https://uk-air.defra.gov.uk)(4), which provides estimates of background levels of pollution across the country, and are included in the results tables where required to calculate the Predicted Environmental Concentrations of pollutants. The background air quality data is provided in Table 5 and is presented as the annual average concentrations. As monitoring sites only measure specific pollutants, it is not possible to use a single site for all background data, and the data has been drawn from the following locations:

- Heavy Metals data is taken from the Pontardawe Brecon Road monitoring site. The heavy metals monitoring network consists of a number of rural, urban and industrial monitoring sites around the country. However, the Pontardawe Brecon Road (suburban industrial) site is considered to be the most local and most representative of possible conditions around the Enviroparks development in Hirwaun. Background data for Mercury (in PM_{10}) has also been taken from this site, although monitoring ceased in 2013 and hence the background concentration is dated.
- Gaseous Ammonia (2019) and Hydrogen Chloride (2015) data is taken from the Cwmystwyth rural background monitoring site in Wales.
- PAH (solid phase) data is taken from the Newport urban background monitoring site.
- PCB (from 2018) and Dioxin (from 2016) data is taken from the Hazlerigg rural background site.

Predicted data taken from the Air Quality Archive Background Pollution Maps, comprise 2020 data for Nitrogen Dioxide and Particulate Matter (PM_{10}); year adjusted data (to 2020) for Carbon Monoxide and Benzene; and 2001 data for Sulphur Dioxide, as per the instruction in the use of the maps(4). The chosen data point for the general area background levels to be taken from, is national grid reference 293500 206500, and is representative of the nearest upwind data record from the discharge points.

Where detailed assessment is made within this study to the contributions to Critical Levels and Critical Loads, background data specific to the sensitive ecological receptor is drawn from the Air Pollution Information System website (http://www.apis.ac.uk/)(5).

Table 5 Background Pollutant Concentrations Applied in the Enviroparks Study

Pollutant	Pollution Maps Data	Measured Network Data
NO_2 (µg m^{-3}) 2020	6.158	
PM_{10} (µg m^{-3}) 2020	10.338	
$PM_{2.5}$ (µg m^{-3}) 2020	6.305	
SO_2 (µg m^{-3}) 2001	2.79	
CO (mg m^{-3}) 2020	0.0979	
Benzene (µg m^{-3}) 2020	0.1616	
Mercury (ng m^{-3}) - 2013		0.0217 (Mercury in PM_{10})
Cadmium (ng m^{-3}) – 2018		0.285 (Heavy Metals)
Arsenic (µg m^{-3}) – 2018		0.00102 (Heavy Metals)
Total Chromium (µg m^{-3}) – 2018		0.00254 (Heavy Metals)
Chromium VI (µg m^{-3}) – 2018		0.00051 (Heavy Metals)
Cobalt (µg m^{-3}) – 2018		0.00041 (Heavy Metals)
Copper (µg m^{-3}) – 2018		0.00476 (Heavy Metals)
Lead (µg m^{-3}) – 2018		0.00532 (Heavy Metals)
Manganese (µg m^{-3}) – 2018		0.00403 (Heavy Metals)
Nickel (µg m^{-3}) – 2018		0.00617 (Heavy Metals)
Vanadium (µg m^{-3}) – 2018		0.00072 (Heavy Metals)
Hydrogen Chloride (µg m-3) 2015		0.185 (Acid Gases)
Ammonia (µg m^{-3}) 2019		1.239 (National Ammonia)
PAH (ng m-3) 2015		0.252 (PAH (B[a]P)
PCBs (pg m-3) 2018		22.2 (TOMPS (sum of 7 PCBs)
Dioxins (fg m-3) 2016		4.575 (TOMPS)

3.4 Nearby Buildings and Structures

For processes which have a stack or stacks located on top of a building, or adjacent to a tall building, the effect of surrounding structures may need to be taken into account. As a general guide, building downwash problems (where emissions are caught in the turbulent wake of the wind blowing around a building), may occur if the stack height is less than 2.5 times the height of the building upon which it sits. Buildings which sit adjacent to stacks may need to be considered if they are within 5 stack heights of the point of release. Although the main stack height of 90 m would suggest minimal impact from the site buildings, the most significant buildings and structures around the site were included in the model to ensure a robust approach. Building shapes must be simplified for incorporation into the ADMS model, and hence a series of shapes denote the site buildings. The data included in the model were obtained from the proposed site plans, and are presented in Table 6. Building dimensions are specified in metres.

Table 6 Details of the Building Data Applied to the Enviroparks Study

Building Data	Shape	X (m)	Y (m)	Height	Length	Width
Waste Reception	Rectangular	293949	206875	14	36.2	64.46
Fuel Preparation 1	Rectangular	293922.5	206737.25	14	36	132
Fuel Preparation 2	Rectangular	293839	206720	16	105	36
Gasifier Building 1	Rectangular	293811	206769.75	18.385	14.585	34.6
Gasifier Building 2	Rectangular	293836	206759.5	23.385	40.69	34.6
Gasifier Building 3	Rectangular	293865	206747.5	18.385	22.965	34.6
Gasifier Building 4	Rectangular	293853.25	206789.75	18.385	77	34.6
High Energy User	Rectangular	293843	206893	14	151.54	61
ACC	Rectangular	293797	206775	15	10	56

3.5 Meteorological Data

One of the key factors affecting the dispersion characteristics of a plume is the height it can gain above the release point, as a result of momentum and buoyancy. The higher the plume rises, the greater the volume of the atmosphere in which it can disperse, and the lower the potential contribution to ground level concentrations of pollutants. This in turn results in a lower potential impact on the environment. Additionally, meteorological conditions affect the dispersion of a plume, and thus the ADMS model uses comprehensive data to determine the impact of the weather on emissions. As a minimum requirement for modelling plume dispersion, details of wind speed, direction, stability conditions and mixing height are required.

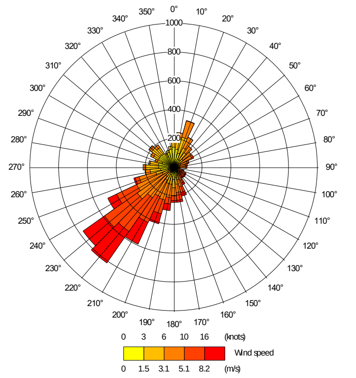
A total of five years' worth of meteorological data have been employed in this modelling exercise. The data used has been drawn from the closest suitable meteorological station at Sennybridge, which is situated approximately 35 km North of the subject site, close to Tirabad in Powys. However as approximately 10 % of the cloud cover data is missing from that site, additional cloud data has been included from the next most local station at St. Athan (approximately 39 km South of the Enviroparks site). Although some distance from the study site, it is considered that data from Sennybridge is the most appropriate to be used for a site in this location and in the absence of any more local, appropriate data. Five full years of data (2015 – 2019) have been applied to the modelling exercise.

During the preparation of the modelling exercises for the original Environmental Statement, a sensitivity analysis was run on the meteorological data used, which also came from Sennybridge. Whilst a prevailing wind from the North or North East was suggested as possibly giving rise to higher pollutant concentrations, the use of actual measured meteorological data was still deemed to be appropriate. The Sennybridge data is from a relatively local site, and includes data of the prevailing wind direction as well as any other wind direction detected over the course of a year. Manipulating a data set to give a differing prevailing wind direction, was therefore considered to provide a less robust approach to the modelling, unless firm evidence should exist to suggest that the prevailing wind is likely to differ significantly. Additionally, prevailing wind from the South West quarter (as per that from Sennybridge) is most likely to impact on the sensitive receptors in the immediate vicinity of the site, including Cors Bryn-y-Gaer, Woodland Park and the Welsh Water Reservoirs, thereby providing a worst-case scenario for the assessment of this particular site.

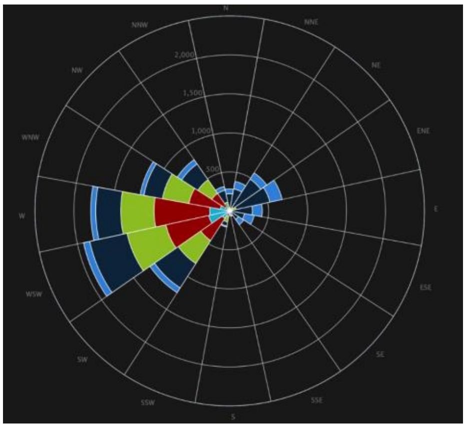
Since September 2013, Enviroparks have undertaken their own meteorological monitoring for the site using a weather station which they have installed at the Dwr Cymru Welsh Water service reservoir compound. Whilst the information collected by the Enviroparks weather station is insufficient for use in running the dispersion models, a comparison can be made between the data obtained from Sennybridge and the data measured at the site.

The wind-roses of the meteorological conditions reported at Sennybridge between 2015 and 2019 are presented over page, as is the wind-rose from the Enviroparks weather station for 2015. Although slight differences are seen in the predominant wind direction recorded at the two sites throughout the course of a year, the wind at both sites predominates from the South West quarter, and hence the use of Sennybridge data to support modelling at the Enviroparks site is considered to be acceptable.

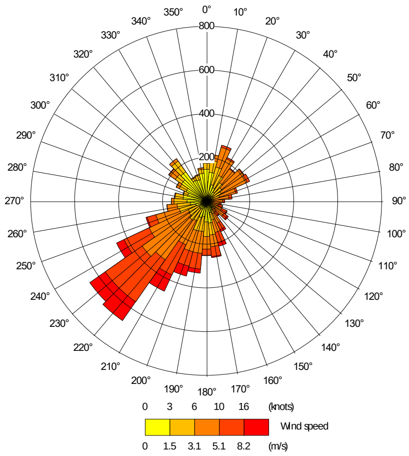
Figure 2 Wind-Roses with a Comparison of 2015 Data



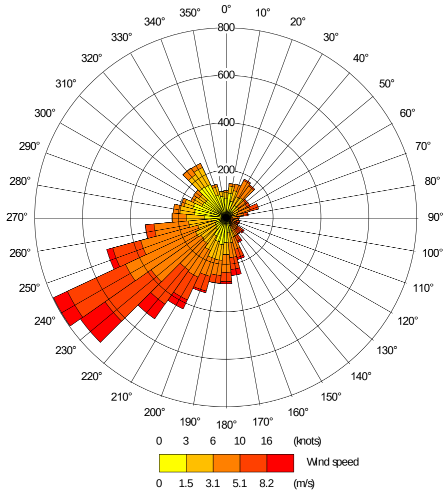
Sennybridge Wind-Rose 2015



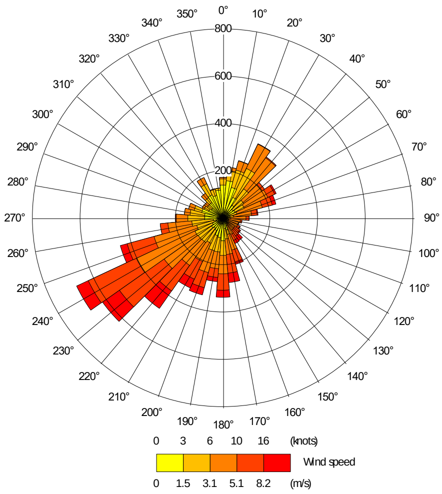
Enviroparks Wind-Rose 2015



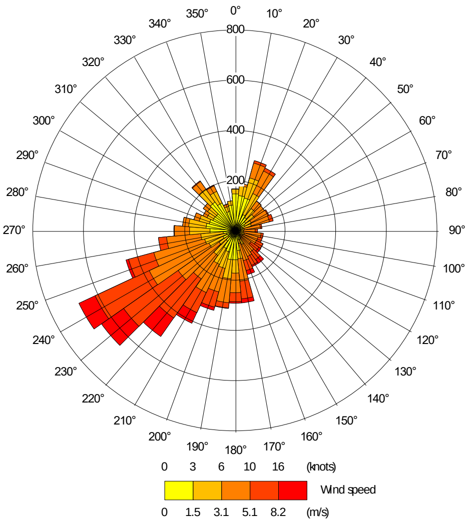
Sennybridge Wind-Rose 2016



Sennybridge Wind-Rose 2017



Sennybridge Wind-Rose 2018



Sennybridge Wind-Rose 2019

3.6 Surface Roughness

For the purpose of running the ADMS model, it is necessary to assign a surface roughness figure to the area to be modelled. This describes the degree of ground turbulence caused by the passage of winds across surface structures. The degree of ground turbulence is much greater in urban areas than in rural areas due to the presence of tall buildings increasing disturbance of wind and plume flow. ADMS requires the selection of a surface roughness factor to be input into the model, or for a complex surface roughness file to be produced to identify different areas of ground turbulence. In previous modelling exercises for the site, a single surface roughness figure has been applied to the model. However, in the current assessment, a spatially variable file has been created across a 6 km x 6 km grid around the site to accurately describe the surface roughness across the local area. When modelling more distant receptors, some of which are located approximately 10 km from the site, a single surface roughness factor of 0.2 was applied. This roughness figure is characteristic of agricultural areas and represents the most commonly applied roughness figure within the 6 square kilometre grid. Due to the presence of trees local to the meteorological station at Sennybridge, in an otherwise agricultural area, the slightly higher surface roughness of 0.3 was applied to represent the station conditions, which is the maximum figure applied to agricultural areas and takes account of the site's open aspect, with some buildings and woodland nearby.

3.7 Terrain Data

The use of terrain data was considered prior to running the model. Although the necessity of using detailed terrain data can generally be assessed using a screening model which utilises worst-case emission rates to undertake a simplified calculation, and subsequently assessing the results against the relevant Air Quality Standards or Environmental Assessment Levels, it was considered that due to the location of the site, which is situated in the shadow of the Penderyn Reservoir embankment, terrain data would need to be incorporated. Thus, OS Terrain 50 digital data was included in the model in order to map the terrain local to the Enviroparks site. Again, the terrain data was only applied to gridded and local receptor data. Receptors located more than 3 km away from the site were modelled without the terrain detail.

3.8 Model Output Parameters

The ADMS 5.2 model calculates the likely contribution to ground level concentrations within a definable grid system, which is pre-determined by the user. For the purpose of this study a Cartesian co-ordinate grid system was chosen, based on the Ordnance Survey British National Grid, to cover an area of 36 km^2 (6 km x 6 km), with the site located at the approximate centre of the grid. The Cartesian style grid has regular, pre-defined increments in both northerly and easterly directions from the specified bottom left corner of the grid, and ground level concentrations are specified at the intersections of these grid lines. Each grid modelled was based on a 201 x 201-point system, giving a total of 40,401 points (or intersections) across the grid, or a result at every 30 m. The use of the grid in this way aids the generation of pollutant contours. When considering the combined potential impact of other local developments, the area of the grid was increased to 64 km^2 in order to ensure that any increase in the main area of discharge was observed. Although the area assessed was increased, the grid system was reduced to 100 x 100 points, or a result at every 80 m.

A selection of points have also been included in the model to represent sensitive receptors in the area, and consideration of the requirements of the Part IV of the Environment Act 1995: Local Air Quality Management Technical Guidance LAQM.TG(16)[(6)], was made in choosing these receptors. With regards to air quality for human health, this states that an assessment of the quality of the air should be made at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present.

Additionally, other key sites have been included, such as the Dwr Cymru service reservoir located close to the site, which is covered but which would draw air in from the local environment as the reservoir empties, and sensitive ecological receptors such as Special Areas of Conservation or Sites of Special Scientific Interest, where these are located within 10 km of the site.

Ancient woodlands within 2 km of the Enviroparks site boundary have also been included, as have 5 points within the Enviroparks site boundary, to assess the potential impact on areas within the site which may subsequently be used for ecological enhancement. Details of the sensitive receptors included in this study are presented in Table 7 below, and the models have considered both the contribution to the ground level concentration of each pollutant, and the dry deposition of pollutants at these receptor locations.

Table 7 Sensitive Receptors Modelled in the Enviroparks Study

Receptor Number	Receptor Name	Grid Reference		Location from Stack	
		X (m)	Y (m)	m	Direction
1	Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	294099	206960	290	E
2	Cwm Cadlan SAC	294970	209125	2,560	NNE
3	Coedydd Nedd a Mellte SAC	292525	207199	1,370	N
4	Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	293790	208448	1,630	NW
5	Cwm Gwrelych and Nant Llynfach Streams SSSI	289980	206868	3,865	W
6	Craig-y-Llyn SSSI	291083	203873	4,038	SSW
7	Bryn Bwch SSSI	291990	210505	4,126	NNW
8	Caeau Nant-y-Llechau SSSI	290235	210177	4,930	NW
9	Gweunedd Dyffern Nedd SSSI	291341	210980	4,856	NNW
10	Bryncarnau Grasslands Llwyncoed SSSI	299424	206366	5,597	E
11	Blaenrhondda Road Cutting SSSI	292768	201528	5,400	S
12	Blaen Nedd SSSI	291234	212551	6,299	NNW
13	Ogof Ffynnon Ddu Pant Mawr SSSI	290258	213083	7,218	NNW
14	Caeau Ton-y-Fildre SSSI	286882	210448	7,852	WNW
15	Penmoelallt SSSI	301892	209166	8,382	NE
16	Mynydd Ty-Isaf Rhondda SSSI	292688	198555	8,345	S
17	Plas-y-Gors SSSI	292223	215231	8,567	NNW
18	Daren Fach SSSI	301984	210048	8,756	NE
19	Cwm Glo a Glyndyrys SSSI	302548	205327	8,830	E
20	Waun Ton-y-Spyddaden SSSI	286406	211980	9,054	NW
21	Gorsllwyn Onllwyn SSSI	285547	210323	9,007	W
22	Cwm Taf Fechan Woodlands SSSI	303358	208182	9,610	NE
23	Nant Llech SSSI	285246	211804	9,939	NW
24	Caeau Nant Y Groes SSSI	302672	202490	9,831	SE
25	Tir Mawr A Dderi Hir, Llwydcoed SSSI	297977	206236	4,173	E
26	Penderyn Reservoir	293890	207015	201	N
27	Eden UK	294020	206800	176	E
28	House at Penderyn Reservoir	294100	207270	516	N
29	Ty Newydd Hotel	294600	206940	764	ENE
30	Caer Llwyn Cottage	293253	207151	678	NW
31	Rhombic Farm	292958	206712	894	W
32	Castell Farm	292871	206783	975	W
33	TY Newydd Cottage	294514	207025	699	NE
34	Residence Woodland Park	294824	207560	1,227	NE
35	Pontbren Llwyd School	295057	208264	1,884	NNE
36	Ffynnon Ddu (spring)	292273	208364	2,203	NNW
37	Ton-Y-Gilfach	289565	208712	4,679	NNW
38	Rose Cottage	291284	208150	2,885	NNW
39	The Don Bungalow	291512	207044	2,344	W
40	Werfa Farm	291944	206721	1,904	SW

Receptor Number	Receptor Name	Grid Reference		Location from Stack	
41	Willows Farm	294129	205879	984	SSE
42	Trebanog Uchaf Farm	294063	207416	634	NE
43	Tai-Cwpla Farm	293519	207024	384	NNW
44	Neuadd Farm	294906	207282	1,157	NE
45	John Street Allotments, Hirwaun	296180	205605	2,633	SE
46	Dwr Cymru Service Reservoir	294068	206939	252	NE
47	Ancient Woodland Site 6686	293520	207166	472	NW
48	Ancient Woodland Site 7652	292255	207548	1,746	NW
49	Ancient Woodland Site 7730	292350	208036	1,924	NW
50	Ancient Woodland Site 10113	295132	207478	1,448	NE
51	Ancient Woodland Site 10232	295491	206845	1,649	E
52	Ancient Woodland Site 10297	295930	207308	2,144	NE
53	Ancient Woodland Site 10323	293604	207328	560	NW
54	Ancient Woodland Site 10450	295888	206925	2,049	E
55	Ancient Woodland Site 11240	294570	207902	1,303	NE
56	Ancient Woodland Site 11255	292098	207655	1,933	NW
57	Ancient Woodland Site 13252	293704	207271	471	NW
58	Ancient Woodland Site 17279	294678	207487	1,069	NE
59	Ancient Woodland Site 17280	294640	207804	1,266	NE
60	Ancient Woodland Site 17307	293510	207339	615	NW
61	Ancient Woodland Site 17308	293904	207366	549	N
62	Ancient Woodland Site 17326	295073	207097	1,262	NE
63	Ancient Woodland Site 17327	295595	207159	1,785	NE
64	Ancient Woodland Site 17359	295701	206840	1,859	E
65	Ancient Woodland Site 17368	293686	207530	726	NW
66	Ancient Woodland Site 17369	294549	207568	1,029	NE
67	Ancient Woodland Site 17396	292255	207410	1,693	NW
68	Ancient Woodland Site 17397	291757	207848	2,324	NW
69	Ancient Woodland Site 17487	292422	207302	1,499	NW
70	Ancient Woodland Site 18190	293864	207751	930	N
71	Ancient Woodland Site 18191	294493	207883	1,246	NE
72	Ancient Woodland Site 18192	295014	207354	1,288	NE
73	Ancient Woodland Site 18212	295502	206353	1,725	SE
74	Ancient Woodland Site 18215	295240	207412	1,518	NE
75	Ancient Woodland Site 18235	294855	208369	1,850	NE
76	Ancient Woodland Site 18296	295870	206531	2,049	E
77	Ancient Woodland Site 18297	295400	206579	1,577	SE
78	Ancient Woodland Site 18347	295654	207338	1,884	NE
79	Ancient Woodland Site 18348	295336	207555	1,665	NE
80	Ancient Woodland Site 18417	294509	208048	1,397	NE
81	Ancient Woodland Site 18418	293731	208107	1,291	NW
82	Ancient Woodland Site 18954	292627	206855	1,215	W
83	Ancient Woodland Site 18955	294701	207247	959	NW
84	Ancient Woodland Site 18956	292957	207163	949	NW
85	Ancient Woodland Site 21799	294095	207765	977	NE
86	Ancient Woodland Site 21855	292363	207227	1,534	NW
87	Ancient Woodland Site 21976	292243	207896	1,927	NW
88	Ancient Woodland Site 42098	292807	206878	1,037	W
89	Ancient Woodland Site 43706	293633	207515	725	NW
90	Onsite Receptor 1	293750	206910	128	NW
91	Onsite Receptor 2	293750	206952	160	NW
92	Onsite Receptor 3	293823	206948	128	N
93	Onsite Receptor 4	293881	206944	129	NE
94	Onsite Receptor 5	293952	206940	162	NE

It should be noted, that although only a selection of discrete receptors have been chosen, such as key commercial or residential sites, or a single grid reference to represent a sensitive ecological area, the purpose of the Cartesian grid is to comprehensively model the pollutant dispersion across a designated area. Thus other residential properties and the wider industrial estate within the gridded areas are considered by the model. The isopleth plots presented in the Figures section of this report demonstrate the dispersion profile of the pollutants.

The output for the model was set as ‘long-term’, which provides a single concentration averaged over all of the lines of meteorological data, for each point on the grid, that is, providing an annual average concentration for each pollutant at each grid point or receptor. Pollutants were modelled over 15-minute, 1-hour, 8-hour (rolling), or 24-hour averaging periods, in line with their respective air quality limits, as presented in Table 8. Additionally, percentile concentrations were calculated to demonstrate the worst predicted contribution to ground level concentrations (the 100th percentile), minus any allowable exceedances (other percentile values). In running the model this way, all lines of meteorological data are considered in the calculations, and any allowable number of exceedances can be taken into account. Where the model output is set as ‘short-term’, only the first 24 lines of the meteorological file are considered (that is, data for 1st January on any given year), and the model cannot give consideration to any relevant percentile values.

Part IV of The Environment Act 1995 sets provisions for protecting air quality in the UK and for local air quality management. The Air Quality Standards Wales Regulations 2010[(7)] implement Directive 2008/50/EC on ambient air quality and cleaner air for Europe, and Directive 2004/107/EC relating to Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in ambient air. The Regulations specify a number of limits, target values, and objectives for pollutants which must be adhered to or aimed at, and where these are considered by this modelling exercise, the relevant assessment level is detailed in Table 8.

Table 8 Welsh / UK Air Quality Limits, Targets and Objectives for Pollutants Modelled

Pollutant	Objective Concentration	Averaging Period
Nitrogen Dioxide (Limit Value)	200 µg m^{-3} not to be exceeded more than 18 times a year (99.79 percentile)	1 Hour Mean
Nitrogen Dioxide (Limit Value)	40 µg m^{-3}	Calendar Year
Oxides of Nitrogen (Critical Level for the protection of vegetation)	30 µg m^{-3}	Calendar Year
Sulphur Dioxide (UK Objective)	266 µg m^{-3} not to be exceeded more than 35 times a year (99.90 percentile)	15 Minute Mean
Sulphur Dioxide (Limit Value)	350 µg m^{-3} not to be exceeded more than 24 times a year (99.73 percentile)	1 Hour Mean
Sulphur Dioxide (Limit Value)	125 µg m^{-3} not to be exceeded more than 3 times a year (99.18 percentile)	1 Day Mean
Sulphur Dioxide (Critical Level for the protection of vegetation)	20 µg m^{-3}	Calendar Year
Particulate (PM_{10}) (Limit Value)	50 µg m^{-3} not to be exceeded more than 35 times a year (90.4 percentile)	1 Day Mean
Particulate (PM_{10}) (Limit Value)	40 µg m^{-3}	Calendar Year
Particulate ($PM_{2.5}$) (Target Value)	20 µg m^{-3} (in urban backgrounds)	Calendar Year
Carbon Monoxide (Limit Value)	10 mg m^{-3}	Max. 8 Hour Mean
Benzene* (Limit Value)	5 µg m^{-3}	Calendar Year
PAH (as B[a]P) (EU Target Value)	1 ng m^{-3}	Annual Mean
PAH (as B[a]P) (UK Target Value)	0.25 ng m^{-3}	Annual Mean
Lead (Limit Value)	0.5 µg m^{-3}	Calendar Year
Lead (UK Target Value)	0.25 µg m^{-3}	Annual Mean
Arsenic (Target Value)	6 ng m^{-3}	Calendar Year
Cadmium (Target Value)	5 ng m^{-3}	Calendar Year
Nickel (Target Value)	20 ng m^{-3}	Calendar Year

*Within this study, the Air Quality Limit value for Benzene has been applied when assessing the impact of emissions of Total Organic Carbon (TOC)

Air Quality Standards (AQS) are considered to be the relevant Environmental Quality Standards (EQS) when considering the protection of human health and the environment as a whole and are used to define the upper bound concentration of a substance in the environment that is considered tolerable. For pollutants which do not have AQS', the modelling results have been compared to Environmental Assessment Levels (EALs). EALs have been derived by the Environment Agency as provisional benchmarks for substances released to each environmental medium from a variety of published UK and international sources. The Natural Resources Wales website links to these EALs for use in risk assessments, as appropriate EQS levels where no AQS' are available. These benchmarks are relevant to the protection of the environment as a whole, rather than specifically for areas where people may be present in any number or for any defined period.

The EALs for the pollutants considered in this study which do not have an AQS, are presented in Table 9 below:

Table 9 Relevant Assessment Levels for Other Pollutants Modelled

Limit Type	Pollutant	Concentration	Measured As
EAL	Ammonia (Human Health)	180 µg m^{-3}	Annual Average
EAL	Ammonia (Conservation where lichens or bryophytes are present)	1 µg m^{-3}	Annual Average
EAL	Ammonia (Conservation other areas)	3 µg m^{-3}	Annual Average
EAL	Mercury	0.25 µg m^{-3}	Annual Average
EAL	Mercury	7.5 µg m^{-3}	Hourly Limit
EAL	Antimony	5 µg m^{-3}	Annual Average
EAL	Total Chromium	5 µg m^{-3}	Annual Average
EAL	Chromium VI	0.0002 µg m^{-3}	Annual Average
EAL	Copper	10 µg m^{-3}	Annual Average
EAL	Manganese	0.15 µg m^{-3}	Annual Average
EAL	Vanadium	5 µg m^{-3}	Annual Average
EAL	Hydrogen Chloride	750 µg m^{-3}	Hourly Limit
EAL	Hydrogen Fluoride	160 µg m^{-3}	Hourly Limit
EAL	Hydrogen Fluoride (Conservation areas)	5 µg m^{-3}	Daily Limit
EAL	Hydrogen Fluoride (Conservation areas)	0.5 µg m^{-3}	Weekly Limit
EAL	PCBs	0.2 µg m^{-3}	Annual Mean
EAL	PCBs	6 µg m-3	Hourly Limit

3.9 Additional Model Considerations

In addition to the basic model parameters included in the study, consideration has also been given to potential contributions to ground level concentrations of pollutants in the local area due to planned or recently built processes which have the potential to emit the same pollutants as the Enviroparks facility. These include the Green Frog Short Term Operating Reserve (STOR) facility, which has been operational since 2012; the Hirwaun Energy Centre, which is a biomass (wood) fired pyrolysis plant, understood to now be built and operational; and the Hirwaun Power facility which is expected to be operational from late 2022 or early 2023, all of which are located within the Hirwaun Industrial Estate. It is understood from a search of more recent planning applications in the area that there are no additional developments which require consideration, and therefore, these three local developments are the only ones which have been considered in combination with the Enviroparks proposal.

Details of emission points, and discharges were largely taken from the Hirwaun Power Development Consent Order Application documentation[8], which also considered the combined effect of these processes and the Enviroparks facility from the original site planning application. The exception to this were the details for the Green Frog STOR, which were confirmed with Green Frog prior to modelling in 2017. Although the STOR includes 48 generator discharge points, these have been combined and modelled as a single release for ease of modelling. The emissions from the STOR have been calculated from the maximum annual operating hours of the site (520 hours), which have then been input as a continuous release (over 8,760 hours per year). In reality, when discussing the site operation with Green Frog in late 2016, the STOR was understood to have only operated for approximately 10 hours per year at that point.

Emissions from the Hirwaun Power development were however considered differently, being input as continuous releases at the levels identified in the Development Consent Order Application, despite only being operational for a maximum of 1,500 hours per year. This was to maintain consistency with the information available, and to ensure the impact of the Hiwaun Power operation could be fully considered at all times of the year, as it can operate for approximately 1/6th of the year in total. Results have however then been manually reduced to represent the relevant operating periods, with short-term releases (less than 8-hour averaging periods) retaining the maximum modelled results, but longer-term releases reduced to represent a maximum of 8 hours in any 24-hour period, and 1,500 hours in any year. This detailed assessment of the longer-term operational capacity of the Hirwaun Power facility maintains the methodology applied in the Enviroparks 2017 modelling.

The details included within the models to assess the cumulative effects of these processes are presented in Table 10 over page. Emissions of NO_x are understood to be total NO_x, rather than Nitrogen Dioxide.

Table 10 Local Processes Considered In-Combination with the Enviroparks Facility

Development	Emission Point Number	Grid Reference	Stack Height (m)	Diameter (m)	Temperature (ºC)	Discharge Velocity at Stack Conditions (m/s)	NO_x Emission Rate (g/s)	CO Emission Rate (g/s)	SO_2 Emission Rate (g/s)	PM_{10} Emission Rate (g/s)
Hirwaun Power	HP A1	293491 206328	30	4.486	479	25	6.61	13.23	0	0
	HP A2	293520 206325	30	4.486	479	25	6.61	13.23	0	0
	HP A3	293545 206322	30	4.486	479	25	6.61	13.23	0	0
	HP A4	293570 206319	30	4.486	479	25	6.61	13.23	0	0
	HP A5	293602 206316	30	4.486	479	25	6.61	13.23	0	0
Hirwaun Energy Centre	HEC A1 (Pyroliser)	294327 206120	20	0.9	180	19.1	0.0706	0	0.353	0
	HEC A2 (Engine 1)	294330 206124	20	0.55	533	28.5	0.0406	0	0	0
	HEC A3 (Engine 2)	294332 206128	20	0.55	533	28.5	0.0406	0	0	0
	HEC A4 (Engine 3)	294335 206132	20	0.55	533	28.5	0.0406	0	0	0
	HEC A5 (Engine 4)	294338 206136	20	0.55	533	28.5	0.0406	0	0	0
Green Frog STOR	GF A1	293762 206107	2.26	1.38564	550	51	1.591	0.3935	0.114	0.0399

3.10 Modelling Assumptions

In addition to the parameters described in the sections above, some assumptions have had to be made for the modelling study and these are listed below:

- All normal operational emissions are assumed to be continuous although may not necessarily be running constantly, with for example time for scheduled and un-planned shut-downs. Thus, the model can be seen to represent a worst-case as emissions are considered to occur on a 24 hour, 365 days per year basis, whereas in reality, the planned operations will include periods of shut-down each year for maintenance.

- Emissions data has been provided by the technology providers and some of these are lower than the BAT-AELs specified in the BAT-C document. Enviroparks is committed to the application of more stringent emission levels in order to minimise the potential impact that the site may have on the sensitive ecological receptors in the immediate vicinity of the Enviroparks site. These levels are confirmed as being achievable and are the emission limit values anticipated as being included within the site Environmental Permit. Modelling the emissions at their anticipated permitted values ensures a worst-case assessment, as operations would usually be expected to remain within the emission limit values and would be required to shut-down where emission limits are exceeded.

- The discharges from the flues have been combined within the model, to account for the fact that emissions from multiple flues within the same stack will effectively act as a single plume with combined source characteristics. Data of the individual sources and emissions were entered into the model, which was then set to calculate the combined source parameters and model all of the Enviroparks flues together as a single source.

- Although a number of wind farms have been constructed in the area or are undergoing construction currently, the potential for modified wind flow field effects on the Enviroparks plume has not been included within the model. This is because, although wake effects including velocity deficit and enhanced turbulence are thought to potentially still be noticeable after fifteen turbine diameters downstream of a wind turbine(9), and thus within a wind farm it is considered appropriate that turbines are placed at least fifteen turbine diameters apart for a cost-efficient power generation(10), the turbine dimeters in the locality are understood to be up to 101 m in diameter, but are located more than 3.5 km from the Enviroparks facility. Therefore, it is considered that, at approximately twice the distance where wake effects can impact on the operation of other turbines, there are unlikely to be significant negative effects on the dispersion of the plume from the Enviroparks site, and hence no further consideration of the local wind farms has been made.

4. Results and Discussion

Tabulated results are presented in Appendix A and consider the Process Contribution to ground level concentrations of pollutants, and the deposition of pollutants to sensitive infrastructure and ecological receptors.

Appendix A Table 1 presents the maximum Process Contribution of each pollutant for each year of meteorological data studied, with the maximum value of each species highlighted. Figures 1 – 12 present the isopleth plots of pollutant dispersion from the 90 m release points proposed for the Enviroparks site. Each of the plots are based on the 2015 meteorological conditions as this was the year that generally produced the maximum Process Contributions.

The Process Contribution of all pollutants, and the Predicted Environmental Concentrations of the pollutants across the area remain within the Air Quality Standards or Environmental Assessment Levels, with the exception of Ammonia, where the background concentration of 1.24 µg m^{-3} as measured at the Cwmystwyth rural background monitoring site, equates to 124 % of the Environmental Assessment Level for sensitive ecological habitats.

An assessment of 'insignificance' can be made by comparing the Process Contribution, or the Predicted Environmental Concentration (where available), to the relevant Environmental Quality Standard. The link to risk assessment guidance from the Natural Resources Wales website[2], specifies that, in order to screen out the Process Contribution of a substance as insignificant:

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

Where Process Contributions cannot immediately be screened as insignificant, Natural Resources Wales propose a second stage of screening whereby results which meet both of the following requirements are insignificant:

- the short-term Process Contribution is less than 20 % of the short-term environmental standards minus twice the long-term background concentration; and
- the long-term Predicted Environmental Concentration is less than 70 % of the long-term environmental standards.

The maximum gridded Process Contributions (PC) of most pollutants are screened as insignificant in terms of their impact during the initial assessment. The exceptions to this are, the annual average Process Contributions of Total Organic Carbon when assessed against the Air Quality Standard for Benzene, and Group I metals (sum of Cadmium and Thallium) when assessed against the target value for concentrations of Cadmium. Continuing the assessment of these groups of pollutants against the single pollutant assessment levels, which is recognised as an over-estimate, the Predicted Environmental Concentration (PEC) of both groups of pollutants remain within 70 % of the assessment levels and are therefore screened as insignificant at the second stage.

It is noted that the Predicted Environmental Concentration of TOC would continue to be screened as insignificant, if the background concentration and assessment level for 1,3-Butadiene were to be applied to the total. The local background concentration of 1,3-Butadiene is calculated by the pollution maps to be 0.0486 µg m^{-3} and thus, with a resultant PEC of 0.109 µg m^{-3}, equating to 4.84 % of the AQS for 1,3-Butadiene (2.25 µg m^{-3}), the PEC remains well within 70 % of the AQS.

Appendix A Table 2 considers the combined Group III metal releases in more detail, and in line with guidance from the Environment Agency[11]. The guidance recommends a two-stage screening assessment, commencing first with a worst-case approach, where each metal is assumed to be emitted at 100 % of the group ELV. The results from this assessment confirm that worst-case contributions of Antimony, total Chromium, Cobalt, Copper, Lead and Vanadium are immediately screened as insignificant, remaining within 1 % of the EAL. Additionally, the PEC of Arsenic, Manganese and Nickel remain within 100 % of the EAL and can therefore still be screened. However, contributions of Chromium VI require more detailed assessment, whereby maximum emissions data provided in the guidance note is applied to the total Process Contribution, in order to determine the likely Process Contribution of Chromium VI, before reassessing against the EAL. The results of this assessment, shown in Appendix A Table 3, confirm that the Process Contribution of Chromium VI can be screened as insignificant, as it remains within 1 % of the long-term assessment level, although the suggested background concentration would still equate to approximately 255 % of the EAL. No further assessment is therefore required.

Appendix A Table 4 summarises the results of models assessing the cumulative effects of other local third-party emissions, and considers their significance or otherwise. The Process Contributions from the Enviroparks facility when modelled in combination with emissions from Hirwaun Power for a maximum of 1,500 hours per year, Hirwaun Energy, and the Green Frog STOR for a maximum of 520 hours per year are presented.

Figures 13 - 15 present the isopleth plots for the combined dispersion of Nitrogen Dioxide from the sites. Each of the plots are based on the 2015 meteorological conditions.

The results of the cumulative discharge modelling confirm that, although the combined Process Contributions of pollutants cannot necessarily be screened as insignificant at the initial assessment stage, with the exception of the maximum short-term (24-hour) contribution of Oxides of Nitrogen which is compared to the short-term standard for impacts on vegetation, the Predicted Environmental Concentrations of all pollutants remain below 70 % of their relevant Environmental Quality Standard. The Environmental Quality Standards for the protection of vegetation will only be relevant at sensitive ecological receptors, and hence are considered in detail later in this section, when the results of modelling at the specified receptor locations are provided.

It should also be noted that estimates have had to be made as to the releases from the third-party operations, with data drawn from planning documentation and other information available. Where possible and relevant, the modelling in this assessment has mirrored the assessments made by the third parties when considering their own sites. Sites which do not operated continually, that is the Green Frog STOR and the Hirwaun Power peaking plant, have been modelled to represent their maximum capacity. In reality, it is recognised that the Green Frog STOR operates for a fraction of this period.

The majority of the maximum Process Contributions occur approximately 640 m to the South of the Enviroparks site, approximately 16 m from the modelled location of the Green Frog discharge, and the isopleth plots show the majority of the ground level concentrations focused around the Rhigos Road area, suggesting that contributions from the Green Frog STOR and the Hirwaun Power peaking plant are likely to be the most significant contributors to the maximum ground level concentrations predicted by the cumulative assessment.

Tables 5 A - H in Appendix A present the Process Contribution results at sensitive receptors, and are highlighted to show pollutants which represent more than 1 % of the long-term, or more than 10 % of the short-term assessment level, and which therefore cannot immediately be screened as insignificant. In reality, this only relates to contributions of Total Organic Carbon which amount to more than 1 % of the Benzene Air Quality Standard, and contributions of Cadmium and Thallium when assessed against the target value for Cadmium. The contribution of Benzene to the Total Organic Carbon release is likely to be small, and would be estimated to equate to approximately 1 % of TOC. Coupled with the fact that, when combined with the background level of Benzene, the maximum Predicted Environmental Concentration of TOC at the receptors equates to 4.35 % of the annual average AQS for Benzene, as shown in Table 6 of Appendix A, contributions of TOC can be screened as insignificant at the second assessment stage. Similarly, although the combined Process Contribution of Cadmium and Thallium cannot be screened as insignificant at all receptors when assessed against the target value for Cadmium, the highest PEC equates to 7.91 % of the target value and is therefore screened as insignificant at the second stage.

Contributions of Dioxins to local receptors are not included in the receptor tables as there is no direct assessment level to compare the contributions to.

Due to the ecological sensitivity of the local area which, amongst others, includes three Special Areas of Conservation (SACs) within 10 km of the site, further consideration has been given to the impact on the SACs of the Enviroparks site when modelled in-combination with other local developments. Appendix A Tables 7 A - D consider the maximum likely Process Contributions of the combined local releases to sensitive ecological receptors. Contributions of particulate as PM_{10}, SO_2 and CO are screened at the initial assessment stage. Contributions to the Nitrogen Dioxide assessment levels cannot always be screened immediately for any of the averaging periods. However, the second stage assessment presented in Appendix A Table 8 confirms that the cumulative contributions screen as insignificant at the second stage, with the long-term PEC equating to less than 70 % of the AQS or ecological Critical Level, and the short-term PCs equating to less than 20 % of the relevant EAL.

Appendix A Tables 9 A to D consider the potential for nutrient Nitrogen and acid to deposit at the local SACs and Sites of Special Scientific Interest (SSSIs). Within the tables, assessment has consistently been made against the lower end of the relevant Critical Loads for each site and apply the maximum current background, both of which have been identified from the UK APIS website(5), thereby providing an absolute worst-case assessment. The methodology implemented by the UK APIS Critical Load Function tool has been applied, and generally provides a close correlation with the outputs from that tool where checks have been made, although minor differences in the final results can be observed for some receptors. For ease of review, the relevant percentage contribution of nutrient Nitrogen and acid deposition to the sensitive ecological receptors are highlighted in the tables.

At the modelled locations representing the sensitive ecological receptors, and generally relating to the nearest point of the receptor to the Enviroparks site, Process Contributions of nutrient Nitrogen and acid deposition remain within 1 % of the Critical Load relevant to each site and can therefore be screened as insignificant. Modelling of the previous technologies for the site resulted in an acid deposition contribution of 1.7 % to Blaen Cynon at this point, which has now reduced to 0.4 % of the Critical Load.

It is noted that, as presented in Figure 17, when modelling acid deposition across the wider grid, the contributions are widely dispersed from the 90 m stack, and not all locations across the Blaen Cynon SAC would actually remain within 1 % of the Critical Load. However, it is important to note that by definition, a Critical Load is "*a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*"[(1)]. It is not a quantitative estimate of damage to a particular habitat, but represents the potential for damage to occur. There appears to be no evidence in the available literature to indicate that the sensitive ecological habitats at Blaen Cynon are suffering as a consequence of acid deposition from nearby sources, although air pollution is identified as a 'threat' to the SAC in the Natura 2000 Standard Data Forms from 2015. It is also important to note that the current minimum background acid deposition identified for the Blaen Cynon site is 1.9 keq/ha/year, which represents approximately 164 % of the lower Critical Load, and indeed the current background concentrations at all three local SACs are above the lower Critical Loads for both nutrient Nitrogen and acid deposition.

When considering the maximum gridded value of potential acid deposition from Process Contributions across the entire 6 km x 6 km grid (0.0339 keq/ha/year) and applying the Critical Load specified for the Blaen Cynon site, the highest contribution of acid deposition is calculated at approximately 2.9 % of the Critical Load. Application of the Critical Load Function tool provides a maximum contribution of 2.6 % of the Critical Load. This level of acid deposition does not occur within the Blaen Cynon SAC and is approximately 235 m away from the nearest point of the sensitive receptor. As such, the contributions of acid across the SAC in its entirety will be less than this.

In relation to the 1 % insignificance level applied in assessments, the Institute of Air Quality Management (IAQM) guide to the assessment of air quality impacts on designated nature conservation sites[(12)] states that *"The 1% threshold has become widely used throughout the air quality assessment profession to define a reasonable quantum of long term pollution which is not likely to be discernible from fluctuations in background/measurements."*

"Crucially, the 1% screening criterion is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat."

Therefore, whilst the calculated contributions to acid deposition cannot necessarily be screened as insignificant across the entire Blaen Cynon site, they amount to a tiny fraction of the total loadings currently experienced by the site and, coupled with the mitigation measures that Enviroparks has already committed to, are not expected to have any measurable or significant effect on the status of the Blaen Cynon site, or any of the other SACs or SSSIs in the vicinity of the Enviroparks site. This is supported by the output of the Critical Load Function tool shown in Figures 18 and 19, which present the data for the modelled receptor point for Blaen Cynon, and the theoretical impact should the maximum acid deposition from across the modelled grid be deposited at the SAC.

When considering the contributions of nutrient Nitrogen and acid deposition to the three local SACs in combination with the cumulative effects of other local third-party emissions, Appendix A Table 10 demonstrates that the contributions of nutrient Nitrogen remain within 1 % of the Critical Load, as do contributions of acid deposition at Cwm Cadlan and Coedydd Nedd a Mellte. Acid deposition does marginally exceed the 1 % insignificance threshold at Blaen Cynon however, equating to approximately 1.03 % at the modelled receptor point. Again however, this is a notable reduction on the case reported in 2017, where the cumulative contribution equated to 2.8 % of the Critical Load for acid deposition.

Additionally, an assessment of the nutrient Nitrogen and acid deposition to local areas of ancient woodland has been undertaken. Nutrient Nitrogen contributions equate to a fraction of 1 % at each of the local sites. Acid deposition also largely remained within 1 % of the Critical Loads, with 32 sites of 43 recording contributions of less than 1 %. Ten sites recorded contributions of between 1 % and 2 %, and one site recorded a contribution marginally over 2 %, the highest contribution equating to 2.01 %. Guidance on assessing the impacts at local nature sites such as ancient woodland, specify that contributions can be screened as insignificant where they remain within 100 % of the assessment level[(2)]. As such, the contributions to local areas of ancient woodland are all screened as insignificant.

Contributions of other pollutants to the most local sensitive receptor, Blaen Cynon, have been assessed against the deposition limit values identified in the guidance adopted by Natural Resources Wales(2) and can be screened as insignificant, being less than 1 % of the limit value, as shown in Appendix A Table 11.

Finally, an assessment has been made of the potential impact of emissions on the Penderyn Reservoir, and the Dwr Cymru service reservoir, which comprise two critical infrastructure items. Previous detailed studies provided to Dwr Cymru Welsh Water highlighted that compliance with the Air Quality Objectives ensures that the majority of releases are incapable of putting the quality of the water either within or transferred from the Penderyn Reservoir system, at risk.

A number of species were however, potentially more significant than others, and these were Nitrite, Benzene, Fluoride, Mercury, and Antimony. Hence, further modelling of the releases anticipated from the plant, which are substantially less than those required for compliance with the Air Quality Standards or Environmental Quality Standards, was undertaken to demonstrate that each of these substances presents no substantive risk to the reservoir and its systems (see Appendix A, Table 12). Annual contributions of Nitrite, Benzene, Fluoride, Mercury and Antimony to the Penderyn Reservoir and in each volume of the Dwr Cymru service reservoir are calculated, and for all species are predicted to contribute substantially less than 1 % of the Water Quality Standard(13), and hence are considered to be insignificant.

The assessment of the effects on the Dwr Cymru Welsh Water infrastructure assumes that all of the deposited NO_x is Nitric Oxide, and suggests a higher level of Nitrite than if all of the NO_x were modelled as Nitrogen Dioxide. However, as noted previously, Nitric Oxide does not deposit in significant quantities, and at least a small portion of the NO_x will comprise Nitrogen Dioxide. Hence this can be considered a robust assessment, which takes a worst-case approach. It is also noted that, although other heavy metals have limits within the Drinking Water Quality Standards, Antimony has the lowest limit of those combined metals which may be discharged and deposited, and hence has been applied in this assessment.

5. Conclusions

Enviroparks (Wales) Limited holds planning consent for their proposed resource recovery and energy production plant which will use Refuse Derived Fuel and residual Commercial and Industrial waste to create energy through multiple gasification units. Since receiving their original planning consent, various changes have been made to the plans for the facility, the latest of these being changes to the specific gasification technology and the proposed stack height. The technology changes take full account of the improvements in available techniques since the original planning consent was awarded, and the on-going need to protect the local environment from the emissions from the plant. Whilst the proposed emissions have reduced due to advances in the available technologies, a higher stack is also proposed in order to ensure that pollutant contributions to the local environment are as low as practically possible.

As such, a revision to the extant planning consent is being requested and this assessment presents the results of atmospheric dispersion modelling, undertaken to assess the impact of the revised site plans. The results of the dispersion modelling demonstrate that, when considering the Enviroparks development in isolation, all Process Contributions can be screened as insignificant at either the initial or secondary assessment stage.

With the exception of Total Organic Carbon when assessed against the AQS for Benzene, and some metal species when considered as a combined emission, all air quality contributions screen immediately. The contributions from these combined emissions also screen as insignificant at the secondary assessment stage, through consideration of the impact of the overall Predicted Environmental Concentration, or when undertaking a detailed assessment of the likely contribution from individual metal species.

An assessment of the cumulative impacts of the Enviroparks and other local new, or proposed developments, also confirmed that contributions to levels of pollution controlled by Air Quality Standards would be screened as insignificant at either the initial or secondary stage. The one apparent exception to this was when considering the maximum modelled 24-hour average NO_x Process Contribution and Predicted Environmental Concentration. However, this maximum result occurs within the Hirwaun Industrial Estate, approximately 640 m to the South of the Enviroparks site and is therefore not a relevant comparison against the EAL for 24-hour NO_x, which ensures the protection of vegetation at sensitive ecological sites.

Similarly to the consideration of the maximum predicted results across the entire 6 km x 6 km grid, most air quality contributions are immediately screened as insignificant when considering the sensitive receptor points included in the model. Again, the exceptions are the contributions of TOC and Group 1 metals at some receptors, but the Predicted Environmental Concentrations are then screened at the secondary assessment stage. Contributions are considered against the Air Quality Standards for the protection of human health and general air quality or, as appropriate, against the Critical Levels assigned to sensitive ecological receptors.

When considering the cumulative impacts of the Enviroparks and other local new, or proposed developments on the discrete receptor points, not all contributions of NO_x can be immediately screened as insignificant, with some annual, 24-hourly and hourly contributions equating to more than 1 % of the long-term or 10 % of the short-term AQS, EAL or Critical Level. All however, screen at the secondary assessment stage, with the long-term PEC equating to less than 70 % of the AQS or Critical Level, and the short-term PCs equating to less than 20 % of the relevant EAL.

An assessment against the Critical Loads for nutrient Nitrogen and acid deposition has been provided for sensitive ecological receptors with both being screened as insignificant against their respective assessment levels when modelling the Enviroparks development alone at each of the modelled receptor points. Contributions increase when modelling the Enviroparks site in combination with other local new, or proposed developments, and acid deposition marginally exceeds the 1 % insignificance threshold at the discrete receptor point modelled for Blaen Cynon, with cumulative acid deposition contributions of 1.03 % of the Critical Load. Whilst accepting that a single point is not necessarily representative of entire receptors, especially those which may extend across a significant area, applying the maximum gridded value of potential acid deposition across the entire 6 km x 6 km grid (0.0339 keq/ha/year) assessed against the Critical Load specified for the Blaen Cynon site, results in a contribution which is less than 3 % of the Critical Load.

Additionally, the 1 % screening criterion is not a threshold of harm and exceeding this threshold does not in itself, imply that damage is being caused to a habitat. Whilst the calculated contributions to acid deposition cannot necessarily be screened as insignificant across the entire Blaen Cynon site, they amount to a tiny fraction of the total loadings currently experienced by the site and, coupled with the mitigation measures that Enviroparks has already committed to, are not expected to have any measurable or significant effect on the status of the Blaen Cynon site, or any of the other SACs or SSSIs in the vicinity of the Enviroparks site.

Finally, the assessment of the potential impact on the Dwr Cymru infrastructure in the locality screened all key species as contributing less than 1 % of the Water Quality Standard, and are therefore considered to represent an insignificant potential impact.

The results of the modelling exercise have demonstrated that impact from the proposed revised scheme, discharging emissions from the gasification units through three 90 m high flues contained within a single multi-flue chimney stack, are acceptable. Emissions to atmosphere from the plant, which have been considered against assessment levels both for the protection of human health and sensitive ecological receptors can almost exclusively be screened as insignificant, and are very small where insignificance cannot comprehensively be demonstrated.

The results from this modelling report have been used to produce an updated Shadow Habitat Regulations Assessment to consider the potential for any significant adverse impact on local European designated sites from the Enviroparks releases to air.

6. References

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APPENDIX A
RESULTS TABLES

Appendix A Table 1
Maximum Predicted Process Contribution (2015 – 2019)

Assessment Criteria	2015	2016	2017	2018	2019	Maximum Process Contribution (PC)	Assessment Level	PC as % Assessment Level	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level
Annual Average NO_2 (100 % NO_x) µg m^{-3}	0.241	0.201	0.225	0.185	0.207	0.241	30 or 40	0.80%	6.40	21.3%
99.79th Percentile Hourly Average NO_2 (50 % NO_x) µg m^{-3}	2.32	2.09	2.16	2.03	2.09	2.319	200	1.16%	14.63	7.3%
Maximum 24-Hour Average NO_2 (100 % NO_x) µg m^{-3}	1.79	1.97	1.51	1.65	1.76	1.97	75	2.63%	14.29	19.0%
99.90th Percentile 15 Minute SO_2 µg m^{-3}	1.28	1.16	1.21	1.24	1.17	1.28	266	0.48%	6.86	2.6%
Annual Average SO_2 µg m^{-3}	0.0603	0.0502	0.0564	0.0463	0.0518	0.0603	10 or 20	0.60%	2.85	14.3%
99.73rd Percentile Hourly Average SO_2 µg m^{-3}	1.08	1.01	1.06	0.98	1.00	1.08	350	0.31%	6.66	1.9%
99.18th Percentile 24-Hour Average SO_2 µg m^{-3}	0.361	0.334	0.306	0.292	0.360	0.361	125	0.29%	5.94	4.8%
90.41st Percentile 24-Hour PM_{10} µg m^{-3}	0.0860	0.0809	0.0862	0.0772	0.0805	0.0862	50	0.17%	20.76	41.5%
Annual Average PM_{10} µg m^{-3}	0.0301	0.0251	0.0282	0.0231	0.0259	0.0301	40	0.08%	10.37	25.9%
Annual Average $PM_{2.5}$ µg m^{-3}	0.0301	0.0251	0.0282	0.0231	0.0259	0.0301	20	0.15%	6.34	31.7%
Annual Average Ammonia µg m^{-3}	0.00301	0.00251	0.00282	0.00231	0.00259	0.00301	1 – 3 (ecological) 180 (health)	0.30%	1.24	124.2%
Maximum Hourly Average HCl µg m^{-3}	1.02	0.83	1.04	1.27	1.09	1.27	750	0.17%	1.46	0.2%
Maximum Hourly Average HF µg m^{-3}	0.204	0.167	0.209	0.255	0.219	0.255	160	0.16%	0.255	0.2%
Maximum 24-Hour HF µg m^{-3}	0.0448	0.0493	0.0379	0.0412	0.0440	0.0493	5	0.99%	0.049	1.0%
Maximum Weekly Average HF µg m^{-3}	0.0174	0.0162	0.0158	0.0146	0.0185	0.0185	0.5	3.69%	0.018	3.7%
Annual Average TOC (as Benzene) µg m^{-3}	0.0603	0.0502	0.0564	0.0463	0.0518	0.0603	5	**1.21%**	0.222	4.4%
Maximum Rolling 8-Hour Average CO mg m^{-3}	0.00492	0.00692	0.00633	0.00752	0.00575	0.00752	10	0.08%	0.105	1.1%
Annual Average Group I Metals ng m^{-3}	0.121	0.100	0.113	0.093	0.104	0.121	5	**2.41%**	0.406	8.1%
Annual Average Mercury µg m^{-3}	1.21E-04	1.00E-04	1.13E-04	9.25E-05	1.04E-04	1.21E-04	0.25	0.05%	0.0218	8.7%
Annual Average Group III Metals µg m^{-3}	0.00181	0.00150	0.00169	0.00139	0.00155	0.00181	0.25	0.72%	0.0018	0.7%
Annual Average PAH (as B[a]P) ng m^{-3}	0.00603	0.00502	0.00564	0.00463	0.00518	0.00603	1	0.60%	0.258	25.8%
Annual Average Dioxins and Furans µg m^{-3}	2.41E-10	2.01E-10	2.25E-10	1.85E-10	2.07E-10	2.41E-10	-	-	4.82E-09	-
Maximum 24-Hour Average Dioxins and Furans µg m^{-3}	1.79E-09	1.97E-09	1.51E-09	1.65E-09	1.76E-09	1.97E-09	-	-	1.11E-08	-
Maximum Weekly Average Dioxins and Furans µg m^{-3}	6.94E-10	6.48E-10	6.33E-10	5.82E-10	7.38E-10	7.38E-10	-	-	9.89E-09	-
Annual Average PCBs (combined with Dioxins and Furans) µg m^{-3}	3.61E-10	3.00E-10	3.37E-10	2.77E-10	3.10E-10	3.61E-10	0.2	0.0000002%	2.22E-05	0.01%
Maximum Hourly PCBs (combined with Dioxins and Furans) µg m^{-3}	1.22E-08	9.98E-09	1.25E-08	1.52E-08	1.31E-08	1.52E-08	6	0.0000003%	4.44E-05	0.0007%

The maximum result from 5 years' worth of data is highlighted in yellow, as are any Process Contributions which cannot be screened as insignificant.

Appendix A Table 2
Detailed Assessment of Group III Metal Contributions

Individual Metal Species	Total Process Contribution (PC) µg m^{-3}	Environmental Assessment Level (EAL) µg m^{-3}	PC as % Assessment Level	Background µg m^{-3}	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level
Antimony	0.00181	5	0.04%	-	0.00181	0.04%
Arsenic	0.00181	0.006	**30.12%**	0.00102	0.00283	47%
Total Chromium	0.00181	5	0.04%	0.00254	0.00435	0.09%
Chromium VI	0.00181	0.0002	**904%**	0.000509	0.00232	**1157.90%**
Cobalt	0.00181	0.2	0.90%	0.000411	0.00222	1.11%
Copper	0.00181	10	0.02%	0.00476	0.00656	0.07%
Lead	0.00181	0.25	0.72%	0.00532	0.00713	2.85%
Manganese	0.00181	0.15	**1.20%**	0.00403	0.00583	3.89%
Nickel	0.00181	0.02	**9.04%**	0.00617	0.00798	40%
Vanadium	0.00181	5	0.04%	0.000723	0.00253	0.05%

Notes:
Highlighted data cannot be screened as insignificant.
The background concentration of Chromium VI is estimated to equate to 20 % of the total Chromium concentration.
In the absence of a current Environmental Assessment Level for Cobalt, the historical EAL of 0.2 is applied.

Appendix A Table 3
Secondary Assessment of Chromium VI Contributions

Metal Species	Cr VI as % of Total	Process Contribution (PC) µg m^{-3}	PC as % Assessment Level	Background µg m^{-3}	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level
Chromium VI (Cr VI)	0.03	5.42112E-07	0.27%	0.000509	0.000509	255%

Appendix A Table 4
Maximum Predicted Cumulative Process Contributions (2015 Data)

Assessment Criteria	Maximum Process Contribution (PC)	Assessment Level	PC as % Assessment Level	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level
Annual Average NO_2 (100 % NO_x) µg m^{-3}	9.12	30 or 40	**30.4%**	15.28	51%
99.79th Percentile Hourly Average NO_2 (50 % NO_x) µg m^{-3}	73.49	200	**36.75%**	85.81	43%
Maximum 24-Hour Average NO_2 (100 % NO_x) µg m^{-3}	90.48	75	**120.64%**	102.8	**137%**
99.90th Percentile 15 Minute SO_2 µg m^{-3}	10.48	266	3.94%	16.06	6%
Annual Average SO_2 µg m^{-3}	0.66	10 or 20	**6.63%**	3.45	35%
99.73rd Percentile Hourly Average SO_2 µg m^{-3}	9.61	350	2.75%	15.19	4%
99.18th Percentile 24-Hour Average SO_2 µg m^{-3}	6.11	125	4.89%	11.69	9%
90.41st Percentile 24-Hour PM_{10} µg m^{-3}	0.687	50	1.37%	21.36	43%
Annual Average PM_{10} µg m^{-3}	0.239	40	0.60%	10.58	26%
Annual Average $PM_{2.5}$ µg m^{-3}	0.239	20	**1.20%**	6.54	33%
Maximum Rolling 8-Hour Average CO mg m^{-3}	0.1464	10	1.46%	0.24	2%

Highlighted data cannot be screened as insignificant.

Appendix A Table 5A
Maximum Predicted Process Contributions of NO_2 and Particulate at Sensitive Receptors (2015 – 2019 Data)

Receptor Name	Annual NOx as NO_2 ($\mu g\ m^{-3}$)	99.79 % Hourly NO_2 ($\mu g\ m^{-3}$)	24-Hour NO_x as NO_2 ($\mu g\ m^{-3}$)	Annual PM_{10} ($\mu g\ m^{-3}$)	90.41 % 24-Hour PM_{10} ($\mu g\ m^{-3}$)	Annual $PM_{2.5}$ ($\mu g\ m^{-3}$)
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.034	1.322	0.821	0.0043	0.0131	0.0043
Cwm Cadlan SAC	0.051	0.502	0.431	0.0064	0.0206	0.0064
Coedydd Nedd a Mellte SAC	0.018	0.702	0.539	0.0023	0.0077	0.0023
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.042	0.701	0.760	0.0053	0.0198	0.0053
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.009	0.280	0.246	0.0011	0.0043	0.0011
Craig-y-Llyn SSSI	0.020	0.409	0.421	0.0025	0.0112	0.0025
Bryn Bwch SSSI	0.011	0.280	0.205	0.0013	0.0058	0.0013
Caeau Nant-y-Llechau SSSI	0.008	0.224	0.174	0.0010	0.0038	0.0010
Gweunedd Dyffern Nedd SSSI	0.009	0.258	0.194	0.0011	0.0045	0.0011
Bryncarnau Grasslands Llwyncoed SSSI	0.016	0.416	0.204	0.0020	0.0075	0.0020
Blaenrhondda Road Cutting SSSI	0.014	0.465	0.350	0.0017	0.0084	0.0017
Blaen Nedd SSSI	0.007	0.210	0.152	0.0009	0.0037	0.0009
Ogof Ffynnon Ddu Pant Mawr SSSI	0.006	0.189	0.146	0.0007	0.0031	0.0007
Caeau Ton-y-Fildre SSSI	0.004	0.161	0.116	0.0005	0.0018	0.0005
Penmoelallt SSSI	0.021	0.271	0.194	0.0026	0.0075	0.0026
Mynydd Ty-Isaf Rhondda SSSI	0.009	0.351	0.321	0.0011	0.0051	0.0011
Plas-y-Gors SSSI	0.007	0.161	0.157	0.0009	0.0033	0.0009
Daren Fach SSSI	0.024	0.261	0.201	0.0030	0.0087	0.0030
Cwm Glo a Glyndyrys SSSI	0.010	0.323	0.145	0.0012	0.0049	0.0012
Waun Ton-y-Spyddaden SSSI	0.004	0.138	0.090	0.0004	0.0018	0.0004
Gorsllwyn Onllwyn SSSI	0.003	0.149	0.128	0.0004	0.0015	0.0004
Cwm Taf Fechan Woodlands SSSI	0.014	0.280	0.151	0.0017	0.0052	0.0017
Nant Llech SSSI	0.003	0.123	0.098	0.0004	0.0015	0.0004
Caeau Nant Y Groes SSSI	0.008	0.262	0.114	0.0010	0.0046	0.0010
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.020	0.518	0.229	0.0025	0.0100	0.0025
Penderyn Reservoir	0.011	0.916	0.618	0.0013	0.0015	0.0013
Eden UK	0.005	0.364	0.364	0.0007	0.0019	0.0007
House at Penderyn Reservoir	0.076	1.411	1.267	0.0096	0.0285	0.0096
Ty Newydd Hotel	0.188	1.536	1.572	0.0235	0.0747	0.0235
Caer Llwyn Cottage	0.026	1.133	0.715	0.0033	0.0123	0.0033
Rhombic Farm	0.036	1.138	1.123	0.0045	0.0185	0.0045
Castell Farm	0.031	1.017	0.899	0.0039	0.0145	0.0039
TY Newydd Cottage	0.213	1.556	1.545	0.0267	0.0817	0.0267
Residence Woodland Park	0.206	0.931	1.077	0.0257	0.0695	0.0257
Pontbren Llwyd School	0.129	0.769	0.674	0.0161	0.0430	0.0161
Ffynnon Ddu (spring)	0.020	0.447	0.453	0.0025	0.0096	0.0025
Ton-Y-Gilfach	0.006	0.250	0.210	0.0008	0.0029	0.0008
Rose Cottage	0.010	0.365	0.344	0.0012	0.0048	0.0012
The Don Bungalow	0.015	0.490	0.319	0.0019	0.0077	0.0019
Werfa Farm	0.024	0.642	0.484	0.0030	0.0120	0.0030
Willows Farm	0.044	1.296	1.073	0.0055	0.0265	0.0055
Trebanog Uchaf Farm	0.067	1.324	1.000	0.0084	0.0269	0.0084
Tai-Cwpla Farm	0.016	1.025	0.769	0.0020	0.0046	0.0020
Neuadd Farm	0.211	1.039	1.014	0.0263	0.0746	0.0263
John Street Allotments, Hirwaun	0.037	0.753	0.494	0.0046	0.0213	0.0046
Dwr Cymru Service Reservoir	0.021	1.102	0.747	0.0027	0.0081	0.0027

Appendix A Table 5B
Maximum Predicted Process Contributions of NO_2 and Particulate at Sensitive Receptors (2015 – 2019 Data) Cont.

Receptor Name	Annual NOx as NO_2 (µg m^{-3})	99.79 % Hourly NO_2 (µg m^{-3})	24-Hour NO_x as NO_2 (µg m^{-3})	Annual PM_{10} (µg m^{-3})	90.41 % 24-Hour PM_{10} (µg m^{-3})	Annual $PM_{2.5}$ (µg m^{-3})
Ancient Woodland Site 6686	0.025	1.114	0.697	0.0031	0.0081	0.0031
Ancient Woodland Site 7652	0.020	0.629	0.580	0.0024	0.0092	0.0024
Ancient Woodland Site 7730	0.024	0.561	0.597	0.0030	0.0109	0.0030
Ancient Woodland Site 10113	0.182	0.874	0.900	0.0228	0.0650	0.0228
Ancient Woodland Site 10232	0.082	0.862	0.738	0.0103	0.0335	0.0103
Ancient Woodland Site 10297	0.104	0.901	0.795	0.0130	0.0386	0.0130
Ancient Woodland Site 10323	0.037	1.268	1.062	0.0046	0.0178	0.0046
Ancient Woodland Site 10450	0.074	0.890	0.606	0.0092	0.0305	0.0092
Ancient Woodland Site 11240	0.144	0.907	0.938	0.0181	0.0530	0.0181
Ancient Woodland Site 11255	0.018	0.556	0.525	0.0022	0.0090	0.0022
Ancient Woodland Site 13252	0.033	1.278	0.954	0.0042	0.0194	0.0042
Ancient Woodland Site 17279	0.225	1.054	1.144	0.0282	0.0761	0.0282
Ancient Woodland Site 17280	0.172	0.911	0.989	0.0215	0.0590	0.0215
Ancient Woodland Site 17307	0.036	1.277	0.995	0.0045	0.0146	0.0045
Ancient Woodland Site 17308	0.042	1.364	0.693	0.0053	0.0227	0.0053
Ancient Woodland Site 17326	0.168	0.993	1.164	0.0210	0.0664	0.0210
Ancient Woodland Site 17327	0.116	0.908	0.872	0.0146	0.0441	0.0146
Ancient Woodland Site 17359	0.073	0.916	0.615	0.0091	0.0319	0.0091
Ancient Woodland Site 17368	0.056	1.268	1.124	0.0070	0.0263	0.0070
Ancient Woodland Site 17369	0.212	1.097	1.192	0.0265	0.0726	0.0265
Ancient Woodland Site 17396	0.018	0.599	0.549	0.0022	0.0096	0.0022
Ancient Woodland Site 17397	0.015	0.453	0.467	0.0019	0.0075	0.0019
Ancient Woodland Site 17487	0.019	0.664	0.542	0.0023	0.0091	0.0023
Ancient Woodland Site 18190	0.058	1.123	0.983	0.0073	0.0256	0.0073
Ancient Woodland Site 18191	0.135	0.936	0.890	0.0169	0.0499	0.0169
Ancient Woodland Site 18192	0.201	0.982	0.966	0.0251	0.0721	0.0251
Ancient Woodland Site 18212	0.049	0.905	0.596	0.0061	0.0269	0.0061
Ancient Woodland Site 18215	0.176	0.900	0.913	0.0220	0.0636	0.0220
Ancient Woodland Site 18235	0.111	0.765	0.744	0.0139	0.0413	0.0139
Ancient Woodland Site 18296	0.048	0.919	0.502	0.0060	0.0237	0.0060
Ancient Woodland Site 18297	0.059	0.961	0.599	0.0073	0.0292	0.0073
Ancient Woodland Site 18347	0.129	0.966	0.917	0.0161	0.0477	0.0161
Ancient Woodland Site 18348	0.165	0.844	0.805	0.0206	0.0586	0.0206
Ancient Woodland Site 18417	0.111	0.912	0.789	0.0139	0.0434	0.0139
Ancient Woodland Site 18418	0.053	0.851	0.950	0.0067	0.0230	0.0067
Ancient Woodland Site 18954	0.026	0.853	0.626	0.0032	0.0134	0.0032
Ancient Woodland Site 18955	0.221	1.183	1.161	0.0276	0.0813	0.0276
Ancient Woodland Site 18956	0.025	0.976	0.662	0.0031	0.0102	0.0031
Ancient Woodland Site 21799	0.068	1.069	0.937	0.0084	0.0266	0.0084
Ancient Woodland Site 21855	0.017	0.648	0.460	0.0021	0.0075	0.0021
Ancient Woodland Site 21976	0.022	0.546	0.494	0.0027	0.0107	0.0027
Ancient Woodland Site 42098	0.026	0.944	0.673	0.0032	0.0134	0.0032
Ancient Woodland Site 43706	0.051	1.198	1.013	0.0064	0.0249	0.0064
Onsite Receptor 1	0.003	0.217	0.353	0.0004	0.0000	0.0004
Onsite Receptor 2	0.006	0.446	0.467	0.0007	0.0002	0.0007
Onsite Receptor 3	0.004	0.229	0.457	0.0005	0.0002	0.0005
Onsite Receptor 4	0.005	0.328	0.413	0.0006	0.0003	0.0006
Onsite Receptor 5	0.007	0.431	0.474	0.0009	0.0007	0.0009

Appendix A Table 5C
Maximum Predicted Process Contributions of SO_2, NH_3 and CO at Sensitive Receptors (2015 – 2019 Data)

Receptor Name	Annual SO_2 (µg m^{-3})	99.9 % 15-Min SO_2 (µg m^{-3})	99.73 % Hourly SO_2 (µg m^{-3})	99.18 % 24-Hour SO_2 (µg m^{-3})	Annual NH_3 (µg m^{-3})	Max. Rolling 8-Hour CO (mg m^{-3})
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.009	1.025	0.574	0.147	0.00043	0.0050
Cwm Cadlan SAC	0.013	0.345	0.228	0.081	0.00064	0.0019
Coedydd Nedd a Mellte SAC	0.005	0.432	0.340	0.081	0.00023	0.0022
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.011	0.439	0.339	0.156	0.00053	0.0022
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.002	0.204	0.130	0.034	0.00011	0.0005
Craig-y-Llyn SSSI	0.005	0.314	0.190	0.045	0.00025	0.0013
Bryn Bwch SSSI	0.003	0.212	0.137	0.035	0.00013	0.0005
Caeau Nant-y-Llechau SSSI	0.002	0.177	0.107	0.036	0.00010	0.0009
Gweunedd Dyffern Nedd SSSI	0.002	0.188	0.125	0.026	0.00011	0.0004
Bryncarnau Grasslands Llwyncoed SSSI	0.004	0.363	0.190	0.048	0.00020	0.0007
Blaenrhondda Road Cutting SSSI	0.003	0.420	0.213	0.040	0.00017	0.0011
Blaen Nedd SSSI	0.002	0.159	0.102	0.024	0.00009	0.0004
Ogof Ffynnon Ddu Pant Mawr SSSI	0.001	0.163	0.092	0.020	0.00007	0.0003
Caeau Ton-y-Fildre SSSI	0.001	0.136	0.078	0.019	0.00005	0.0008
Penmoelallt SSSI	0.005	0.223	0.124	0.030	0.00026	0.0006
Mynydd Ty-Isaf Rhondda SSSI	0.002	0.312	0.166	0.027	0.00011	0.0009
Plas-y-Gors SSSI	0.002	0.133	0.079	0.021	0.00009	0.0003
Daren Fach SSSI	0.006	0.238	0.123	0.034	0.00030	0.0008
Cwm Glo a Glyndyrys SSSI	0.002	0.321	0.151	0.026	0.00012	0.0005
Waun Ton-y-Spyddaden SSSI	0.001	0.113	0.064	0.018	0.00004	0.0005
Gorsllwyn Onllwyn SSSI	0.001	0.129	0.066	0.017	0.00004	0.0007
Cwm Taf Fechan Woodlands SSSI	0.003	0.221	0.125	0.026	0.00017	0.0005
Nant Llech SSSI	0.001	0.124	0.058	0.016	0.00004	0.0006
Caeau Nant Y Groes SSSI	0.002	0.242	0.112	0.023	0.00010	0.0006
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.005	0.388	0.250	0.052	0.00025	0.0007
Penderyn Reservoir	0.003	0.877	0.374	0.086	0.00013	0.0031
Eden UK	0.001	0.346	0.139	0.049	0.00007	0.0015
House at Penderyn Reservoir	0.019	0.915	0.663	0.145	0.00096	0.0046
Ty Newydd Hotel	0.047	0.845	0.755	0.260	0.00235	0.0036
Caer Llwyn Cottage	0.007	0.685	0.522	0.122	0.00033	0.0022
Rhombic Farm	0.009	0.667	0.550	0.149	0.00045	0.0032
Castell Farm	0.008	0.620	0.484	0.136	0.00039	0.0024
TY Newydd Cottage	0.053	0.870	0.772	0.260	0.00267	0.0035
Residence Woodland Park	0.052	0.642	0.460	0.243	0.00257	0.0028
Pontbren Llwyd School	0.032	0.589	0.319	0.154	0.00161	0.0016
Ffynnon Ddu (spring)	0.005	0.280	0.219	0.094	0.00025	0.0011
Ton-Y-Gilfach	0.002	0.200	0.116	0.030	0.00008	0.0011
Rose Cottage	0.002	0.258	0.180	0.045	0.00012	0.0019
The Don Bungalow	0.004	0.323	0.239	0.053	0.00019	0.0008
Werfa Farm	0.006	0.405	0.318	0.081	0.00030	0.0013
Willows Farm	0.011	1.086	0.623	0.228	0.00055	0.0065
Trebanog Uchaf Farm	0.017	0.791	0.609	0.182	0.00084	0.0056
Tai-Cwpla Farm	0.004	0.816	0.417	0.116	0.00020	0.0025
Neuadd Farm	0.053	0.711	0.515	0.237	0.00263	0.0025
John Street Allotments, Hirwaun	0.009	0.507	0.346	0.105	0.00046	0.0016
Dwr Cymru Service Reservoir	0.005	0.969	0.467	0.123	0.00027	0.0048

Appendix A Table 5D
Maximum Predicted Process Contributions of SO_2, NH_3 and CO at Sensitive Receptors (2015 – 2019 Data) Cont.

Receptor Name	Annual SO_2 ($\mu g\ m^{-3}$)	99.9 % 15-Min SO_2 ($\mu g\ m^{-3}$)	99.73 % Hourly SO_2 ($\mu g\ m^{-3}$)	99.18 % 24-Hour SO_2 ($\mu g\ m^{-3}$)	Annual NH_3 ($\mu g\ m^{-3}$)	Max. Rolling 8-Hour CO (mg m^{-3})
Ancient Woodland Site 6686	0.006	0.776	0.520	0.128	0.00031	0.0023
Ancient Woodland Site 7652	0.005	0.384	0.298	0.081	0.00024	0.0023
Ancient Woodland Site 7730	0.006	0.350	0.275	0.113	0.00030	0.0014
Ancient Woodland Site 10113	0.046	0.687	0.425	0.205	0.00228	0.0026
Ancient Woodland Site 10232	0.021	0.584	0.407	0.143	0.00103	0.0018
Ancient Woodland Site 10297	0.026	0.623	0.429	0.132	0.00130	0.0021
Ancient Woodland Site 10323	0.009	0.795	0.576	0.147	0.00046	0.0022
Ancient Woodland Site 10450	0.018	0.683	0.426	0.123	0.00092	0.0020
Ancient Woodland Site 11240	0.036	0.740	0.425	0.205	0.00181	0.0036
Ancient Woodland Site 11255	0.004	0.353	0.267	0.073	0.00022	0.0023
Ancient Woodland Site 13252	0.008	0.833	0.563	0.136	0.00042	0.0029
Ancient Woodland Site 17279	0.056	0.663	0.520	0.257	0.00282	0.0027
Ancient Woodland Site 17280	0.043	0.641	0.436	0.214	0.00215	0.0029
Ancient Woodland Site 17307	0.009	0.769	0.606	0.147	0.00045	0.0023
Ancient Woodland Site 17308	0.011	0.800	0.621	0.140	0.00053	0.0056
Ancient Woodland Site 17326	0.042	0.651	0.490	0.220	0.00210	0.0032
Ancient Woodland Site 17327	0.029	0.648	0.407	0.143	0.00146	0.0022
Ancient Woodland Site 17359	0.018	0.627	0.393	0.133	0.00091	0.0019
Ancient Woodland Site 17368	0.014	0.735	0.582	0.187	0.00070	0.0035
Ancient Woodland Site 17369	0.053	0.815	0.529	0.247	0.00265	0.0031
Ancient Woodland Site 17396	0.004	0.376	0.290	0.075	0.00022	0.0023
Ancient Woodland Site 17397	0.004	0.288	0.219	0.060	0.00019	0.0023
Ancient Woodland Site 17487	0.005	0.409	0.316	0.081	0.00023	0.0023
Ancient Woodland Site 18190	0.015	0.671	0.538	0.210	0.00073	0.0042
Ancient Woodland Site 18191	0.034	0.727	0.433	0.193	0.00169	0.0042
Ancient Woodland Site 18192	0.050	0.707	0.473	0.230	0.00251	0.0026
Ancient Woodland Site 18212	0.012	0.626	0.408	0.113	0.00061	0.0018
Ancient Woodland Site 18215	0.044	0.657	0.436	0.199	0.00220	0.0024
Ancient Woodland Site 18235	0.028	0.624	0.343	0.154	0.00139	0.0021
Ancient Woodland Site 18296	0.012	0.644	0.419	0.104	0.00060	0.0017
Ancient Woodland Site 18297	0.015	0.629	0.424	0.122	0.00073	0.0018
Ancient Woodland Site 18347	0.032	0.685	0.426	0.175	0.00161	0.0024
Ancient Woodland Site 18348	0.041	0.795	0.401	0.194	0.00206	0.0022
Ancient Woodland Site 18417	0.028	0.674	0.405	0.173	0.00139	0.0039
Ancient Woodland Site 18418	0.013	0.501	0.417	0.183	0.00067	0.0026
Ancient Woodland Site 18954	0.006	0.510	0.406	0.106	0.00032	0.0018
Ancient Woodland Site 18955	0.055	0.650	0.586	0.240	0.00276	0.0027
Ancient Woodland Site 18956	0.006	0.562	0.451	0.109	0.00031	0.0025
Ancient Woodland Site 21799	0.017	0.704	0.510	0.189	0.00084	0.0048
Ancient Woodland Site 21855	0.004	0.392	0.311	0.078	0.00021	0.0021
Ancient Woodland Site 21976	0.005	0.359	0.267	0.112	0.00027	0.0017
Ancient Woodland Site 42098	0.006	0.547	0.460	0.122	0.00032	0.0020
Ancient Woodland Site 43706	0.013	0.730	0.574	0.173	0.00064	0.0029
Onsite Receptor 1	0.001	0.336	0.065	0.055	0.00004	0.0013
Onsite Receptor 2	0.001	0.468	0.112	0.074	0.00007	0.0016
Onsite Receptor 3	0.001	0.444	0.085	0.052	0.00005	0.0014
Onsite Receptor 4	0.001	0.563	0.134	0.054	0.00006	0.0015
Onsite Receptor 5	0.002	0.601	0.188	0.089	0.00009	0.0032

Appendix A Table 5E
Maximum Predicted Process Contributions of HCl, HF and PCBs at Sensitive Receptors (2015 – 2019 Data)

Receptor Name	Hourly HCl ($\mu g\ m^{-3}$)	Hourly HF ($\mu g\ m^{-3}$)	24-Hour HF ($\mu g\ m^{-3}$)	Weekly HF ($\mu g\ m^{-3}$)	Annual PCB ($\mu g\ m^{-3}$)	Hourly PCB ($\mu g\ m^{-3}$)
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.686	0.137	0.021	0.005	5.15E-11	8.21E-09
Cwm Cadlan SAC	0.232	0.046	0.011	0.006	7.65E-11	2.78E-09
Coedydd Nedd a Mellte SAC	0.258	0.052	0.013	0.005	2.77E-11	3.08E-09
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.370	0.074	0.019	0.009	6.36E-11	4.43E-09
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.218	0.044	0.006	0.003	1.37E-11	2.61E-09
Craig-y-Llyn SSSI	0.180	0.036	0.011	0.003	3.01E-11	2.16E-09
Bryn Bwch SSSI	0.154	0.031	0.005	0.003	1.59E-11	1.84E-09
Caeau Nant-y-Llechau SSSI	0.105	0.021	0.004	0.002	1.18E-11	1.26E-09
Gweunedd Dyffern Nedd SSSI	0.150	0.030	0.005	0.002	1.34E-11	1.80E-09
Bryncarnau Grasslands Llwyncoed SSSI	0.171	0.034	0.005	0.002	2.45E-11	2.05E-09
Blaenrhondda Road Cutting SSSI	0.184	0.037	0.009	0.003	2.02E-11	2.21E-09
Blaen Nedd SSSI	0.142	0.028	0.004	0.002	1.08E-11	1.70E-09
Ogof Ffynnon Ddu Pant Mawr SSSI	0.141	0.028	0.004	0.001	8.89E-12	1.69E-09
Caeau Ton-y-Fildre SSSI	0.126	0.025	0.003	0.001	5.78E-12	1.51E-09
Penmoelallt SSSI	0.128	0.026	0.005	0.002	3.11E-11	1.54E-09
Mynydd Ty-Isaf Rhondda SSSI	0.135	0.027	0.008	0.002	1.29E-11	1.62E-09
Plas-y-Gors SSSI	0.133	0.027	0.004	0.001	1.06E-11	1.59E-09
Daren Fach SSSI	0.124	0.025	0.005	0.002	3.58E-11	1.48E-09
Cwm Glo a Glyndyrys SSSI	0.128	0.026	0.004	0.001	1.45E-11	1.53E-09
Waun Ton-y-Spyddaden SSSI	0.110	0.022	0.002	0.001	5.29E-12	1.32E-09
Gorsllwyn Onllwyn SSSI	0.115	0.023	0.003	0.001	5.11E-12	1.37E-09
Cwm Taf Fechan Woodlands SSSI	0.118	0.024	0.004	0.001	2.04E-11	1.41E-09
Nant Llech SSSI	0.098	0.020	0.002	0.001	4.60E-12	1.17E-09
Caeau Nant Y Groes SSSI	0.118	0.024	0.003	0.001	1.20E-11	1.41E-09
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.200	0.040	0.006	0.002	2.98E-11	2.39E-09
Penderyn Reservoir	0.711	0.142	0.015	0.003	1.59E-11	8.51E-09
Eden UK	0.579	0.116	0.009	0.002	7.92E-12	6.93E-09
House at Penderyn Reservoir	0.946	0.189	0.032	0.008	1.14E-10	1.13E-08
Ty Newydd Hotel	0.580	0.116	0.039	0.015	2.81E-10	6.94E-09
Caer Llwyn Cottage	0.385	0.077	0.018	0.008	3.93E-11	4.61E-09
Rhombic Farm	0.348	0.070	0.028	0.016	5.45E-11	4.16E-09
Castell Farm	0.317	0.063	0.022	0.015	4.69E-11	3.80E-09
TY Newydd Cottage	0.737	0.148	0.039	0.014	3.19E-10	8.83E-09
Residence Woodland Park	0.596	0.119	0.027	0.014	3.08E-10	7.13E-09
Pontbren Llwyd School	0.441	0.088	0.017	0.008	1.92E-10	5.28E-09
Ffynnon Ddu (spring)	0.206	0.041	0.011	0.004	2.94E-11	2.46E-09
Ton-Y-Gilfach	0.159	0.032	0.005	0.002	9.13E-12	1.90E-09
Rose Cottage	0.193	0.039	0.009	0.003	1.49E-11	2.31E-09
The Don Bungalow	0.314	0.063	0.008	0.005	2.28E-11	3.76E-09
Werfa Farm	0.324	0.065	0.012	0.009	3.60E-11	3.87E-09
Willows Farm	0.717	0.144	0.027	0.011	6.62E-11	8.58E-09
Trebanog Uchaf Farm	0.934	0.187	0.025	0.009	1.00E-10	1.12E-08
Tai-Cwpla Farm	0.544	0.109	0.019	0.005	2.34E-11	6.51E-09
Neuadd Farm	0.522	0.105	0.025	0.013	3.15E-10	6.25E-09
John Street Allotments, Hirwaun	0.271	0.054	0.012	0.005	5.54E-11	3.24E-09
Dwr Cymru Service Reservoir	0.704	0.141	0.019	0.005	3.21E-11	8.42E-09

Appendix A Table 5F
Maximum Predicted Process Contributions of HCl, HF and PCBs at Sensitive Receptors (2015 – 2019 Data) Cont.

Receptor Name	Hourly HCl ($\mu g\ m^{-3}$)	Hourly HF ($\mu g\ m^{-3}$)	24-Hour HF ($\mu g\ m^{-3}$)	Weekly HF ($\mu g\ m^{-3}$)	Annual PCB ($\mu g\ m^{-3}$)	Hourly PCB ($\mu g\ m^{-3}$)
Ancient Woodland Site 6686	0.492	0.099	0.017	0.004	3.75E-11	5.89E-09
Ancient Woodland Site 7652	0.244	0.049	0.015	0.006	2.93E-11	2.92E-09
Ancient Woodland Site 7730	0.273	0.055	0.015	0.006	3.59E-11	3.26E-09
Ancient Woodland Site 10113	0.629	0.126	0.023	0.012	2.73E-10	7.53E-09
Ancient Woodland Site 10232	0.419	0.084	0.018	0.007	1.23E-10	5.01E-09
Ancient Woodland Site 10297	0.420	0.084	0.020	0.007	1.55E-10	5.03E-09
Ancient Woodland Site 10323	0.446	0.089	0.027	0.005	5.50E-11	5.34E-09
Ancient Woodland Site 10450	0.529	0.106	0.015	0.006	1.11E-10	6.33E-09
Ancient Woodland Site 11240	0.575	0.115	0.023	0.012	2.16E-10	6.89E-09
Ancient Woodland Site 11255	0.233	0.047	0.013	0.005	2.65E-11	2.78E-09
Ancient Woodland Site 13252	0.480	0.096	0.024	0.004	5.00E-11	5.75E-09
Ancient Woodland Site 17279	0.705	0.141	0.029	0.014	3.37E-10	8.44E-09
Ancient Woodland Site 17280	0.525	0.105	0.025	0.012	2.57E-10	6.29E-09
Ancient Woodland Site 17307	0.416	0.083	0.025	0.004	5.39E-11	4.98E-09
Ancient Woodland Site 17308	0.824	0.165	0.017	0.005	6.33E-11	9.86E-09
Ancient Woodland Site 17326	0.643	0.129	0.029	0.011	2.51E-10	7.70E-09
Ancient Woodland Site 17327	0.439	0.088	0.022	0.008	1.74E-10	5.25E-09
Ancient Woodland Site 17359	0.487	0.097	0.015	0.006	1.09E-10	5.83E-09
Ancient Woodland Site 17368	0.549	0.110	0.028	0.008	8.40E-11	6.57E-09
Ancient Woodland Site 17369	0.555	0.111	0.030	0.012	3.18E-10	6.65E-09
Ancient Woodland Site 17396	0.242	0.048	0.014	0.005	2.66E-11	2.90E-09
Ancient Woodland Site 17397	0.227	0.045	0.012	0.004	2.22E-11	2.72E-09
Ancient Woodland Site 17487	0.253	0.051	0.014	0.005	2.78E-11	3.02E-09
Ancient Woodland Site 18190	0.606	0.121	0.025	0.012	8.71E-11	7.26E-09
Ancient Woodland Site 18191	0.610	0.122	0.022	0.013	2.02E-10	7.30E-09
Ancient Woodland Site 18192	0.555	0.111	0.024	0.013	3.01E-10	6.65E-09
Ancient Woodland Site 18212	0.337	0.067	0.015	0.007	7.33E-11	4.03E-09
Ancient Woodland Site 18215	0.483	0.097	0.023	0.012	2.64E-10	5.78E-09
Ancient Woodland Site 18235	0.411	0.082	0.019	0.009	1.66E-10	4.92E-09
Ancient Woodland Site 18296	0.349	0.070	0.013	0.005	7.21E-11	4.18E-09
Ancient Woodland Site 18297	0.354	0.071	0.015	0.007	8.77E-11	4.24E-09
Ancient Woodland Site 18347	0.480	0.096	0.023	0.009	1.93E-10	5.75E-09
Ancient Woodland Site 18348	0.501	0.100	0.020	0.011	2.46E-10	5.99E-09
Ancient Woodland Site 18417	0.568	0.114	0.020	0.012	1.66E-10	6.79E-09
Ancient Woodland Site 18418	0.439	0.088	0.024	0.011	7.97E-11	5.25E-09
Ancient Woodland Site 18954	0.269	0.054	0.016	0.011	3.87E-11	3.22E-09
Ancient Woodland Site 18955	0.614	0.123	0.029	0.014	3.30E-10	7.35E-09
Ancient Woodland Site 18956	0.317	0.063	0.017	0.008	3.71E-11	3.79E-09
Ancient Woodland Site 21799	0.615	0.123	0.023	0.009	1.01E-10	7.36E-09
Ancient Woodland Site 21855	0.256	0.051	0.012	0.005	2.52E-11	3.06E-09
Ancient Woodland Site 21976	0.211	0.042	0.012	0.006	3.24E-11	2.53E-09
Ancient Woodland Site 42098	0.286	0.057	0.017	0.012	3.86E-11	3.43E-09
Ancient Woodland Site 43706	0.557	0.112	0.025	0.008	7.70E-11	6.67E-09
Onsite Receptor 1	0.490	0.098	0.009	0.002	5.17E-12	5.87E-09
Onsite Receptor 2	0.597	0.119	0.012	0.002	8.23E-12	7.14E-09
Onsite Receptor 3	0.567	0.113	0.011	0.002	6.58E-12	6.78E-09
Onsite Receptor 4	0.584	0.117	0.010	0.002	6.92E-12	6.99E-09
Onsite Receptor 5	0.706	0.141	0.012	0.003	1.03E-11	8.46E-09

Appendix A Table 5G
Maximum Predicted Process Contributions of TOC, Metals and PAH at Sensitive Receptors (2015 – 2019 Data)

Receptor Name	Annual TOC ($\mu g\ m^{-3}$)	Annual Group I Metals ($ng\ m^{-3}$)	Annual Group III Metals ($\mu g\ m^{-3}$)	Annual Mercury ($\mu g\ m^{-3}$)	Hourly Mercury (µg m-3)	Annual PAH ($\mu g\ m^{-3}$)
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.009	0.017	2.58E-04	1.72E-05	0.0027	0.0009
Cwm Cadlan SAC	0.013	0.026	3.83E-04	2.56E-05	0.0009	0.0013
Coedydd Nedd a Mellte SAC	0.005	0.009	1.39E-04	9.26E-06	0.0010	0.0005
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.011	0.021	3.18E-04	2.13E-05	0.0015	0.0011
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.002	0.005	6.87E-05	4.59E-06	0.0009	0.0002
Craig-y-Llyn SSSI	0.005	0.010	1.51E-04	1.01E-05	0.0007	0.0005
Bryn Bwch SSSI	0.003	0.005	7.99E-05	5.33E-06	0.0006	0.0003
Caeau Nant-y-Llechau SSSI	0.002	0.004	5.93E-05	3.96E-06	0.0004	0.0002
Gweunedd Dyffern Nedd SSSI	0.002	0.004	6.70E-05	4.47E-06	0.0006	0.0002
Bryncarnau Grasslands Llwyncoed SSSI	0.004	0.008	1.23E-04	8.21E-06	0.0007	0.0004
Blaenrhondda Road Cutting SSSI	0.003	0.007	1.01E-04	6.77E-06	0.0007	0.0003
Blaen Nedd SSSI	0.002	0.004	5.41E-05	3.62E-06	0.0006	0.0002
Ogof Ffynnon Ddu Pant Mawr SSSI	0.001	0.003	4.45E-05	2.97E-06	0.0006	0.0001
Caeau Ton-y-Fildre SSSI	0.001	0.002	2.90E-05	1.93E-06	0.0005	0.0001
Penmoelallt SSSI	0.005	0.010	1.56E-04	1.04E-05	0.0005	0.0005
Mynydd Ty-Isaf Rhondda SSSI	0.002	0.004	6.47E-05	4.32E-06	0.0005	0.0002
Plas-y-Gors SSSI	0.002	0.004	5.29E-05	3.54E-06	0.0005	0.0002
Daren Fach SSSI	0.006	0.012	1.79E-04	1.20E-05	0.0005	0.0006
Cwm Glo a Glyndyrys SSSI	0.002	0.005	7.27E-05	4.85E-06	0.0005	0.0002
Waun Ton-y-Spyddaden SSSI	0.001	0.002	2.65E-05	1.77E-06	0.0004	0.0001
Gorsllwyn Onllwyn SSSI	0.001	0.002	2.56E-05	1.71E-06	0.0005	0.0001
Cwm Taf Fechan Woodlands SSSI	0.003	0.007	1.02E-04	6.82E-06	0.0005	0.0003
Nant Llech SSSI	0.001	0.002	2.31E-05	1.54E-06	0.0004	0.0001
Caeau Nant Y Groes SSSI	0.002	0.004	6.02E-05	4.02E-06	0.0005	0.0002
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.005	0.010	1.49E-04	9.98E-06	0.0008	0.0005
Penderyn Reservoir	0.003	0.005	7.98E-05	5.33E-06	0.0028	0.0003
Eden UK	0.001	0.003	3.97E-05	2.65E-06	0.0023	0.0001
House at Penderyn Reservoir	0.019	0.038	5.73E-04	3.83E-05	0.0038	0.0019
Ty Newydd Hotel	0.047	0.094	1.41E-03	9.40E-05	0.0023	0.0047
Caer Llwyn Cottage	0.007	0.013	1.97E-04	1.32E-05	0.0015	0.0007
Rhombic Farm	0.009	0.018	2.73E-04	1.82E-05	0.0014	0.0009
Castell Farm	0.008	0.016	2.35E-04	1.57E-05	0.0013	0.0008
TY Newydd Cottage	0.053	0.107	1.60E-03	1.07E-04	0.0030	0.0053
Residence Woodland Park	0.052	0.103	1.54E-03	1.03E-04	0.0024	0.0052
Pontbren Llwyd School	0.032	0.064	9.64E-04	6.44E-05	0.0018	0.0032
Ffynnon Ddu (spring)	0.005	0.010	1.47E-04	9.84E-06	0.0008	0.0005
Ton-Y-Gilfach	0.002	0.003	4.58E-05	3.06E-06	0.0006	0.0002
Rose Cottage	0.002	0.005	7.48E-05	5.00E-06	0.0008	0.0002
The Don Bungalow	0.004	0.008	1.14E-04	7.64E-06	0.0013	0.0004
Werfa Farm	0.006	0.012	1.80E-04	1.21E-05	0.0013	0.0006
Willows Farm	0.011	0.022	3.32E-04	2.22E-05	0.0029	0.0011
Trebanog Uchaf Farm	0.017	0.033	5.01E-04	3.35E-05	0.0037	0.0017
Tai-Cwpla Farm	0.004	0.008	1.17E-04	7.82E-06	0.0022	0.0004
Neuadd Farm	0.053	0.105	1.58E-03	1.05E-04	0.0021	0.0053
John Street Allotments, Hirwaun	0.009	0.019	2.78E-04	1.85E-05	0.0011	0.0009
Dwr Cymru Service Reservoir	0.005	0.011	1.61E-04	1.07E-05	0.0028	0.0005

Appendix A Table 5H
Maximum Predicted Process Contributions of TOC, Metals and PAH at Sensitive Receptors (2015 – 2019 Data) Cont.

Receptor Name	Annual TOC (µg m^{-3})	Annual Group I Metals (ng m^{-3})	Annual Group III Metals (µg m^{-3})	Annual Mercury (µg m^{-3})	Hourly Mercury (µg m-3)	Annual PAH (µg m^{-3})
Ancient Woodland Site 6686	0.006	0.013	1.88E-04	1.26E-05	0.0020	0.0006
Ancient Woodland Site 7652	0.005	0.010	1.47E-04	9.80E-06	0.0010	0.0005
Ancient Woodland Site 7730	0.006	0.012	1.80E-04	1.20E-05	0.0011	0.0006
Ancient Woodland Site 10113	0.046	0.091	1.37E-03	9.13E-05	0.0025	0.0046
Ancient Woodland Site 10232	0.021	0.041	6.16E-04	4.12E-05	0.0017	0.0021
Ancient Woodland Site 10297	0.026	0.052	7.78E-04	5.19E-05	0.0017	0.0026
Ancient Woodland Site 10323	0.009	0.018	2.76E-04	1.84E-05	0.0018	0.0009
Ancient Woodland Site 10450	0.018	0.037	5.54E-04	3.70E-05	0.0021	0.0018
Ancient Woodland Site 11240	0.036	0.072	1.08E-03	7.23E-05	0.0023	0.0036
Ancient Woodland Site 11255	0.004	0.009	1.33E-04	8.86E-06	0.0009	0.0004
Ancient Woodland Site 13252	0.008	0.017	2.51E-04	1.67E-05	0.0019	0.0008
Ancient Woodland Site 17279	0.056	0.113	1.69E-03	1.13E-04	0.0028	0.0056
Ancient Woodland Site 17280	0.043	0.086	1.29E-03	8.60E-05	0.0021	0.0043
Ancient Woodland Site 17307	0.009	0.018	2.70E-04	1.80E-05	0.0017	0.0009
Ancient Woodland Site 17308	0.011	0.021	3.17E-04	2.12E-05	0.0033	0.0011
Ancient Woodland Site 17326	0.042	0.084	1.26E-03	8.40E-05	0.0026	0.0042
Ancient Woodland Site 17327	0.029	0.058	8.72E-04	5.83E-05	0.0018	0.0029
Ancient Woodland Site 17359	0.018	0.037	5.47E-04	3.66E-05	0.0019	0.0018
Ancient Woodland Site 17368	0.014	0.028	4.21E-04	2.81E-05	0.0022	0.0014
Ancient Woodland Site 17369	0.053	0.106	1.59E-03	1.06E-04	0.0022	0.0053
Ancient Woodland Site 17396	0.004	0.009	1.33E-04	8.90E-06	0.0010	0.0004
Ancient Woodland Site 17397	0.004	0.007	1.11E-04	7.44E-06	0.0009	0.0004
Ancient Woodland Site 17487	0.005	0.009	1.39E-04	9.30E-06	0.0010	0.0005
Ancient Woodland Site 18190	0.015	0.029	4.36E-04	2.91E-05	0.0024	0.0015
Ancient Woodland Site 18191	0.034	0.068	1.01E-03	6.76E-05	0.0024	0.0034
Ancient Woodland Site 18192	0.050	0.101	1.51E-03	1.01E-04	0.0022	0.0050
Ancient Woodland Site 18212	0.012	0.025	3.67E-04	2.45E-05	0.0013	0.0012
Ancient Woodland Site 18215	0.044	0.088	1.32E-03	8.82E-05	0.0019	0.0044
Ancient Woodland Site 18235	0.028	0.056	8.34E-04	5.57E-05	0.0016	0.0028
Ancient Woodland Site 18296	0.012	0.024	3.61E-04	2.41E-05	0.0014	0.0012
Ancient Woodland Site 18297	0.015	0.029	4.40E-04	2.94E-05	0.0014	0.0015
Ancient Woodland Site 18347	0.032	0.065	9.68E-04	6.47E-05	0.0019	0.0032
Ancient Woodland Site 18348	0.041	0.082	1.23E-03	8.24E-05	0.0020	0.0041
Ancient Woodland Site 18417	0.028	0.056	8.32E-04	5.56E-05	0.0023	0.0028
Ancient Woodland Site 18418	0.013	0.027	3.99E-04	2.67E-05	0.0018	0.0013
Ancient Woodland Site 18954	0.006	0.013	1.94E-04	1.30E-05	0.0011	0.0006
Ancient Woodland Site 18955	0.055	0.110	1.65E-03	1.10E-04	0.0025	0.0055
Ancient Woodland Site 18956	0.006	0.012	1.86E-04	1.24E-05	0.0013	0.0006
Ancient Woodland Site 21799	0.017	0.034	5.06E-04	3.38E-05	0.0025	0.0017
Ancient Woodland Site 21855	0.004	0.008	1.26E-04	8.42E-06	0.0010	0.0004
Ancient Woodland Site 21976	0.005	0.011	1.62E-04	1.08E-05	0.0008	0.0005
Ancient Woodland Site 42098	0.006	0.013	1.93E-04	1.29E-05	0.0011	0.0006
Ancient Woodland Site 43706	0.013	0.026	3.86E-04	2.58E-05	0.0022	0.0013
Onsite Receptor 1	0.001	0.002	2.59E-05	1.73E-06	0.0020	0.0001
Onsite Receptor 2	0.001	0.003	4.12E-05	2.75E-06	0.0024	0.0001
Onsite Receptor 3	0.001	0.002	3.30E-05	2.20E-06	0.0023	0.0001
Onsite Receptor 4	0.001	0.002	3.46E-05	2.31E-06	0.0023	0.0001
Onsite Receptor 5	0.002	0.003	5.14E-05	3.43E-06	0.0028	0.0002

Appendix A Table 6
Secondary Screening Assessment of Maximum Process Contributions at Sensitive Receptors

Assessment Criteria	Maximum Receptor Process Contribution	Assessment Level	PC as % Assessment Level	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level
Annual Average TOC (as Benzene) µg m^{-3}	0.056	5	**1.13%**	0.218	4.35%
Annual Average Group I Metals ng m^{-3}	0.113	5	**2.26%**	0.395	7.91%

Highlighted data cannot be screened as insignificant.

Appendix A Table 7A
Maximum Predicted Cumulative Process Contributions of NO_2 and Particulate at Sensitive Receptors (2015 Data)

Receptor Name	Annual NOx as NO_2 ($\mu g\ m^{-3}$)	99.79 % Hourly NO_2 ($\mu g\ m^{-3}$)	24-Hour NO_x as NO_2 ($\mu g\ m^{-3}$)	Annual PM_{10} ($\mu g\ m^{-3}$)	90.41 % 24-Hour PM_{10} ($\mu g\ m^{-3}$)
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.7562	18.44	10.31	0.0115	0.0323
Cwm Cadlan SAC	0.1517	4.65	1.71	0.0078	0.0241
Coedydd Nedd a Mellte SAC	0.0889	9.59	3.90	0.0043	0.0159
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.0997	6.83	2.14	0.0053	0.0195
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.0260	2.68	0.99	0.0016	0.0048
Craig-y-Llyn SSSI	0.0278	3.37	0.96	0.0014	0.0053
Bryn Bwch SSSI	0.0333	2.69	1.04	0.0020	0.0071
Caeau Nant-y-Llechau SSSI	0.0166	2.19	0.55	0.0009	0.0031
Gweunedd Dyffern Nedd SSSI	0.0246	2.36	0.85	0.0014	0.0054
Bryncarnau Grasslands Llwyncoed SSSI	0.0658	3.72	0.75	0.0043	0.0151
Blaenrhondda Road Cutting SSSI	0.0571	3.76	2.17	0.0026	0.0111
Blaen Nedd SSSI	0.0198	1.87	0.58	0.0012	0.0043
Ogof Ffynnon Ddu Pant Mawr SSSI	0.0139	1.76	0.47	0.0007	0.0031
Caeau Ton-y-Fildre SSSI	0.0160	1.81	0.41	0.0009	0.0038
Penmoelallt SSSI	0.0468	2.29	0.55	0.0023	0.0072
Mynydd Ty-Isaf Rhondda SSSI	0.0232	2.90	0.97	0.0014	0.0058
Plas-y-Gors SSSI	0.0134	1.40	0.36	0.0008	0.0027
Daren Fach SSSI	0.0516	2.09	0.42	0.0025	0.0074
Cwm Glo a Glyndyrys SSSI	0.0647	3.30	0.94	0.0042	0.0162
Waun Ton-y-Spyddaden SSSI	0.0101	1.30	0.34	0.0005	0.0024
Gorsllwyn Onllwyn SSSI	0.0165	2.12	0.47	0.0009	0.0035
Cwm Taf Fechan Woodlands SSSI	0.0376	2.26	0.59	0.0021	0.0066
Nant Llech SSSI	0.0117	1.30	0.32	0.0007	0.0027
Caeau Nant Y Groes SSSI	0.0365	2.85	0.54	0.0021	0.0087
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.0908	4.01	0.98	0.0064	0.0228
Penderyn Reservoir	0.4546	19.41	8.63	0.0075	0.0264
Eden UK	0.9527	23.21	14.58	0.0118	0.0330
House at Penderyn Reservoir	0.4278	14.43	6.22	0.0108	0.0307
Ty Newydd Hotel	0.8120	13.23	7.19	0.0308	0.0743
Caer Llwyn Cottage	0.1690	15.96	5.76	0.0058	0.0236
Rhombic Farm	0.1571	15.99	7.21	0.0071	0.0295
Castell Farm	0.1401	15.06	6.51	0.0063	0.0264
TY Newydd Cottage	0.8430	13.40	7.01	0.0301	0.0747
Residence Woodland Park	0.5849	8.93	5.28	0.0286	0.0751
Pontbren Llwyd School	0.3309	5.89	3.06	0.0171	0.0464
Ffynnon Ddu (spring)	0.0533	5.05	1.94	0.0026	0.0095
Ton-Y-Gilfach	0.0271	2.89	0.79	0.0016	0.0062
Rose Cottage	0.0401	4.16	1.63	0.0024	0.0085
The Don Bungalow	0.0527	4.98	2.25	0.0029	0.0104
Werfa Farm	0.0636	5.66	2.30	0.0039	0.0137
Willows Farm	0.2952	9.61	5.72	0.0252	0.1011
Trebanog Uchaf Farm	0.3231	12.72	5.98	0.0099	0.0310
Tai-Cwpla Farm	0.1915	15.65	5.97	0.0053	0.0206
Neuadd Farm	0.6401	9.23	4.93	0.0306	0.0774
John Street Allotments, Hirwaun	0.1163	3.92	1.87	0.0105	0.0426
Dwr Cymru Service Reservoir	0.7588	19.32	10.87	0.0109	0.0299

Appendix A Table 7B
Maximum Predicted Cumulative Process Contributions of NO_2 and Particulate at Sensitive Receptors (2015 Data) Cont.

Receptor Name	Annual NOx as NO_2 (µg m^{-3})	99.79 % Hourly NO_2 (µg m^{-3})	24-Hour NO_x as NO_2 (µg m^{-3})	Annual PM_{10} (µg m^{-3})	90.41 % 24-Hour PM_{10} (µg m^{-3})
Ancient Woodland Site 6686	0.1690	14.26	4.81	0.0055	0.0210
Ancient Woodland Site 7652	0.0699	7.05	2.78	0.0040	0.0139
Ancient Woodland Site 7730	0.0621	5.90	2.25	0.0032	0.0100
Ancient Woodland Site 10113	0.5336	7.63	4.09	0.0271	0.0689
Ancient Woodland Site 10232	0.2875	7.14	2.18	0.0189	0.0495
Ancient Woodland Site 10297	0.2709	6.00	2.42	0.0157	0.0399
Ancient Woodland Site 10323	0.1678	14.02	4.80	0.0065	0.0259
Ancient Woodland Site 10450	0.2187	6.00	1.83	0.0138	0.0387
Ancient Woodland Site 11240	0.3487	7.99	3.91	0.0168	0.0506
Ancient Woodland Site 11255	0.0627	6.43	2.55	0.0036	0.0122
Ancient Woodland Site 13252	0.2026	14.93	5.82	0.0065	0.0232
Ancient Woodland Site 17279	0.6176	9.64	5.70	0.0293	0.0754
Ancient Woodland Site 17280	0.4234	8.17	4.36	0.0208	0.0582
Ancient Woodland Site 17307	0.1532	12.98	3.81	0.0062	0.0224
Ancient Woodland Site 17308	0.2601	13.95	6.59	0.0076	0.0263
Ancient Woodland Site 17326	0.5344	9.10	4.52	0.0285	0.0691
Ancient Woodland Site 17327	0.3310	6.95	2.97	0.0196	0.0493
Ancient Woodland Site 17359	0.2368	6.39	1.92	0.0155	0.0426
Ancient Woodland Site 17368	0.1628	12.26	4.42	0.0071	0.0221
Ancient Woodland Site 17369	0.5316	9.82	5.22	0.0247	0.0680
Ancient Woodland Site 17396	0.0734	7.71	3.14	0.0039	0.0143
Ancient Woodland Site 17397	0.0510	5.15	2.14	0.0030	0.0108
Ancient Woodland Site 17487	0.0822	8.78	3.50	0.0042	0.0154
Ancient Woodland Site 18190	0.1699	10.12	4.32	0.0072	0.0261
Ancient Woodland Site 18191	0.3283	8.17	3.82	0.0153	0.0479
Ancient Woodland Site 18192	0.5892	8.49	4.52	0.0292	0.0734
Ancient Woodland Site 18212	0.1973	5.43	1.74	0.0168	0.0539
Ancient Woodland Site 18215	0.4953	7.67	3.90	0.0263	0.0667
Ancient Woodland Site 18235	0.2647	6.11	2.85	0.0136	0.0396
Ancient Woodland Site 18296	0.1719	5.23	1.51	0.0128	0.0428
Ancient Woodland Site 18297	0.2468	6.65	2.08	0.0192	0.0544
Ancient Woodland Site 18347	0.3442	6.67	3.01	0.0199	0.0504
Ancient Woodland Site 18348	0.4600	7.00	3.56	0.0244	0.0618
Ancient Woodland Site 18417	0.2737	7.55	3.16	0.0130	0.0424
Ancient Woodland Site 18418	0.1135	7.94	2.65	0.0059	0.0202
Ancient Woodland Site 18954	0.1162	12.27	4.60	0.0052	0.0208
Ancient Woodland Site 18955	0.7216	10.59	5.91	0.0321	0.0833
Ancient Woodland Site 18956	0.1273	12.22	4.97	0.0055	0.0198
Ancient Woodland Site 21799	0.2283	9.77	4.91	0.0094	0.0293
Ancient Woodland Site 21855	0.0831	9.06	3.64	0.0040	0.0154
Ancient Woodland Site 21976	0.0610	6.49	1.91	0.0034	0.0121
Ancient Woodland Site 42098	0.1232	14.08	5.87	0.0055	0.0228
Ancient Woodland Site 43706	0.1551	12.38	4.24	0.0070	0.0268
Onsite Receptor 1	0.3837	22.73	11.39	0.0065	0.0251
Onsite Receptor 2	0.3523	21.72	10.78	0.0063	0.0251
Onsite Receptor 3	0.4417	21.16	10.15	0.0071	0.0248
Onsite Receptor 4	0.5228	21.11	8.76	0.0078	0.0263
Onsite Receptor 5	0.6237	20.75	10.37	0.0087	0.0275

Appendix A Table 7C
Maximum Predicted Cumulative Process Contributions of SO_2 and CO at Sensitive Receptors (2015 Data)

Receptor Name	Annual SO_2 (µg m^{-3})	99.9 % 15-Min SO_2 (µg m^{-3})	99.73 % Hourly SO_2 (µg m^{-3})	99.18 % 24-Hour SO_2 (µg m^{-3})	Max. Rolling 8-Hour CO (mg m^{-3})
Blaen Cynon Cors Bryn-Y-Gaer SSSI / SAC	0.0212	0.9123	0.4721	0.1322	0.0596
Cwm Cadlan SAC	0.0143	0.3093	0.2493	0.0963	0.0114
Coedydd Nedd a Mellte SAC	0.0071	0.4841	0.3548	0.0897	0.0344
Dyffrynoedd Nedd a Mellte a Moel Penderyn SSSI	0.0090	0.4458	0.3612	0.0953	0.0192
Cwm Gwrelych and Nant Llynfach Streams SSSI	0.0028	0.2670	0.1542	0.0473	0.0069
Craig-y-Llyn SSSI	0.0026	0.2339	0.1690	0.0428	0.0103
Bryn Bwch SSSI	0.0032	0.2352	0.1470	0.0484	0.0079
Caeau Nant-y-Llechau SSSI	0.0016	0.1498	0.1087	0.0243	0.0055
Gweunedd Dyffern Nedd SSSI	0.0023	0.1916	0.1284	0.0333	0.0063
Bryncarnau Grasslands Llwyncoed SSSI	0.0071	0.3713	0.2273	0.0552	0.0085
Blaenrhondda Road Cutting SSSI	0.0042	0.2516	0.1795	0.0534	0.0718
Blaen Nedd SSSI	0.0019	0.1524	0.0974	0.0270	0.0048
Ogof Ffynnon Ddu Pant Mawr SSSI	0.0012	0.1373	0.0836	0.0181	0.0035
Caeau Ton-y-Fildre SSSI	0.0016	0.1535	0.1013	0.0194	0.0040
Penmoelallt SSSI	0.0042	0.1910	0.1216	0.0230	0.0052
Mynydd Ty-Isaf Rhondda SSSI	0.0021	0.1703	0.1004	0.0272	0.0378
Plas-y-Gors SSSI	0.0013	0.1112	0.0696	0.0181	0.0069
Daren Fach SSSI	0.0046	0.1840	0.1043	0.0236	0.0040
Cwm Glo a Glyndyrys SSSI	0.0073	0.6501	0.3545	0.0603	0.0070
Waun Ton-y-Spyddaden SSSI	0.0010	0.0983	0.0568	0.0142	0.0035
Gorsllwyn Onllwyn SSSI	0.0015	0.2073	0.0987	0.0268	0.0058
Cwm Taf Fechan Woodlands SSSI	0.0038	0.1789	0.1301	0.0237	0.0061
Nant Llech SSSI	0.0011	0.0978	0.0653	0.0139	0.0034
Caeau Nant Y Groes SSSI	0.0036	0.2283	0.1506	0.0338	0.0101
Tir Mawr A Dderi Hir, Llwydcoed SSSI	0.0102	0.4986	0.3056	0.0789	0.0097
Penderyn Reservoir	0.0133	0.7570	0.2844	0.1121	0.0678
Eden UK	0.0228	0.3541	0.3115	0.1569	0.0807
House at Penderyn Reservoir	0.0197	0.9368	0.5952	0.1688	0.0443
Ty Newydd Hotel	0.0552	0.8160	0.7249	0.2345	0.0471
Caer Llwyn Cottage	0.0107	0.7456	0.4233	0.1217	0.0504
Rhombic Farm	0.0123	0.6066	0.5106	0.1377	0.0654
Castell Farm	0.0106	0.6086	0.5018	0.1293	0.0600
TY Newydd Cottage	0.0561	0.8600	0.7318	0.2171	0.0456
Residence Woodland Park	0.0540	0.6440	0.5014	0.2444	0.0295
Pontbren Llwyd School	0.0323	0.3957	0.3156	0.1668	0.0171
Ffynnon Ddu (spring)	0.0046	0.3137	0.2423	0.0635	0.0128
Ton-Y-Gilfach	0.0026	0.2060	0.1282	0.0425	0.0060
Rose Cottage	0.0041	0.2477	0.1903	0.0664	0.0138
The Don Bungalow	0.0049	0.3507	0.2514	0.0651	0.0182
Werfa Farm	0.0069	0.4170	0.3306	0.0915	0.0181
Willows Farm	0.0321	1.8267	0.7726	0.2431	0.0344
Trebanog Uchaf Farm	0.0181	0.7833	0.5607	0.2026	0.0432
Tai-Cwpla Farm	0.0095	0.6195	0.3270	0.1030	0.0474
Neuadd Farm	0.0561	0.6030	0.5278	0.2174	0.0316
John Street Allotments, Hirwaun	0.0157	0.5449	0.4134	0.1323	0.0120
Dwr Cymru Service Reservoir	0.0199	0.8236	0.3902	0.1388	0.0642

Appendix A Table 7D
Maximum Predicted Cumulative Process Contributions of SO_2 and CO at Sensitive Receptors (2015 Data) Cont.

Receptor Name	Annual SO_2 ($\mu g\ m^{-3}$)	99.9 % 15-Min SO_2 ($\mu g\ m^{-3}$)	99.73 % Hourly SO_2 ($\mu g\ m^{-3}$)	99.18 % 24-Hour SO_2 ($\mu g\ m^{-3}$)	Max. Rolling 8-Hour CO ($mg\ m^{-3}$)
Ancient Woodland Site 6686	0.0097	0.7500	0.4663	0.1040	0.0417
Ancient Woodland Site 7652	0.0068	0.3917	0.3168	0.1018	0.0225
Ancient Woodland Site 7730	0.0056	0.3436	0.2716	0.0766	0.0156
Ancient Woodland Site 10113	0.0495	0.5607	0.4402	0.1968	0.0251
Ancient Woodland Site 10232	0.0283	0.6129	0.4471	0.1369	0.0181
Ancient Woodland Site 10297	0.0260	0.6056	0.3577	0.1175	0.0187
Ancient Woodland Site 10323	0.0113	0.8476	0.5671	0.1484	0.0426
Ancient Woodland Site 10450	0.0221	0.6727	0.4085	0.1159	0.0145
Ancient Woodland Site 11240	0.0316	0.5761	0.4344	0.1855	0.0267
Ancient Woodland Site 11255	0.0062	0.3583	0.2822	0.0912	0.0206
Ancient Woodland Site 13252	0.0111	0.9074	0.4962	0.1306	0.0516
Ancient Woodland Site 17279	0.0555	0.6603	0.5714	0.2567	0.0325
Ancient Woodland Site 17280	0.0393	0.5137	0.4423	0.2237	0.0276
Ancient Woodland Site 17307	0.0110	0.8254	0.5518	0.1433	0.0355
Ancient Woodland Site 17308	0.0134	0.7939	0.5553	0.1381	0.0446
Ancient Woodland Site 17326	0.0463	0.6070	0.5223	0.1839	0.0297
Ancient Woodland Site 17327	0.0311	0.6363	0.4163	0.1371	0.0225
Ancient Woodland Site 17359	0.0241	0.6636	0.4237	0.1281	0.0156
Ancient Woodland Site 17368	0.0124	0.7673	0.5414	0.1731	0.0398
Ancient Woodland Site 17369	0.0471	0.6616	0.5262	0.2429	0.0309
Ancient Woodland Site 17396	0.0065	0.3921	0.3196	0.0883	0.0268
Ancient Woodland Site 17397	0.0051	0.2957	0.2329	0.0795	0.0172
Ancient Woodland Site 17487	0.0070	0.4375	0.3566	0.0936	0.0303
Ancient Woodland Site 18190	0.0128	0.6426	0.5219	0.1424	0.0320
Ancient Woodland Site 18191	0.0290	0.5469	0.4489	0.1742	0.0266
Ancient Woodland Site 18192	0.0533	0.5685	0.4853	0.2099	0.0289
Ancient Woodland Site 18212	0.0245	0.6600	0.4531	0.1435	0.0133
Ancient Woodland Site 18215	0.0461	0.6107	0.4336	0.1929	0.0248
Ancient Woodland Site 18235	0.0252	0.4418	0.3218	0.1547	0.0194
Ancient Woodland Site 18296	0.0200	0.6177	0.4249	0.1211	0.0107
Ancient Woodland Site 18297	0.0276	0.6379	0.4523	0.1480	0.0148
Ancient Woodland Site 18347	0.0327	0.6087	0.3886	0.1345	0.0208
Ancient Woodland Site 18348	0.0436	0.6325	0.3865	0.1754	0.0224
Ancient Woodland Site 18417	0.0245	0.5046	0.4036	0.1782	0.0220
Ancient Woodland Site 18418	0.0102	0.4996	0.4275	0.1238	0.0236
Ancient Woodland Site 18954	0.0089	0.5467	0.4249	0.1043	0.0405
Ancient Woodland Site 18955	0.0600	0.7063	0.6082	0.2261	0.0335
Ancient Woodland Site 18956	0.0097	0.5936	0.4503	0.1285	0.0352
Ancient Woodland Site 21799	0.0174	0.5963	0.5132	0.1932	0.0318
Ancient Woodland Site 21855	0.0065	0.4431	0.3312	0.0764	0.0333
Ancient Woodland Site 21976	0.0061	0.3571	0.2774	0.0981	0.0150
Ancient Woodland Site 42098	0.0090	0.5781	0.4261	0.1074	0.0532
Ancient Woodland Site 43706	0.0123	0.8021	0.5504	0.1711	0.0363
Onsite Receptor 1	0.0117	0.3453	0.2934	0.1201	0.0772
Onsite Receptor 2	0.0112	0.3301	0.2787	0.1098	0.0714
Onsite Receptor 3	0.0127	0.4156	0.2749	0.1185	0.0766
Onsite Receptor 4	0.0140	0.4873	0.2797	0.1221	0.0686
Onsite Receptor 5	0.0158	0.7388	0.2764	0.1334	0.0735

Appendix A Table 8
Secondary Screening of Maximum Cumulative Process Contributions at Sensitive Receptors

NOx as NO2 (µg m^{-3})	Maximum Receptor Process Contribution	Assessment Level	PC as % Assessment Level	Predicted Environmental Concentration (PEC)	PEC as % Assessment Level	Revised Short-Term Assessment Level	Short-Term PC as % Assessment Level
Annual Average	0.95	30	**3%**	7.11	24%	-	-
99.79 % Hourly Average	23.21	20	**12%**	35.53	18%	187.68	12%
24-Hour Average	11.39	75	**15%**	23.71	32%	62.68	18%

Notes:
Highlighted data cannot be screened as insignificant.
The maximum 24-hour average contribution included above considers the ecological receptors only to which this assessment level applies.

Appendix A Table 9A
Contribution of Nutrient Nitrogen and Acid Deposition to Sensitive Ecological Receptors

Total Deposited Nutrient Nitrogen and Acid Contributions	Blaen Cynon	Cwm Cadlan	Coedydd Nedd a Mellte	Dyffrynoedd Nedd a Mellte a Moel Penderyn	Cwm Gwrelych and Nant Llynfach Streams	Craig-y-Llyn
Rate of Total Deposition as N (kg N/ha/yr)	0.0056	0.0081	0.0053	0.01200	0.00141	0.00309
Current Maximum Background (kg N/ha/yr)	21.1	21.1	26.5	26.46	15.96	21.14
Low End of Critical Load Range (kg N/ha/yr)	10	15	10	10	5	5
Deposition as % of Lower Critical Load	0.056%	0.054%	0.053%	0.12%	0.028%	0.062%
Rate of Total Dry Deposition as N (keq/ha/yr)	0.0004	0.0006	0.0004	0.000857	0.000101	0.000221
Low End of Critical Load Range N (CLminN keq/ha/yr)	0.438	0.223	0.142	0.5	0.856	0.999
Deposition as % of Lower Critical Load	0.09%	0.26%	0.27%	0.17%	0.01%	0.02%
Current Maximum N Background (keq/ha/yr)	1.50	1.50	1.90	1.89	1.14	1.51
PEC N (keq/ha/yr)	1.500	1.501	1.900	1.891	1.140	1.510
Is PEC N > CLminN?	Yes	Yes	Yes	Yes	Yes	Yes
Rate of Total Dry Deposition as S (kg S/ha/yr)	0.0157	0.0226	0.0159	0.03584	0.00388	0.00851
Rate of Total Dry Deposition as S (keq/ha/yr)	0.0010	0.0014	0.0010	0.00224	0.00024	0.00053
Rate of Total Deposition as HCl (kg H/ha/yr)	0.0026	0.0036	0.0030	0.00658	0.00061	0.00133
Rate of Total Deposition as HF (kg H/ha/yr)	0.0007	0.0012	0.0004	0.00092	0.00016	0.00033
Rate of Total Deposition as S and H (keq/ha/yr)	0.0043	0.0062	0.0044	0.0097	0.0010	0.0022
Low End of Critical Load Range S (CLmaxS keq/ha/yr)	0.58	0.58	1.552	2.491	4	4.018
Deposition as % of Lower Critical Load	0.74%	1.07%	0.28%	0.39%	0.03%	0.05%
Current Maximum S Background (keq/ha/yr)	0.4	0.4	0.4	0.42	0.29	0.42
PEC S and H (keq/ha/yr)	0.4043	0.4062	0.4044	0.4297	0.2910	0.4222
PC Acid (Combined N and S keq/ha/yr)	0.0047	0.0068	0.0048	0.0106	0.0011	0.0024
Minimum Critical Load (CLmaxN keq/ha/yr)	1.161	1.161	1.837	2.991	4.856	5.017
% of Critical Load	0.4%	0.6%	0.3%	0.35%	0.02%	0.05%
Combined Acid Background (keq/ha/yr)	1.90	1.90	2.30	1.33	1	1.26
PEC Acid (keq/ha/yr)	1.90	1.91	2.30	1.34	1.00	1.26
% of Critical Load	164%	164%	125%	45%	21%	25%

Final assessment of relevant deposition at each receptor are highlighted in green.

Appendix A Table 9B
Contribution of Nutrient Nitrogen and Acid Deposition to Sensitive Ecological Receptors Cont.

Total Deposited Nutrient Nitrogen and Acid Contributions	Bryn Bwch	Caeau Nant-y-Llechau	Gweunedd Dyffern Nedd	Bryncarnau Grasslands Llwyncoed	Blaenrhondda Road Cutting	Blaen Nedd	Ogof Ffynnon Ddu Pant Mawr
Rate of Total Deposition as N (kg N/ha/yr)	0.00163	0.00120	0.00135	0.00251	0.00206	0.00108	0.00088
Current Maximum Background (kg N/ha/yr)	16.24	16.24	16.24	21	21.14	16.24	16.24
Low End of Critical Load Range (kg N/ha/yr)	10	10	10	10	5	5	5
Deposition as % of Lower Critical Load	0.016%	0.012%	0.014%	0.025%	0.041%	0.022%	0.018%
Rate of Total Dry Deposition as N (keq/ha/yr)	0.000116	0.000086	0.000097	0.000179	0.000147	0.000077	0.000063
Low End of Critical Load Range N (CLminN keq/ha/yr)	Not Sensitive	1.214	Not Sensitive	1.214	0.999	1.214	0.999
Deposition as % of Lower Critical Load	N/A	0.01%	N/A	0.01%	0.01%	0.01%	0.01%
Current Maximum N Background (keq/ha/yr)	1.16	1.16	1.16	1.5	1.51	1.16	1.16
PEC N (keq/ha/yr)	1.160	1.160	1.160	1.500	1.510	1.160	1.160
Is PEC N > CLminN?	No						
Rate of Total Dry Deposition as S (kg S/ha/yr)	0.00447	0.00327	0.00369	0.00686	0.00560	0.00291	0.00237
Rate of Total Dry Deposition as S (keq/ha/yr)	0.00028	0.00020	0.00023	0.00043	0.00035	0.00018	0.00015
Rate of Total Deposition as HCl (kg H/ha/yr)	0.00069	0.00050	0.00057	0.00108	0.00089	0.00044	0.00035
Rate of Total Deposition as HF (kg H/ha/yr)	0.00021	0.00015	0.00017	0.00024	0.00019	0.00013	0.00010
Rate of Total Deposition as S and H (keq/ha/yr)	0.0012	0.0009	0.0010	0.0017	0.0014	0.0008	0.0006
Low End of Critical Load Range S (CLmaxS keq/ha/yr)	Not Sensitive	4	Not Sensitive	4.048	4.015	4	4
Deposition as % of Lower Critical Load	N/A	0.02%	N/A	0.04%	0.04%	0.02%	0.02%
Current Maximum S Background (keq/ha/yr)	0.3	0.3	0.3	0.41	0.42	0.3	0.3
PEC S and H (keq/ha/yr)	0.3012	0.3009	0.3010	0.4117	0.4214	0.3008	0.3006
PC Acid (Combined N and S keq/ha/yr)	Not Sensitive	No N Considered	Not Sensitive	0.0019	0.0016	No N Considered	0.0007
Minimum Critical Load (CLmaxN keq/ha/yr)	-	-	-	5.262	5.017	-	4.999
% of Critical Load	-	-	-	0.04%	0.03%	-	0.01%
Combined Acid Background (keq/ha/yr)	-	-	-	1.25	1.26	-	1.01
PEC Acid (keq/ha/yr)	-	-	-	1.25	1.26	-	1.01
% of Critical Load	-	-	-	24%	25%	-	20%

Final assessment of relevant deposition at each receptor are highlighted in green.

Appendix A Table 9C
Contribution of Nutrient Nitrogen and Acid Deposition to Sensitive Ecological Receptors Cont.

Total Deposited Nutrient Nitrogen and Acid Contributions	**Caeau Ton-y-Fildre**	**Penmoelallt**	**Mynydd Ty-Isaf Rhondda**	**Plas-y-Gors**	**Daren Fach**	**Cwm Glo a Glyndyrys**
Rate of Total Deposition as N (kg N/ha/yr)	0.00056	0.00540	0.00128	0.00103	0.00353	0.00144
Current Maximum Background (kg N/ha/yr)	16.8	30.1	20.72	16.94	18.48	21.28
Low End of Critical Load Range (kg N/ha/yr)	5	10	5	10	10	10
Deposition as % of Lower Critical Load	0.011%	0.054%	0.026%	0.010%	0.035%	0.014%
Rate of Total Dry Deposition as N (keq/ha/yr)	0.000040	0.000386	0.000091	0.000074	0.000252	0.000103
Low End of Critical Load Range N (CLminN keq/ha/yr)	1.214	0.142	0.999	Not Sensitive	0.892	1.071
Deposition as % of Lower Critical Load	0.003%	0.27%	0.01%	N/A	0.03%	0.01%
Current Maximum N Background (keq/ha/yr)	1.2	2.15	1.48	1.21	1.32	1.52
PEC N (keq/ha/yr)	1.200	2.150	1.480	1.210	1.320	1.520
Is PEC N > CLminN?		Yes	Yes	No	Yes	Yes
Rate of Total Dry Deposition as S (kg S/ha/yr)	0.00150	0.01451	0.00340	0.00276	0.00944	0.00385
Rate of Total Dry Deposition as S (keq/ha/yr)	0.00009	0.00091	0.00021	0.00017	0.00059	0.00024
Rate of Total Deposition as HCl (kg H/ha/yr)	0.00022	0.00255	0.00052	0.00041	0.00141	0.00059
Rate of Total Deposition as HF (kg H/ha/yr)	0.00006	0.00034	0.00011	0.00012	0.00040	0.00013
Rate of Total Deposition as S and H (keq/ha/yr)	0.0004	0.0038	0.0008	0.0007	0.0024	0.0010
Low End of Critical Load Range S (CLmaxS keq/ha/yr)	4	2.681	4	Not Sensitive	0.98	4.048
Deposition as % of Lower Critical Load	0.01%	0.14%	0.02%	N/A	0.24%	0.02%
Current Maximum S Background (keq/ha/yr)	0.3	0.46	0.4	0.3	0.34	0.39
PEC S and H (keq/ha/yr)	0.3004	0.4638	0.4008	0.3007	0.3424	0.3910
PC Acid (Combined N and S keq/ha/yr)	No N Considered	0.0042	0.0009	Not Sensitive	0.0027	0.0011
Minimum Critical Load (CLmaxN keq/ha/yr)	-	2.823	4.999	-	1.872	5.119
% of Critical Load	-	0.15%	0.02%	-	0.14%	0.02%
Combined Acid Background (keq/ha/yr)	-	1.56	1.27	-	1.15	1.31
PEC Acid (keq/ha/yr)	-	1.56	1.27	-	1.15	1.31
% of Critical Load	-	55%	25%	-	62%	26%

Final assessment of relevant deposition at each receptor are highlighted in green.

Appendix A Table 9D
Contribution of Nutrient Nitrogen and Acid Deposition to Sensitive Ecological Receptors Cont.

Total Deposited Nutrient Nitrogen and Acid Contributions	Waun Ton-y-Spyddaden	Gorsllwyn Onllwyn	Cwm Taf Fechan Woodlands	Nant Llech	Caeau Nant Y Groes	Tir Mawr A Dderi Hir, Llwydcoed
Rate of Total Deposition as N (kg N/ha/yr)	0.00052	0.00049	0.00350	0.00044	0.00119	0.00311
Current Maximum Background (kg N/ha/yr)	16.8	16.8	30.1	16.8	22.4	21
Low End of Critical Load Range (kg N/ha/yr)	5	5	10	5	5	5
Deposition as % of Lower Critical Load	0.010%	0.010%	0.035%	0.009%	0.024%	0.062%
Rate of Total Dry Deposition as N (keq/ha/yr)	0.000037	0.000035	0.000250	0.000032	0.000085	0.000222
Low End of Critical Load Range N (CLminN keq/ha/yr)	1.214	0.321	0.285	1.214	0.438	0.438
Deposition as % of Lower Critical Load	0.003%	0.01%	0.09%	0.003%	0.02%	0.05%
Current Maximum N Background (keq/ha/yr)	1.2	1.2	2.15	1.2	1.6	1.5
PEC N (keq/ha/yr)	1.200	1.200	2.150	1.200	1.600	1.500
Is PEC N > CLminN?	No	Yes	Yes	No	Yes	Yes
Rate of Total Dry Deposition as S (kg S/ha/yr)	0.00138	0.00129	0.00930	0.00117	0.00319	0.00858
Rate of Total Dry Deposition as S (keq/ha/yr)	0.00009	0.00008	0.00058	0.00007	0.00020	0.00054
Rate of Total Deposition as HCl (kg H/ha/yr)	0.00020	0.00019	0.00162	0.00017	0.00049	0.00138
Rate of Total Deposition as HF (kg H/ha/yr)	0.00006	0.00005	0.00020	0.00005	0.00010	0.00029
Rate of Total Deposition as S and H (keq/ha/yr)	0.0003	0.0003	0.0024	0.0003	0.0008	0.0022
Low End of Critical Load Range S (CLmaxS keq/ha/yr)	4	0.692	1.759	4	1.76	1.77
Deposition as % of Lower Critical Load	0.01%	0.05%	0.14%	0.01%	0.04%	0.12%
Current Maximum S Background (keq/ha/yr)	0.3	0.3	0.46	0.3	0.42	0.41
PEC S and H (keq/ha/yr)	0.3003	0.3003	0.4624	0.3003	0.4208	0.4122
PC Acid (Combined N and S keq/ha/yr)	No N Considered	0.0004	0.0027	No N Considered	0.0009	0.0024
Minimum Critical Load (CLmaxN keq/ha/yr)	-	1.013	2.044	-	2.198	2.208
% of Critical Load	-	0.04%	0.13%	-	0.04%	0.11%
Combined Acid Background (keq/ha/yr)	-	1	1.56	-	1.38	1.25
PEC Acid (keq/ha/yr)	-	1.00	1.56	-	1.38	1.25
% of Critical Load	-	99%	76%	-	63%	57%

Final assessment of relevant deposition at each receptor are highlighted in green.

Appendix A Table 10
Cumulative Contribution of Nutrient Nitrogen and Acid Deposition to Local SACs

Total Deposited Nutrient Nitrogen and Acid Contributions (Cumulative)	Blaen Cynon	Cwm Cadlan	Coedydd Nedd a Mellte
Rate of Total Deposition as N (kg N/ha/yr)	0.0780	0.0180	0.0195
Current Maximum Background (kg N/ha/yr)	21.1	21.1	26.5
Low End of Critical Load Range (kg N/ha/yr)	10	15	10
Deposition as % of Lower Critical Load	0.78%	0.12%	0.195%
Rate of Total Dry Deposition as N (keq/ha/yr)	0.0056	0.0013	0.0014
Low End of Critical Load Range N (CLminN keq/ha/yr)	0.438	0.223	0.142
Deposition as % of Lower Critical Load	**1.27%**	0.58%	0.98%
Current Maximum N Background (keq/ha/yr)	1.50	1.50	1.90
PEC N (keq/ha/yr)	1.506	1.501	1.901
Is PEC N > CLminN?	Yes	Yes	Yes
Rate of Total Dry Deposition as S (kg S/ha/yr)	0.0375	0.0247	0.0236
Rate of Total Dry Deposition as S (keq/ha/yr)	0.0023	0.0015	0.0015
Rate of Total Deposition as HCl (kg H/ha/yr)	0.0036	0.0037	0.0043
Rate of Total Deposition as HF (kg H/ha/yr)	0.0005	0.0011	0.0004
Rate of Total Deposition as S and H (keq/ha/yr)	0.0064	0.0064	0.0062
Low End of Critical Load Range S (CLmaxS keq/ha/yr)	0.58	0.58	1.552
Deposition as % of Lower Critical Load	**1.11%**	**1.10%**	0.40%
Current Maximum S Background (keq/ha/yr)	0.4	0.4	0.4
PEC S and H (keq/ha/yr)	0.4064	0.4064	0.4062
PC Acid (Combined N and S keq/ha/yr)	0.0120	0.0076	0.0076
Minimum Critical Load (CLmaxN keq/ha/yr)	1.161	1.161	1.837
% of Critical Load	1.03%	0.66%	0.41%
Combined Acid Background (keq/ha/yr)	1.90	1.90	2.30
PEC Acid (keq/ha/yr)	1.91	1.91	2.31
% of Critical Load	188%	238%	136%

Appendix A Table 11
Assessment of Other Pollutant Deposits to Blaen Cynon

Pollutant Contribution	Deposition Concentration (at Blaen Cynon)		
	Modelled ($ug/m^2/day$)	Limit Value ($ug/m^2/day$)	< 1 % of the Limit?
Fluoride (from HF)	1.265	2100	Yes
Cadmium	0.0028	9	Yes
Mercury	0.0028	4	Yes
Arsenic	0.0422	20	Yes
Chromium	0.0422	1500	Yes
Copper	0.0422	250	Yes
Lead	0.0422	1100	Yes
Nickel	0.0422	110	Yes

Appendix A Table 12
Assessment of Contributions to Local Drinking Water Resources

Pollutant	WQ Standard (mg/l)	Contribution to Penderyn Reservoir Per Year (mg/l)	Contribution to Service Reservoir Per Fill (mg/l)	Total Contribution (mg/l)	Contribution as a % of Water Quality Standard
Nitrite	0.5	1.02E-04	3.29E-08	1.03E-04	0.021%
Chloride	250	1.27E-04	2.61E-09	1.27E-04	0.00005%
Fluoride	1.5	1.69E-05	5.10E-10	1.69E-05	0.001%
Benzene	0.001	1.53E-07	5.37E-11	1.53E-07	0.015%
Mercury	0.001	4.19E-08	1.07E-11	4.20E-08	0.004%
Antimony	0.005	6.98E-08	1.79E-11	6.98E-08	0.001%

FIGURES

Figure 1 Annual Average Process Contributions of Nitrogen Dioxide from Total NO_x ($\mu g\ m^{-3}$) 2015 Meteorological Conditions

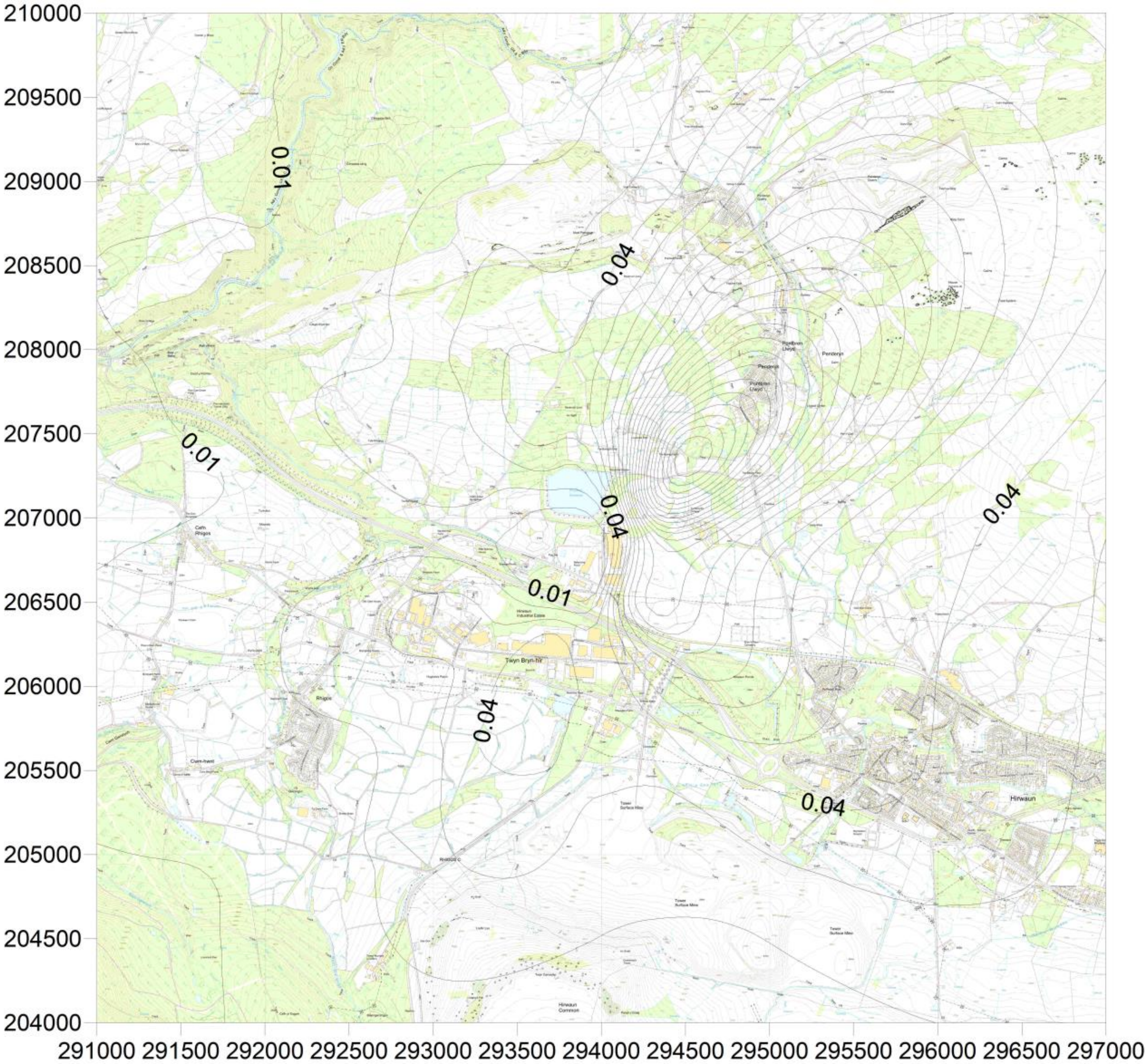


Figure 2 24-Hourly Average Process Contributions of Nitrogen Dioxide from Total NO_x ($\mu g\ m^{-3}$) 2015 Meteorological Conditions

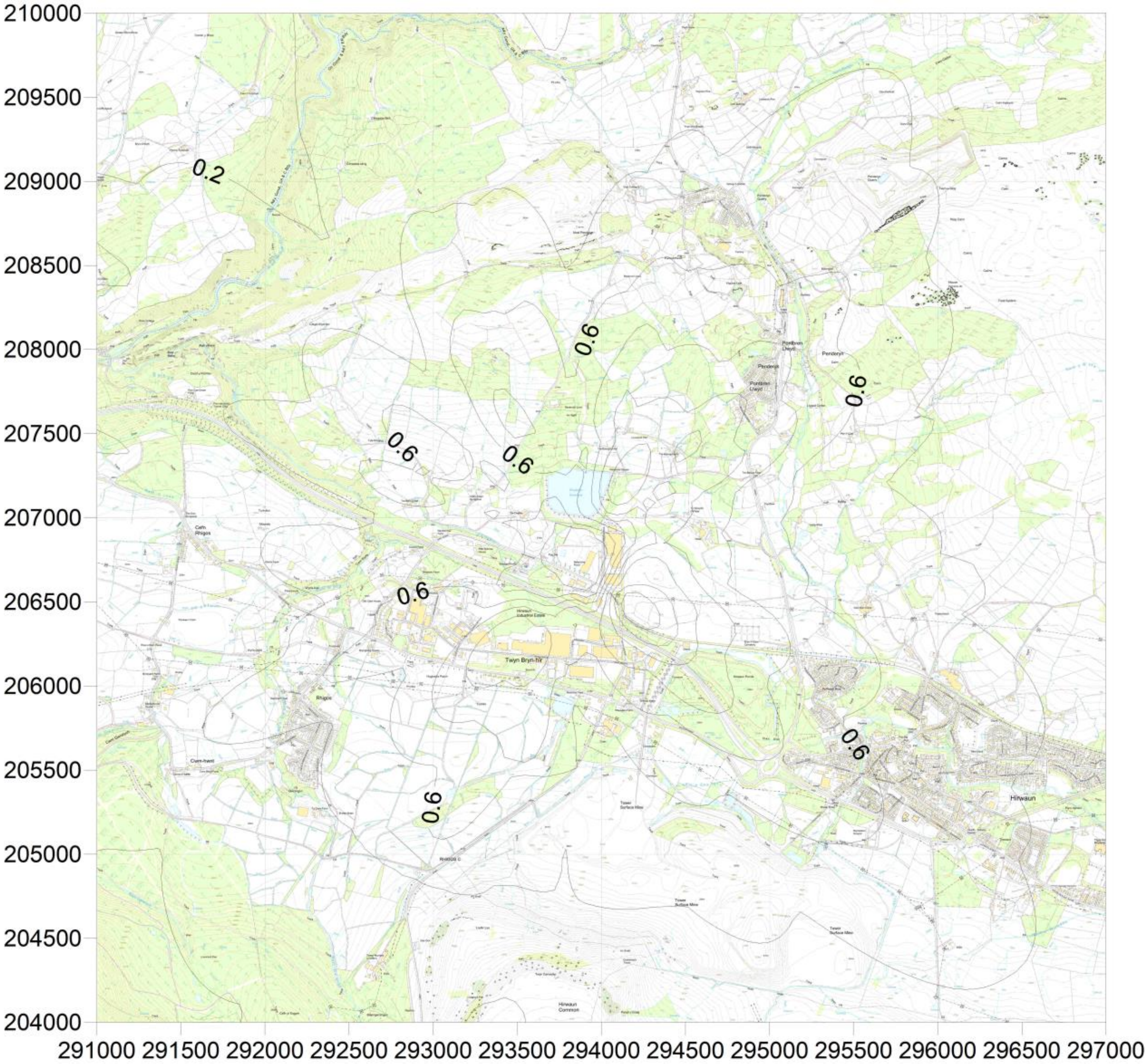


Figure 3 99.79th Percentile Hourly Average Process Contributions of Nitrogen Dioxide (50 % NO_x µg m^{-3}) 2015 Meteorological Conditions

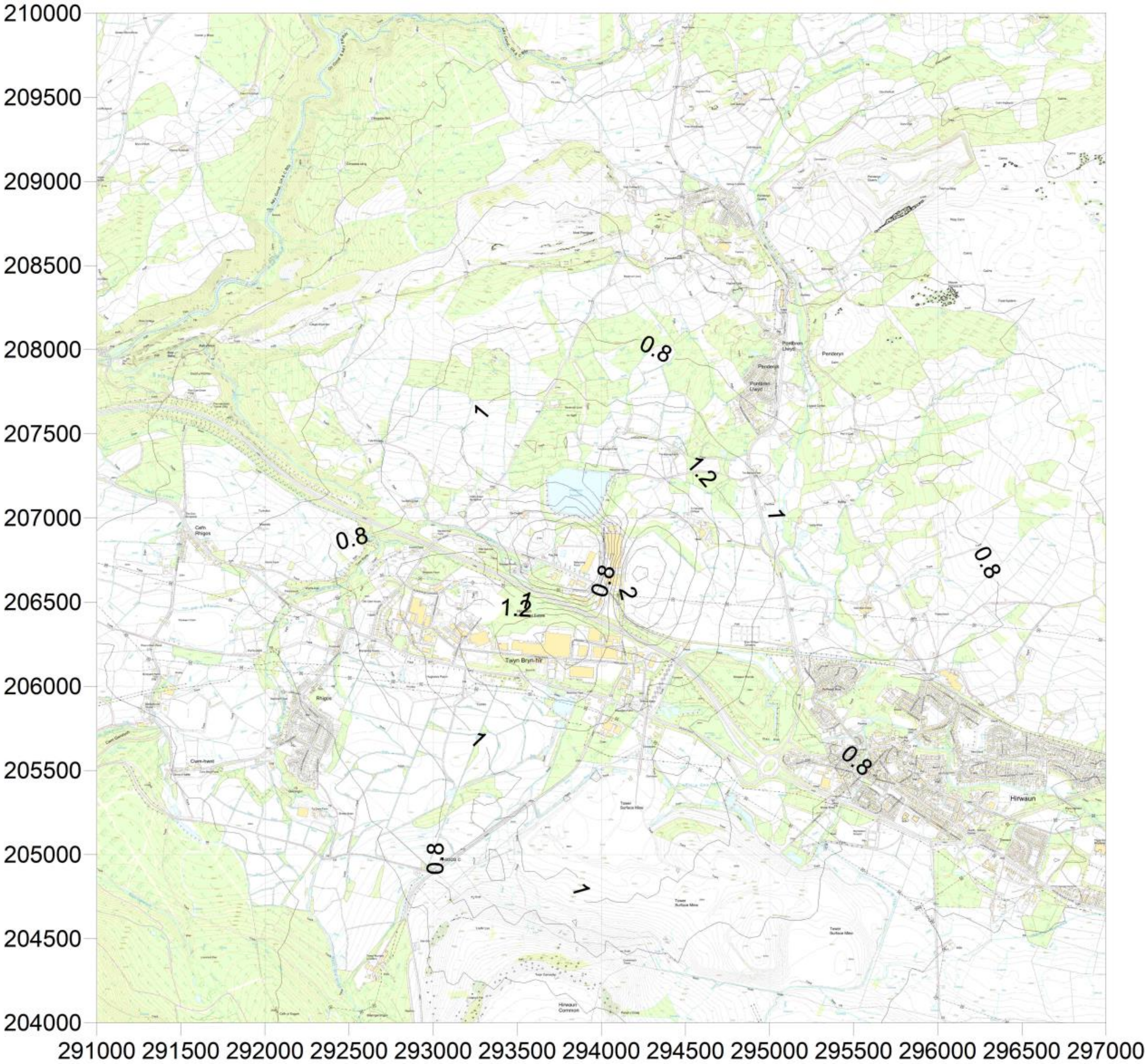


Figure 4 Annual Average Process Contributions of Sulphur Dioxide ($\mu g\ m^{-3}$) 2015 Meteorological Conditions

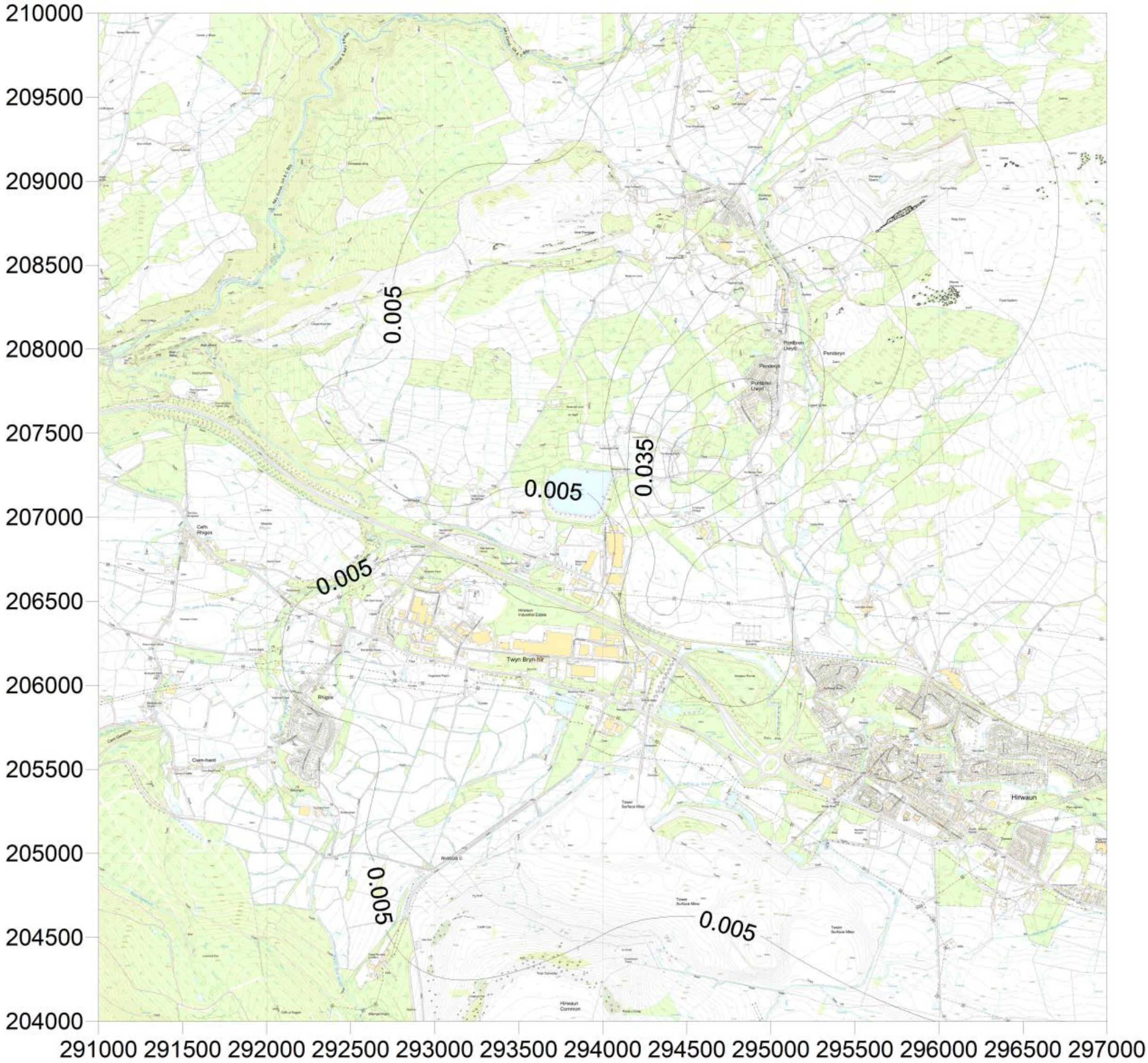


Figure 5 99.18^{th} Percentile 24-Hourly Average Process Contributions of Sulphur Dioxide (µg m^{-3}) 2015 Meteorological Conditions

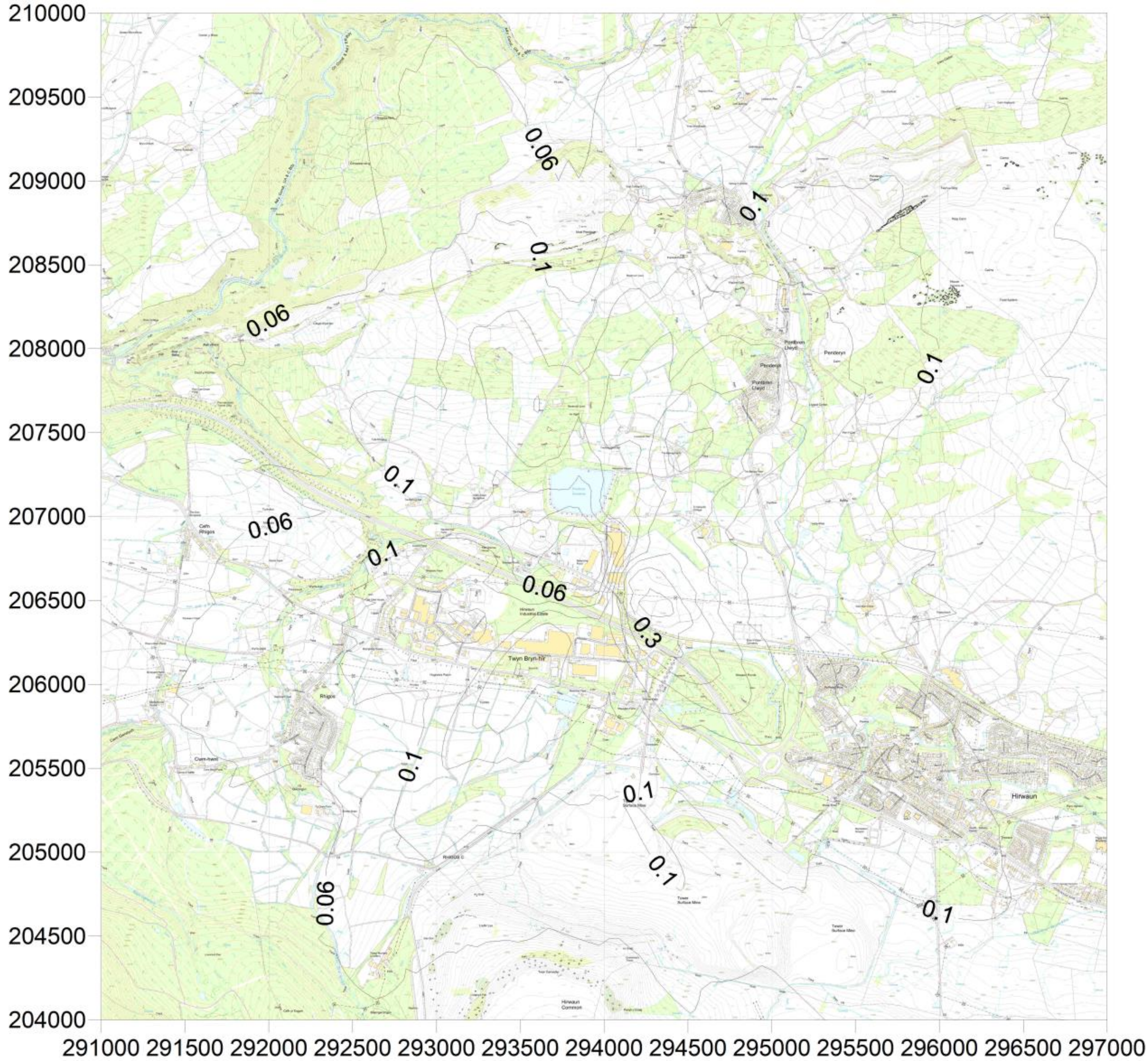


Figure 6 99.73rd Percentile Hourly Average Process Contributions of Sulphur Dioxide (µg m^{-3}) 2015 Meteorological Conditions

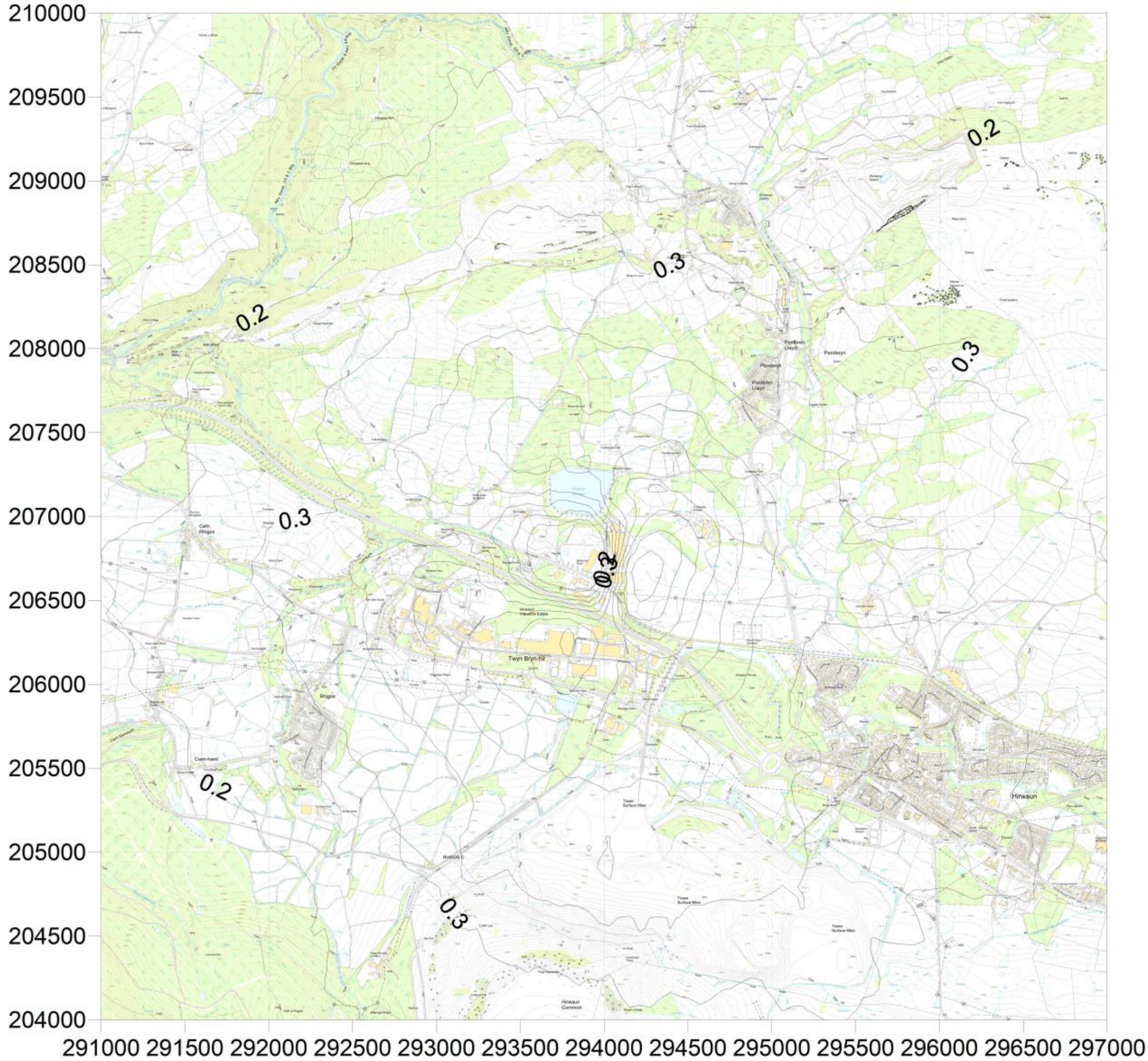


Figure 7 99.9th Percentile 15-Minute Average Process Contributions of Sulphur Dioxide (µg m^{-3}) 2015 Meteorological Conditions

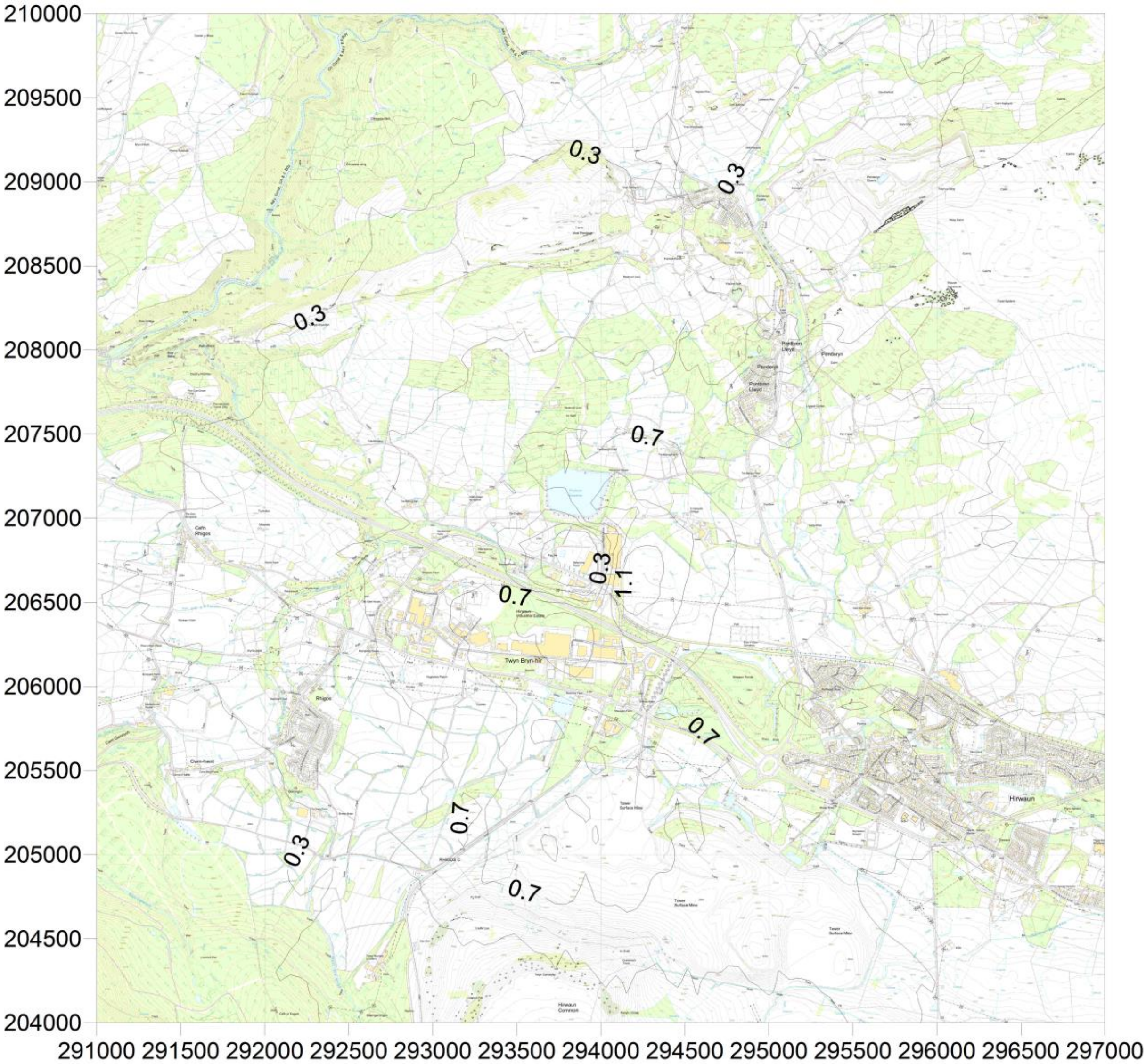
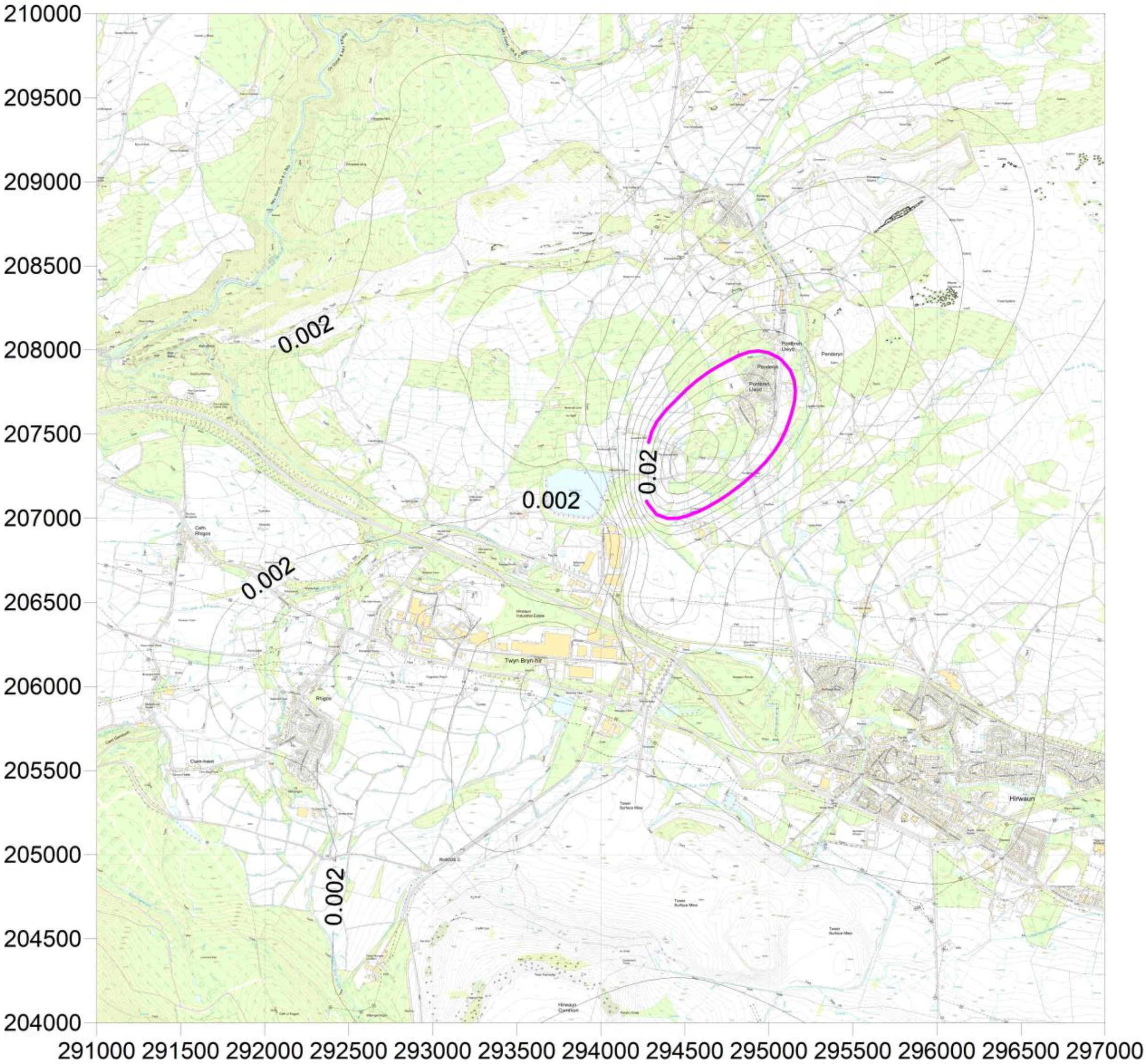


Figure 8 Annual Average Process Contributions of Particulate (PM_{10} or $PM_{2.5}$ - µg m^{-3}) 2015 Meteorological Conditions



As PM_{10} and $PM_{2.5}$ can be considered to have a similar pattern of distribution, Figure 8 can be considered to represent the plot of either particulate size fraction.

The isopleth marked in magenta denotes the point of insignificance for $PM_{2.5}$ and contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Contributions of PM_{10} are immediately screened as insignificant.

Figure 9 90.41st Percentile 24-Hourly Average Process Contributions of PM_{10} (µg m^{-3}) 2015 Meteorological Conditions

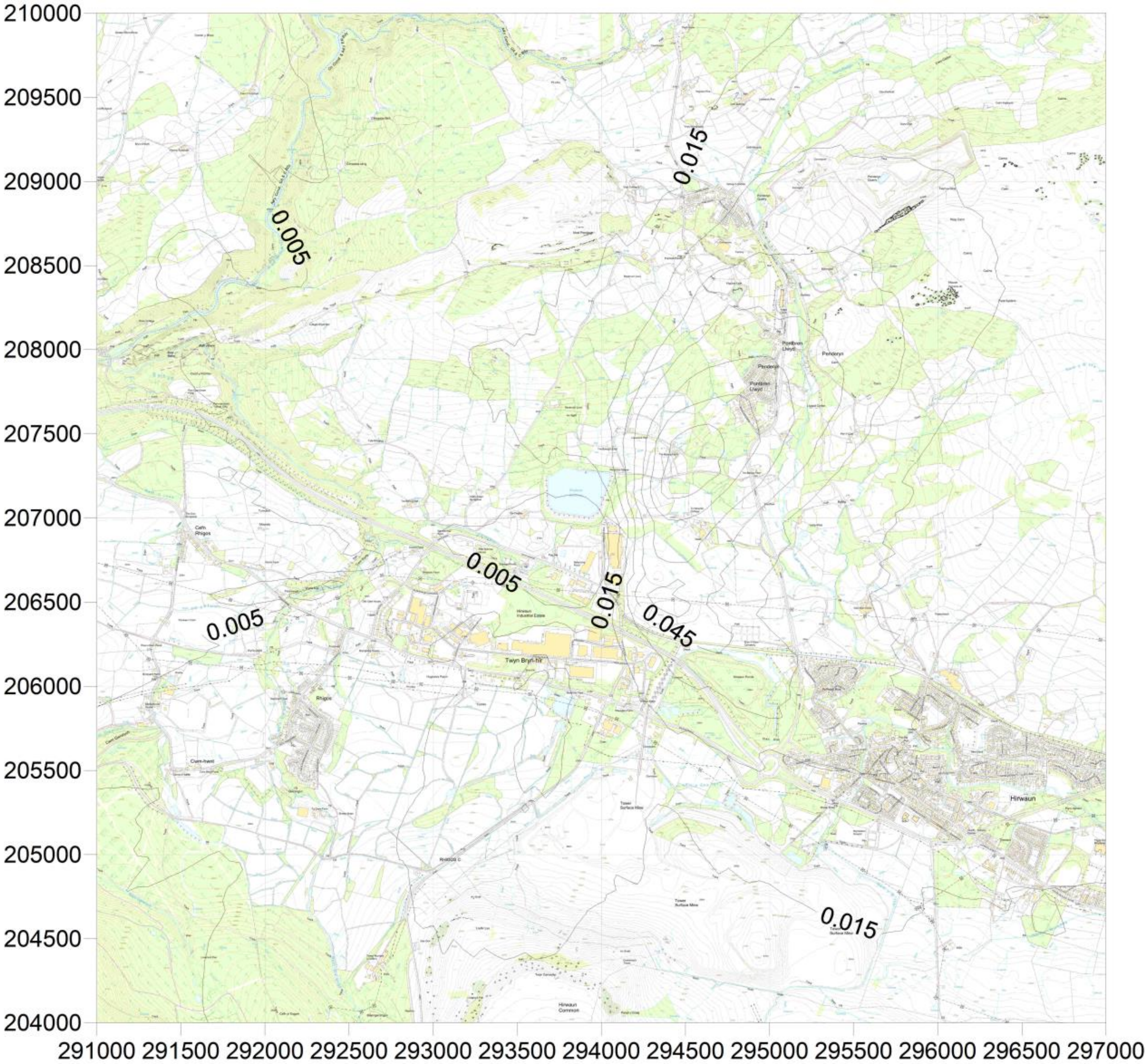
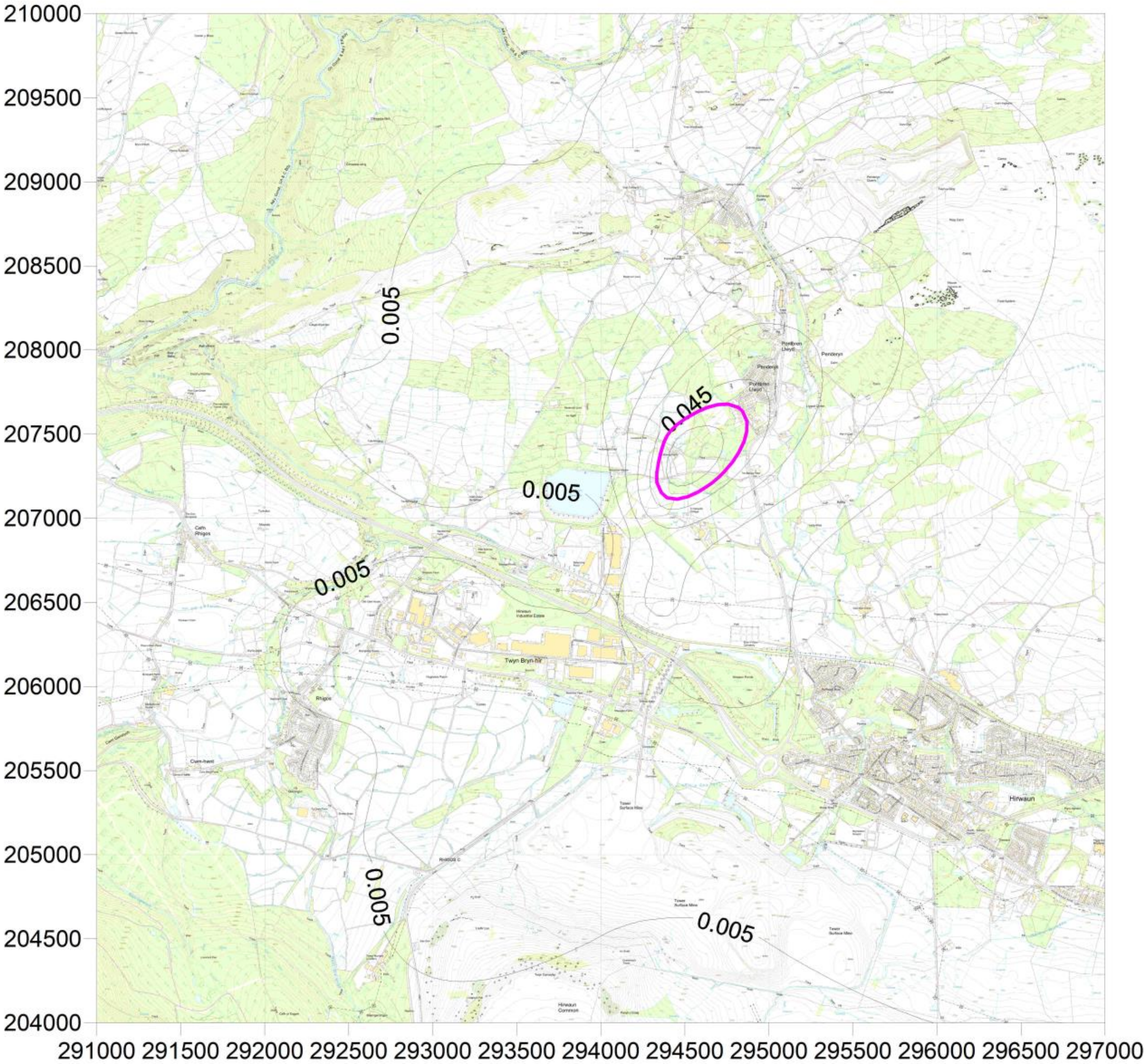


Figure 10 Annual Average Process Contributions of TOC (µg m^{-3}) 2015 Meteorological Conditions



The isopleth marked in magenta denotes the point of insignificance for TOC when compared to the AQS for Benzene and contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Figure 11 Maximum Rolling 8-Hour Average Process Contributions of CO (mg m^{-3}) 2015 Meteorological Conditions

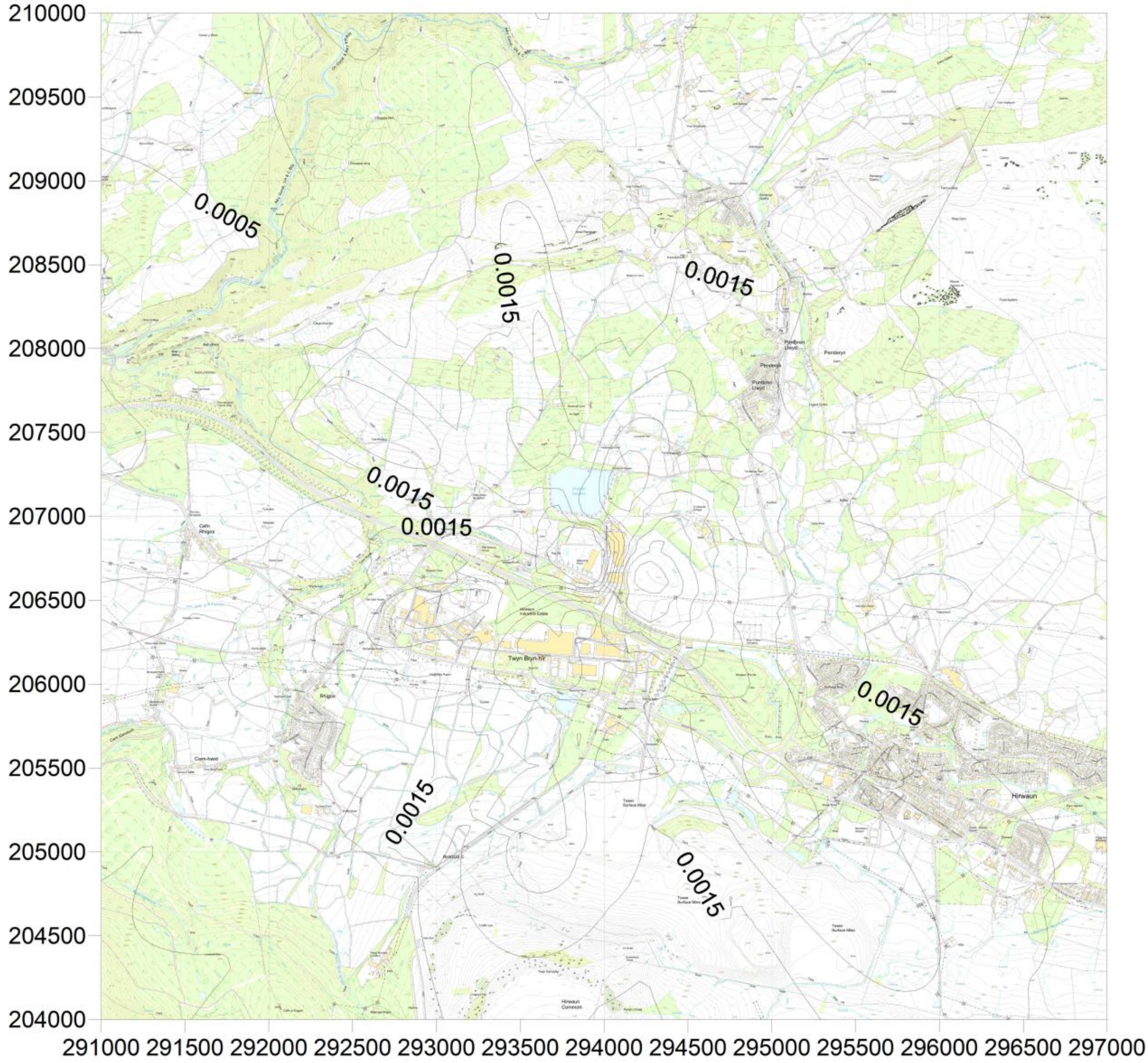
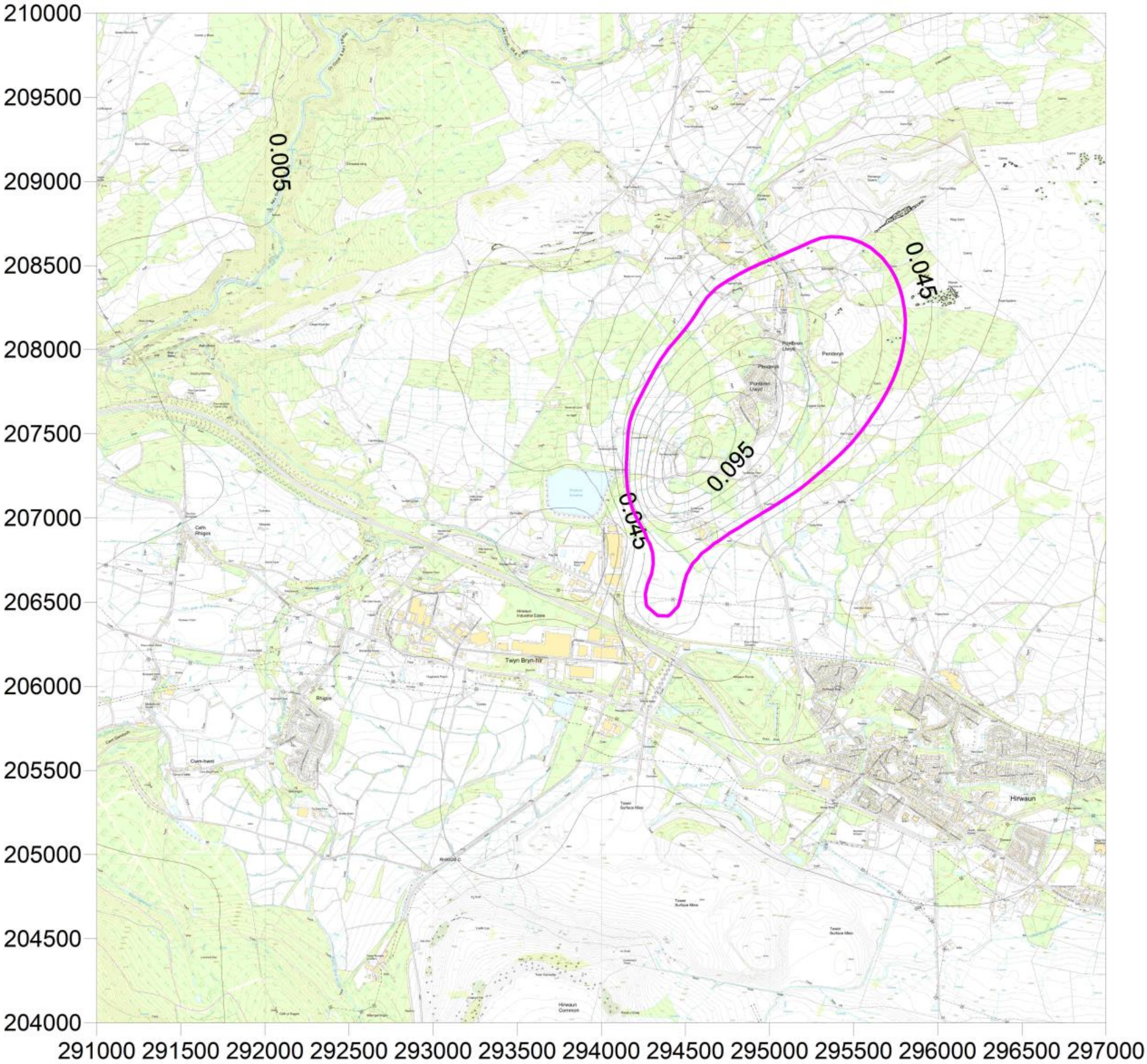
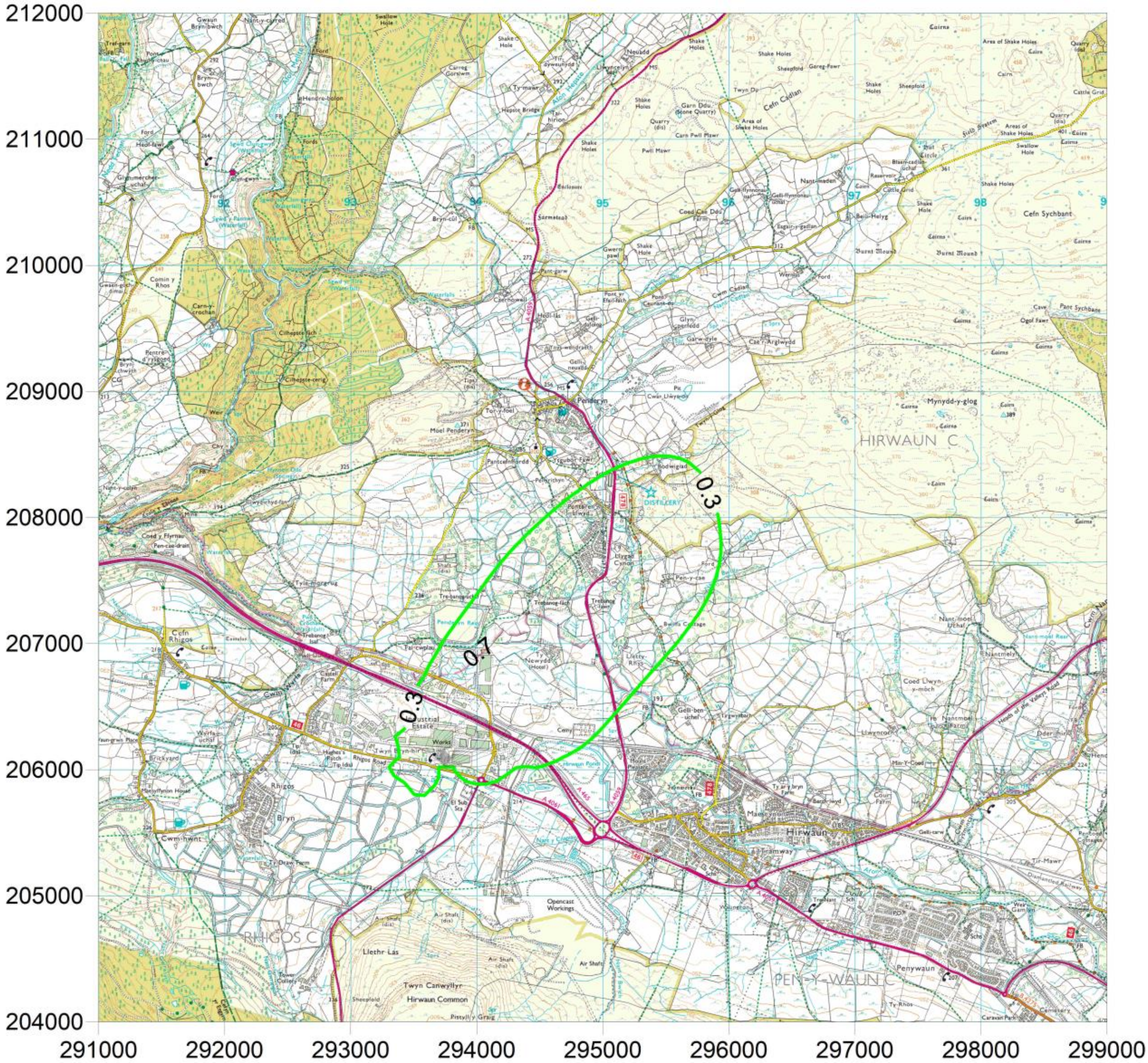


Figure 12 Maximum Annual Average Process Contributions of Cadmium and Thallium (ng m^{-3}) 2015 Meteorological Conditions



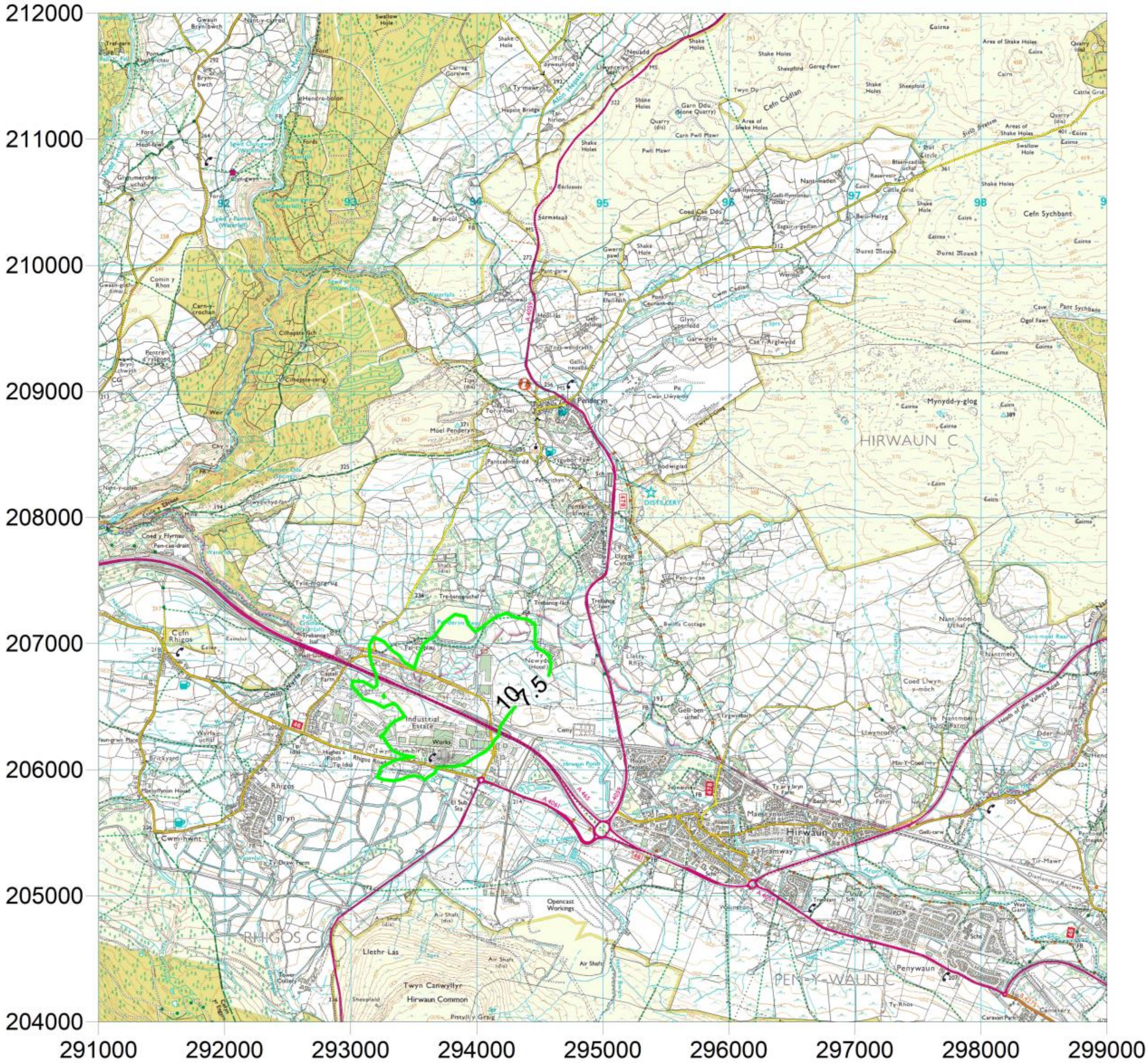
The isopleth marked in magenta denotes the point of insignificance for the combined contribution of Cadmium and Thallium when compared to the AQS for Cadmium and contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Figure 13 Cumulative Annual Average Process Contributions of Nitrogen Dioxide from Total NO_X ($\mu g\ m^{-3}$) 2015 Meteorological Conditions



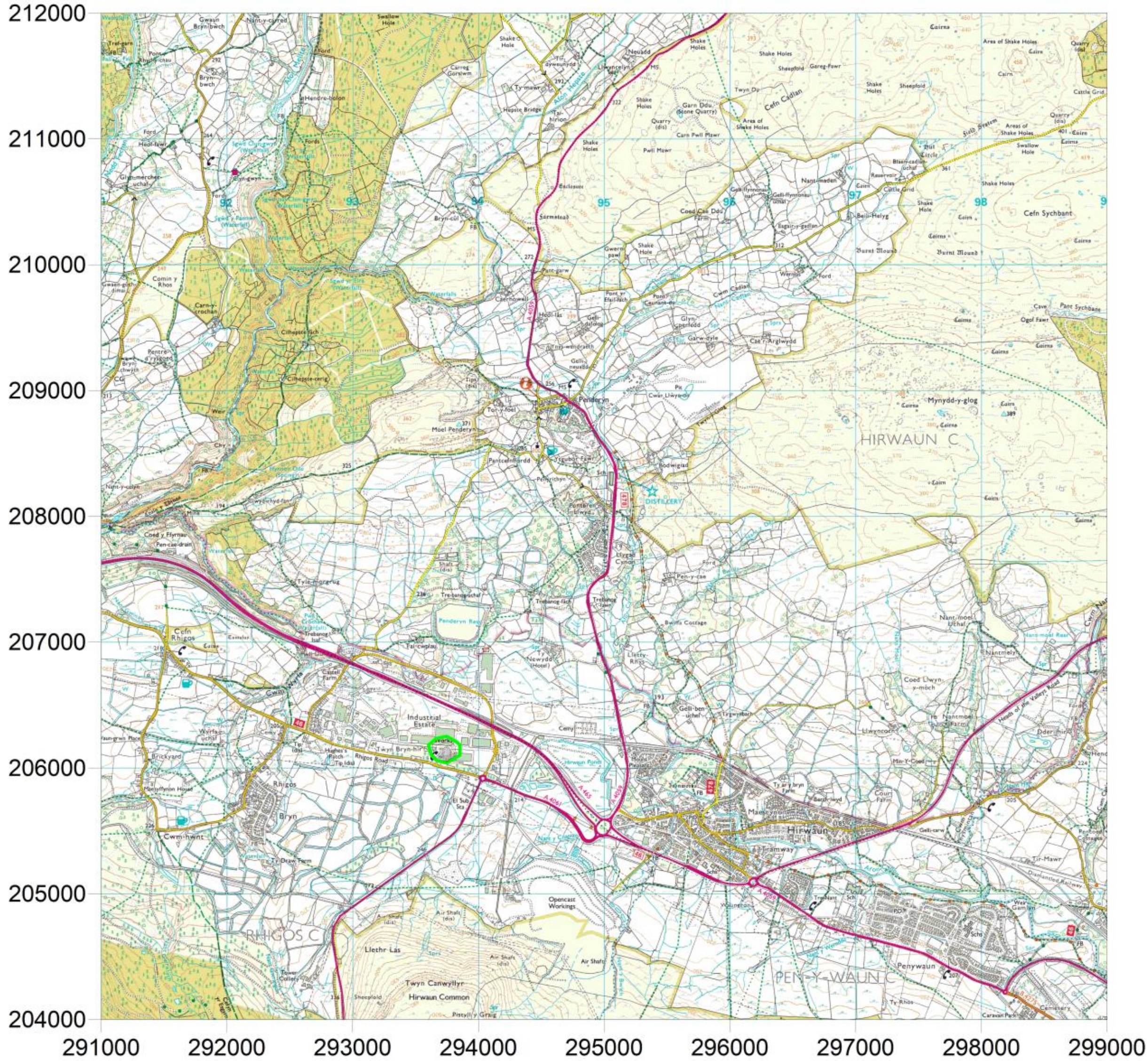
The isopleth marked in green denotes the point of insignificance for annual average contributions of NO_2 when considering the most stringent assessment level, for the protection of vegetation. Contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Figure 14 Cumulative 24-Hourly Average Process Contributions of Nitrogen Dioxide from Total NO_x ($\mu g\ m^{-3}$) 2015 Meteorological Conditions



The isopleth marked in green denotes the point of insignificance for daily average contributions of NO_2, which is relevant to sensitive ecological areas only. Contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Figure 15 99.79th Percentile Hourly Average Process Contributions of Nitrogen Dioxide (50 % NO_x µg m^{-3}) 2015 Meteorological Conditions



The isopleth marked in green denotes the point of insignificance for the 99.79th percentile hourly average contributions of NO_2 and contributions in all areas outside of this isopleth can immediately be screened as insignificant. Contributions across the entire grid are screened as insignificant at the second assessment stage.

Figure 16 Enviroparks (Wales) Limited Process Contributions to Deposited Nutrient Nitrogen Levels 2015 Meteorological Conditions

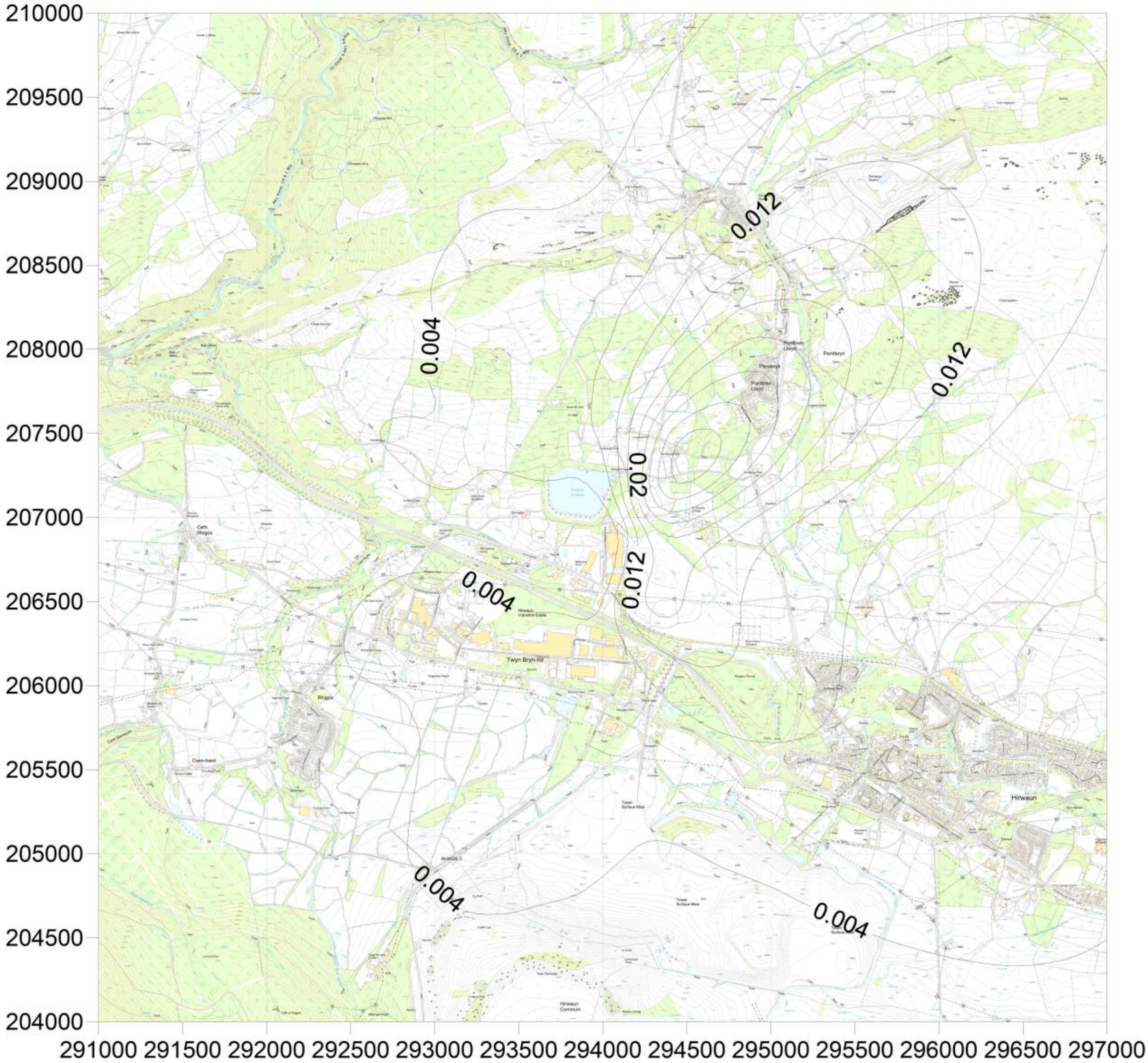
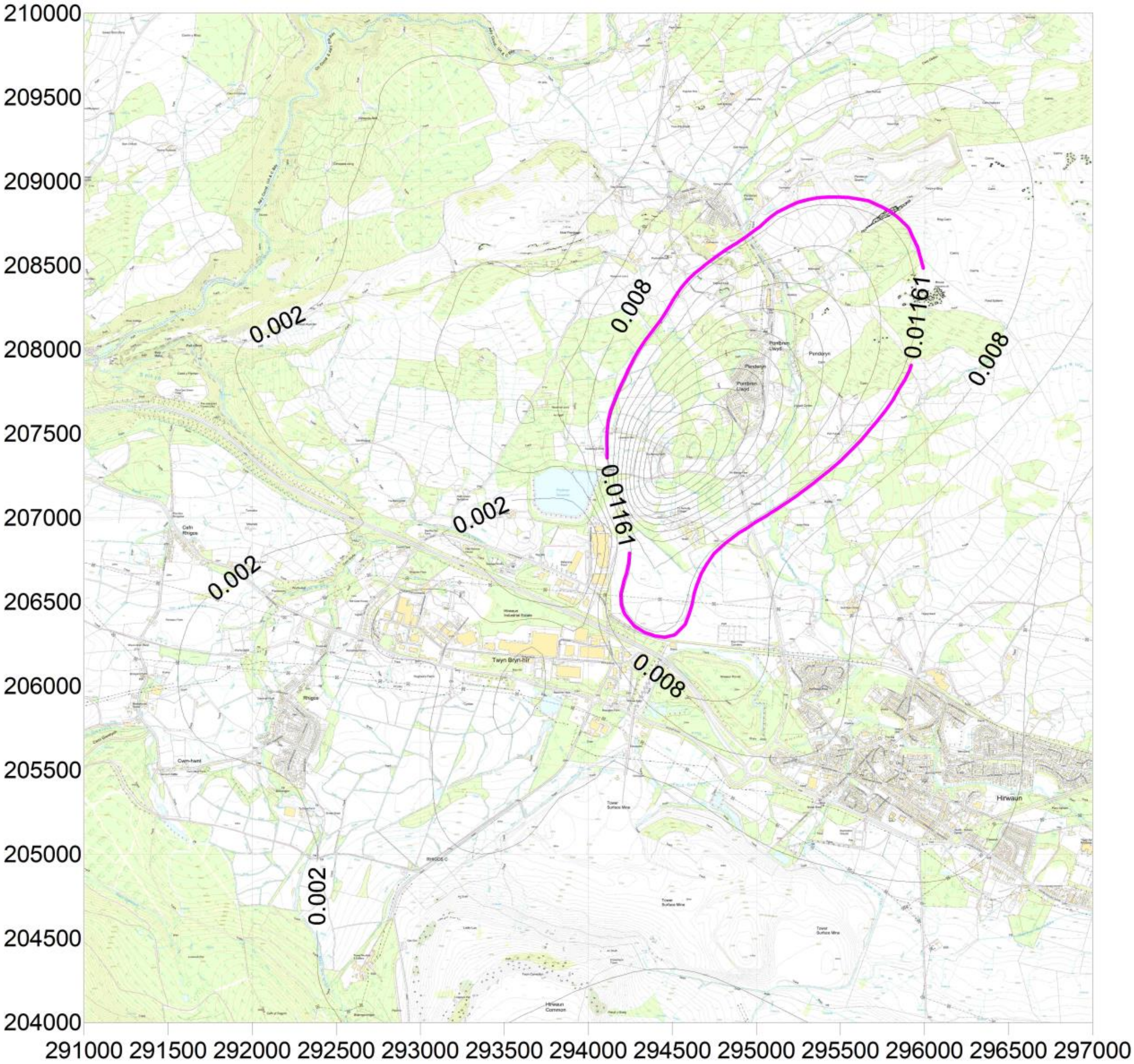


Figure 17 Enviroparks (Wales) Limited Process Contributions to Acid Deposition 2015 Meteorological Conditions



The magenta isopleth denotes the point of insignificance for contributions to acid deposition from the Enviroparks (Wales) Limited facility. Whilst the contributions from the process cannot immediately be screened as insignificant across large areas of the Blaen Cynon SAC, the Critical Load Function diagrams in Figures 18 and 19 demonstrate the small contribution relative to the Blaen Cynon Critical Load.

Figure 18 Critical Load Function for Blaen Cynon at the Modelled Point

User data input

Critical Load Function

CLmaxS:	0.58
CLminN:	0.438
CLmaxN:	1.161

Deposition data

Source	**keq/ha/yr**		
	Sulphur Deposition	**Nitrogen Deposition**	**Total Acid Deposition (S+N)**
Process Contribution (PC)	0.0043	0.0004	0
Background	0.4	1.5	1.9
Predicted Environmental Concentration (PEC)	0.4	1.5	1.9

Results - exceedance and deposition as a proportion of the CL function

Source	**Exceedance (keq/ha/yr)**	**% of CL function***
Process Contribution (PC)	no exceedance of CL function	0
Background	0.74	163.7
Predicted Environmental Concentration (PEC)	0.74	163.7

* % of CL function is calculated after the value of PEC relative to CLminN is taken into account. See detailed explanation for further information and justification.

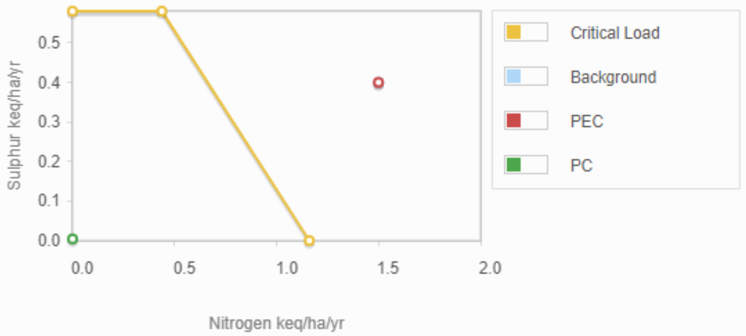


Figure 19 Critical Load Function for the Maximum Modelled Acid Deposition Across the Entire Gridded Area Compared to the Blaen Cynon Critical Load

User data input

Critical Load Function

CLmaxS:	0.58
CLminN:	0.438
CLmaxN:	1.161

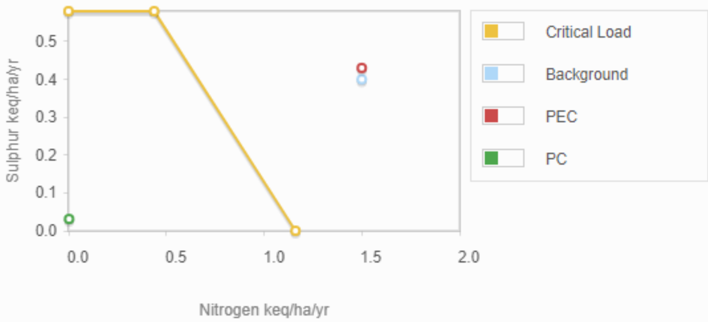
Deposition data

Source	keq/ha/yr		
	Sulphur Deposition	Nitrogen Deposition	Total Acid Deposition (S+N)
Process Contribution (PC)	0.0311	0.00277	0.03
Background	0.4	1.5	1.9
Predicted Environmental Concentration (PEC)	0.43	1.5	1.93

Results - exceedance and deposition as a proportion of the CL function

Source	Exceedance (keq/ha/yr)	% of CL function*
Process Contribution (PC)	no exceedance of CL function	2.6
Background	0.74	163.7
Predicted Environmental Concentration (PEC)	0.77	166.2

* % of CL function is calculated after the value of PEC relative to CLminN is taken into account. See detailed explanation for further information and justification.



enviroparks

APPENDIX 7.6

Dioxin Health Impact Assessment Report

DIOXIN AND FURAN HEALTH IMPACT ASSESSMENT FOR THE REVISED ENVIROPARKS SCHEME IN HIRWAUN, ABERDARE

ENVIROPARKS (WALES) LIMITED

Report Issue No: 1
Report Date: May 2020
Report Author: Amanda Owen

Executive Summary

Enviroparks (Wales) Limited (EWL) has planning consent for the development of a resource recovery and energy production plant at their site in Hirwaun, South Wales. The site is located partly within the Rhondda Cynon Taf County Borough Council's jurisdiction, and partly within that of the Brecon Beacons National Park Authority. Since the original consent was granted by both Councils (2010), the specific technologies to be employed at the site have changed, although the fundamental processes of the operation remain the same, and the 2010 consent was amended by Brecon Beacons National Park Authority in 2019 to account for changes in both the nature of the materials to be treated at the site, and in the number of different technologies used to treat them. A revised dispersion model and Health Impact Assessment was produced in 2017 to account for the revisions to the scheme, and supported the ES Addendum submitted at that time.

Additional changes are now proposed at the site and as these include an increase in the stack height to 90 m, EWL is requesting an amendment to their planning permission, and provides a further Addendum to the earlier Environmental Statement and supporting studies. The effects on the dispersion of emissions to atmosphere have been re-modelled and are reported in the Atmospheric Dispersion Modelling Assessment accompanying the ES Addendum, including consideration of most of the emitted pollutants against the Air Quality Standards for the protection of human health. Where no relevant Air Quality Standard is available, that is, when considering discharges of Dioxins and Furans and Dioxin-like PCBs, this Health Impact Assessment has applied the US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities to assess the potential risk to the health of people living and working in the vicinity of the EWL facility. The assessment considers the potential health risks associated with the intake of Dioxins from the consumption of potentially contaminated foodstuffs due to emissions to atmosphere from the chimney as assessed against the Tolerable Daily Intake promoted by the UK Committee on Toxicology. The assumptions used within the assessment are conservative and therefore the study has been undertaken on a worst-case basis.

The assessment indicates that the risk to health of the local population due to exposure to Dioxins in emissions from the facility is likely to be low, typically equating to less than 1 % of the Tolerable Daily Intake (TDI) of 2 pg/kg for adults and less than 2.5 % of the TDI for children. This is a significant reduction from the previous (2017) assessment and demonstrates that the proposed amendments to the scheme which include a regulated reduction in the emission concentrations of Dioxins, Furans and PCBs, and an increase in the height of the discharge point for the emissions, will reduce the potential impact of these pollutants.

When the combined emissions of Dioxins, Furans and Dioxin-like PCBs was considered in relation to the European Food Standards Agency's recommended Tolerable Weekly Intake (TWI) value of 2 pg/kg/week, the results showed that Process Contributions due to the operation of the Enviroparks facility were likely to be a small percentage of the TWI, being less than 7 % in all cases.

Additionally, when considering the impacts against the proposed Tolerable Weekly Intake (TWI) value of 2 pg/kg/week, the risk to health of the local population due to exposure to Dioxins, Furans and Dioxin-like PCBs in emissions from the facility, remained within 50 % of the TWI.

In conclusion, the results from the health impact assessment confirm that there is no significant health risk associated with potential exposure to emissions of pollutants from the proposed Enviroparks facility to be located on the Hirwaun Industrial Estate in South Wales.

Contents

Issue and Revision Record

Issue	Date	Author	Review / Authorise	Description
Draft	22/05/2020	A. Owen	ENVISAGE	Initial Draft
1	11/06/2020	A. Owen	ENVISAGE	Issue 1

1. Introduction

Enviroparks (Wales) Limited (EWL) are in the process of developing a site on the Hirwaun Industrial Estate in Hirwaun, Aberdare. The company plans to operate a resource recovery and energy production plant using Refuse Derived Fuel (RDF) and Commercial and Industrial waste in an advanced thermal treatment process. The site will receive up to 238,000 tonnes of incoming material each year. After the initial removal of any recyclates, the residual fuel will amount to 180,000 tonnes which will be prepared and processed through three gasification lines. The proposed development will create 86,724 MW of electrical energy each year, some of which will be used by a ‘high energy user’ – a manufacturing facility with high energy needs, occupying an industrial unit proposed in the northern part of the site, with the remainder being exported to the grid.

All of the activities associated with the EWL facility will take place within fully enclosed buildings, minimising the potential for the fugitive release of pollutants from process areas. The principal sources of emissions to atmosphere are those from the three gasification lines and energy recovery process with associated discharges to atmosphere via 90 m high flues.

Emissions from the three gasification lines will be discharged through individual flues, co-located within a single chimney structure, and will include pollutants associated with both acute effects (noticeable effects soon after exposure), such as Oxides of Nitrogen, Sulphur Dioxide, particulate matter and Hydrogen Chloride, or chronic effects (noticeable effects after prolonged exposure), which might include Volatile Organic Compounds, heavy metals such as Lead, Polycyclic Aromatic Hydrocarbons (PAH), or Dioxins and Furans.

Air Quality Standards (AQS) have been established within Europe and the UK primarily to protect the health of the general population. The initial Atmospheric Dispersion Modelling Assessment(1) was based upon the incremental increase in background concentration, the Process Contribution (PC), associated with emissions to atmosphere from the proposed plant. Where data was also available on the current background concentrations of pollutants, reference was subsequently made to the Predicted Environmental Concentration (PEC), which is the sum of the PC and the current background. The PC and PEC values were compared to the relevant AQS or Environmental Assessment Level for the protection of human health, and were screened as having an insignificant effect.

Detailed atmospheric dispersion modelling has shown that there will be no exceedances of any relevant AQS objective value or Environmental Assessment Level (EAL), and indeed the potential impact of the Enviroparks facility can be screened as insignificant at the modelled receptor points for their potential to impact on human health. Accordingly, it can be confirmed that the operation of the proposed facility is unlikely to pose a significant risk to the health of the local population living and working in the surrounding area, from pollutants which have associated Air Quality Standards.

However, for some pollutants, no AQS or EAL exists, and therefore this document presents the results of a Health Impact Assessment which specifically considers discharges of Dioxins and Furans (Dioxins) and Dioxin-like PCBs, and their potential impact on the health of people living and working in the vicinity of the EWL site. The assessment applies the US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities and considers the potential health risks associated with the intake of Dioxins through inhalation and from the consumption of potentially contaminated foodstuffs. The assumptions used within the assessment are conservative and therefore the study has been undertaken on a worst-case basis.

This document should be read in conjunction with the associated Atmospheric Dispersion Modelling Assessment report.

2. Dioxin and Furan Health Impact Assessment

2.1 Introduction

In the absence of other assessment levels appropriate for human health receptors, a Dioxin and Furan Health Impact Assessment has been undertaken using the US EPA Human Health Risk Assessment Protocol (HHRAP) calculation procedures to estimate intake of Dioxins via the dietary and inhalation routes in the vicinity of the proposed Enviroparks development. Regulators in the UK, including NRW, the Environment Agency and SEPA, currently recommend the use of the HHRAP procedures in the absence of similar UK or European guidance. Accordingly, the assessment was based upon the US EPA methodology outlined in the *Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities, EPA530-R-05-006, September 2005*, and the results are discussed in this section.

The basis for the Dioxin and Furan health risk assessment are the results from the ADMS atmospheric dispersion model, which are used to estimate the likely ground level concentrations and deposition rates for Dioxins and Furans as a result of emissions to atmosphere from the facility. The assessment is based upon the incremental increase in pollutant concentrations due to emissions from the chimney of the proposed plant and does not take account of any existing Dioxin contamination at the location of the specific receptors. The assessment does, however, take account of ambient Dioxin concentrations in the atmosphere using measured data from the TOMPS network of monitoring stations operated by DEFRA(2).

The Enviroparks site on the Hirwaun Industrial Estate is located to the West of Hirwaun village. Land use in the area is mixed, the site itself located on the outskirts of the industrial estate, with the villages of Hirwaun, Rhigos and Penderyn locally. Aberdare town is further afield, located to the South-East of the Enviroparks site. The main A465 runs generally East to West and the old Tower Colliery site extends across a significant area to the South of the main road. Otherwise, the area in the vicinity is largely rural, with the Brecon Beacons National Park and the Penderyn Reservoir located to the North of the site.

2.2 Potential Pathways for Exposure

Dioxin emissions from the proposed facility will be very low, in line with the anticipated operational conditions of the Environmental Permit which will be issued by NRW prior to commissioning. These trace emissions of Dioxins will be released from a 90 metre high chimney, designed to provide effective dispersion of releases to atmosphere, minimising ground level concentrations in the vicinity of the site.

The maximum annual Process Contribution for Dioxins associated with emissions from the Enviroparks facility was approximately 0.24 fg m^{-3}, at the point of maximum Process Contribution, located approximately 917 metres to the North-East of the discharge points. Emissions from the facility are not expected to significantly increase the airborne concentrations or deposition rate of Dioxins and Furans over what may be currently experienced in the vicinity of the development site. The maximum daily average PC for Dioxins was predicted to be about 1.97 fg m^{-3}.

It should be noted that the emissions profile was based on the achievable ELV recommended for Dioxin emissions from incineration plant burning solid fuels, in the revised BREF Note for Waste Incineration, and the associated BAT Conclusions document(3) (0.04 ng Nm^{-3} at 11% O_2, dry and STP). Although this is the anticipated Emission Limit Value (ELV) likely to be specified within the Environmental Permit for the operation, the Enviroparks plant will usually operate in compliance with the conditions to be incorporated in the Permit, and Dioxin emissions are therefore expected to be significantly below the specified ELVs. The emissions profile is therefore considered to be overly pessimistic, and to result in higher predicted Process Contributions than are considered likely during normal operations.

The following pathways were considered as part of the health risk assessment, and take account of potential exposure due to trace concentrations of Dioxins in the atmosphere, as well as Dioxins deposited on the ground, attributable to emissions from the proposed ERF:

- Potential exposure by inhalation;
- Potential exposure by ingestion of soil as a result of working the land, or playing at a particular location;

- Potential exposure by consumption of fruit and vegetables grown at a particular location;
- Potential exposure by consumption of milk produced at a particular location;
- Potential exposure by consumption of poultry and eggs produced at a particular location; and
- Potential exposure by consumption of drinking water collected at a particular location.

Members of the local population are only likely to be exposed to emissions of Dioxins and Furans from the proposed Enviroparks facility if:

- They spend significant periods of time at locations where and when emissions from the facility increase the concentration of Dioxins above the existing background;
- They consume food grown at locations where emissions from the facility increase the concentration of Dioxins above the concentration normally present in food from those locations;
- They drink milk or consume dairy products from cows grazing in areas where emissions from the facility increase the concentration of Dioxins on the land above the concentrations normally present at those locations;
- They undertake activities likely to lead to ingestion of soil at locations where emissions from the facility have increased the concentration of Dioxins in the soil above those normally present; and
- They drink water from sources exposed to increased concentrations of Dioxins above the levels normally present.

The extent of exposure that any person may experience will depend directly on the degree to which they engage in any or all of the above activities, and by how much existing background concentrations of Dioxins increase as a result of the operation of the facility. The drinking water route is considered to be highly unlikely as very few people are likely to collect and drink rainwater in the vicinity of the development site.

2.3 Pathways Relevant to the Revised Enviroparks (Wales) Scheme

2.3.1 Inhalation

People living in the vicinity of the development site may be exposed to marginally higher levels of Dioxins and Furans, as a result of the operation of the Enviroparks resource recovery and energy production plant, for the proportion of the time that they spend there. Accordingly, this pathway is considered relevant to the current assessment, and the default values recommended by the US EPA were used as the basis for assessment. Reference was also made to the average rural background concentration for Dioxins and Furans of 6.55 fg m^{-3} in 2016, the most recent set of complete data, based upon measured data for Auchencorth Moss, Hazelrigg, High Muffles and Weybourne (2). Although the local area includes a mixture of rural and urban functions, the area is predominantly rural, with relatively small and localised urban areas, and thus, the application of the average background from the rural measurement stations is considered to be appropriate.

2.3.2 Ingestion of Soil

People working on the land in close proximity to the development site may be exposed to marginally higher levels of Dioxins and Furans as a result of the operation of the facility, for the proportion of the time that they work there. The potential for exposure by soil ingestion is likely to affect only a few local residents who may tend allotments or plots in their home gardens, and then for only limited periods of the year. Dioxin intake via the ingestion of soil is included in the assessment.

2.3.3 Consumption of Fruit and Vegetables

The majority of the general population purchase their fruit and vegetables from commercial outlets that are likely to source their produce from outside the locality. Unless a substantial proportion of fruit and vegetables sold are produced locally, the overwhelming majority of the local population’s exposure to Dioxins due to consumption of fruit and vegetables will not be affected significantly by the operation of the Enviroparks facility.

However, people who consume fruit and vegetables grown within the vicinity of the facility may be exposed to marginally higher levels of Dioxins and Furans as a result of the operation of the process, although any increase is likely to be small. The likelihood of individuals obtaining almost all of their fruit and vegetable consumption from farms, gardens or allotments in the vicinity of the development site is likely to be low. Nevertheless, Dioxin and Furan intake via the consumption of fruit and vegetables is included in the assessment.

2.3.4 Consumption of Local Dairy Produce

The development site is located within the Hirwaun Industrial Estate and as such, there are a number of industrial and commercial premises nearby. However the wider area includes farmland, fields and open spaces and therefore, there is the potential for grazing animals to forage on land in the vicinity of the development site that could be contaminated by deposits of trace amounts of Dioxins and Furans from the Enviroparks facility once operational. Accordingly, the consumption of locally produced milk has been considered in this assessment.

2.3.5 Consumption of Poultry and Eggs

Free-range poultry may be exposed to Dioxins and Furans through soil ingested with food picked up from the ground. It is not known if the rearing of free-range poultry occurs to any significant level in the vicinity of the development site. However, local households may keep chickens, and a future scenario might see a change in land use that could be used for rearing chickens commercially. Under this scenario, the consumption of chicken meat and eggs could be a realistic exposure pathway in future, and hence has been considered further in this assessment.

2.3.6 Consumption of Beef and Pork

Consumption of beef and pork reared on land in the vicinity of the development site is unlikely. As the assessment for the consumption of chicken meat revealed that this dietary pathway represented less than 1 % of the total potential Dioxin intake, and that beef and pork consumption was similar to that of chicken, similar conclusions were drawn for beef and pork and no further assessment was carried out.

2.3.7 Breast Milk

The consumption of breast milk by infants may be a potentially significant pathway for the dietary intake of Dioxins and Furans due to absorption from contaminated foodstuffs by the mother’s lactate system. However, the Dioxin intake via the consumption of cow’s milk has been considered and Dioxin levels in both types of milk are likely to be of a similar level. Where an infant is consuming breast milk it is unlikely that it will also be consuming cow’s milk, and vice versa and therefore, the assessment for cow’s milk is considered to be representative of the situation for the consumption of breast milk, and no further analysis has been carried out.

2.3.8 Drinking Water

The likelihood of contamination of groundwater aquifers occurring due to the deposition of Dioxins and Furans associated with emissions from the facility is considered highly unlikely given the very low solubility of Dioxins in water. Furthermore, the likelihood of local residents collecting rainwater for drinking purposes is also thought to be low, and has been discounted. Accordingly, no further consideration has been given to drinking water as a potential pathway.

2.4 Exposure Scenarios

For all of the exposure scenarios, being at the location of exposure for less than 100 % of the time, and obtaining less than 100 % of the total consumption of relevant food, would reduce proportionately any exposure to potential emissions of Dioxins and Furans from the facility. Accordingly, the estimates of exposure resulting from this assessment are likely to overestimate considerably, those that could be experienced by local residents when the Enviroparks facility is operational.

The following exposure scenarios have been considered as relevant to the exposure sites selected:

2.4.1 General Population Exposure

Land use in the immediate vicinity of the development site comprises a mixture of commercial / industrial activities, although with more rural landscapes very close by. The nearest residential property is understood to be Tai-Cwpla Farm, located approximately 384 m to the North, North-West.

Specific receptors were included in the Dioxin and Furan Health Impact Assessment, to represent key local infrastructure, such as the Penderyn Reservoir, and nearby locations where members of the general public may be present for significant periods of time. People living and working in the vicinity of the development site may be exposed to very low emissions of Dioxins and Furans from the facility via the inhalation route, although it must be recognised that the Enviroparks facility will not be the only source of airborne Dioxins in the wider area. The results presented in this report consider all of the modelled human health impact receptors within 2.75 km of the site.

The area covered by the modelling assessment is shown in Figure 1 and shows the location of the Specific Receptors included in the assessment. Table 1 provides further detail on the receptors.

Figure 1 Location of the Development Site and the Receptors Considered Within the Dioxin and Furan Health Impact Assessment

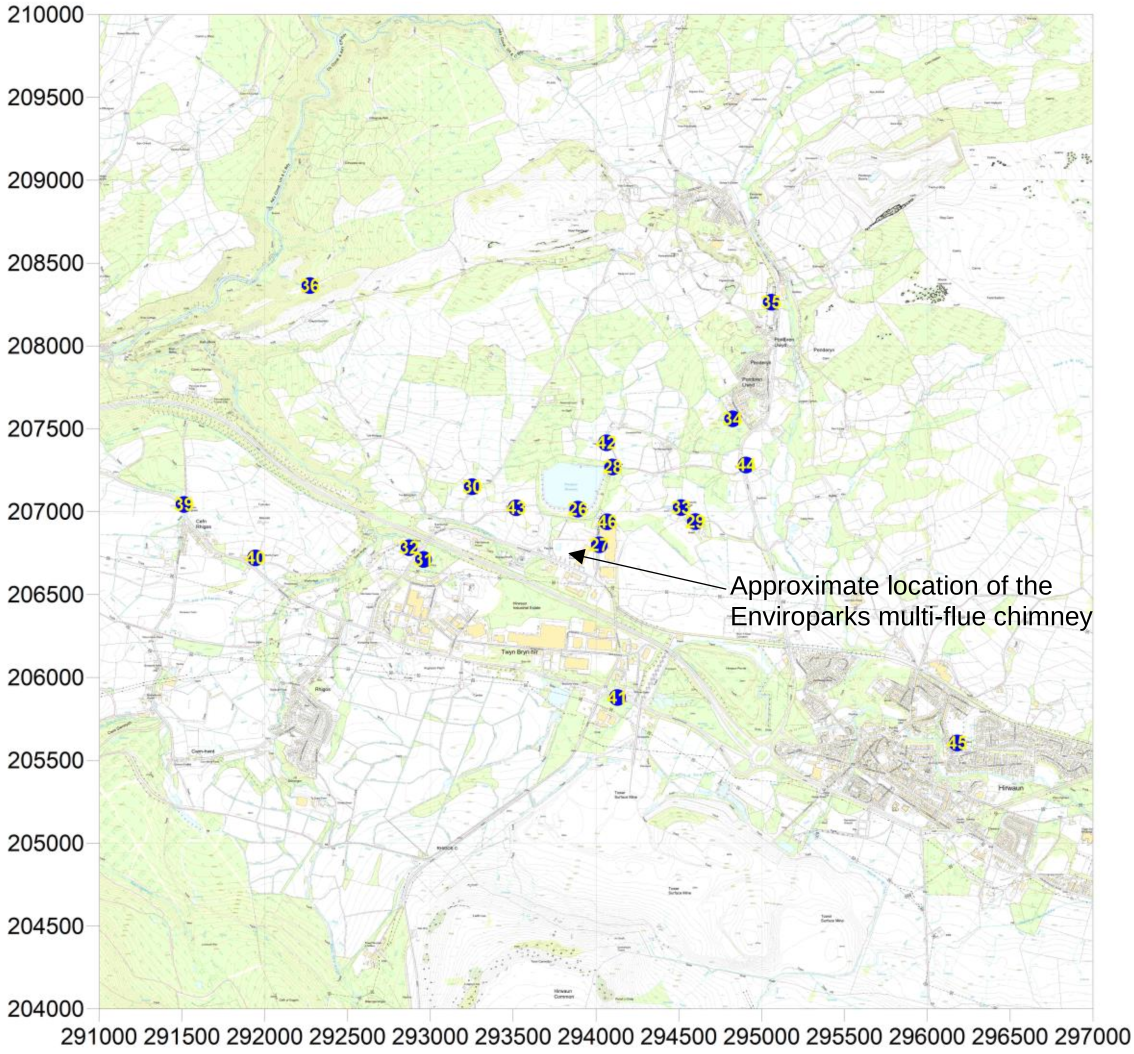


Table 1 Specific Receptors Included in Dioxin Deposition Modelling

Receptor Number	Receptor Name	OS Coordinates		Distance from Source (metres)
		X	Y	
26	Penderyn Reservoir	293890	207015	201
27	Eden UK	294020	206800	176
28	House at Penderyn Reservoir	294100	207270	516
29	Ty Newydd Hotel	294600	206940	764
30	Caer Llwyn Cottage	293253	207151	678
31	Rhombic Farm	292958	206712	894
32	Castell Farm	292871	206783	975
33	Ty Newydd Cottage	294514	207025	699
34	Residence Woodland Park	294824	207560	1,227
35	Pontbren Llwyd School	295057	208264	1,884
36	Ffynnon Ddu (spring)	292273	208364	2,203
39	The Don Bungalow	291512	207044	2,344
40	Werfa Farm	291944	206721	1,904
41	Willows Farm	294129	205879	984
42	Trebanog Uchaf Farm	294063	207416	634
43	Tai-Cwpla Farm	293519	207024	384
44	Neuadd Farm	294906	207282	1,157
45	John Street Allotments, Hirwaun	296180	205605	2,633
46	Dwr Cymru Service Reservoir	294068	206939	252

2.4.2 Exposure by the Consumption of Poultry

This scenario could apply to those individuals who derive their total consumption of eggs and poultry meat produced within the potential zone of exposure of emissions from the Enviroparks facility.

2.4.3 Exposure via the Consumption of Fruit and Vegetables

This scenario is only likely to apply to a proportion of the local population who source all of their fruit and vegetables from local farms in the vicinity of the site, or grow fruit and vegetables for their own consumption either in their gardens or on allotments in the vicinity of the development site.

2.4.4 Exposure via the Consumption of Milk

This scenario could apply to those people whose milk supply is produced exclusively by dairy herds grazing on pasture that could potentially become contaminated in the vicinity of the development site.

2.4.5 Ingestion of Soil

This scenario could apply to workers on nearby agricultural land and local residents working in their gardens or allotments, who may be exposed to soil that could be contaminated by Dioxins deposited from the emissions from the Enviroparks facility.

2.5 Exposure Factors

Exposure factors were obtained from literature sources for rates of breathing and ingestion of soil and foodstuffs.

2.5.1 Inhalation Rates

For a 70 kg adult, the daily respiration volume was taken as about 20 m^3 day^{-1} which is in line with US EPA recommendations. This corresponds to an average value of about 0.012 m^3 kg^{-1} hr^{-1}. The corresponding value for an infant weighing about 14.5 kg was 5.1 m^3 day^{-1}, or about 0.015 m^3 kg^{-1} hr^{-1}.

2.5.2 Consumption of Eggs and Poultry Meat

Information on the intake of eggs and poultry meat was obtained from the National Diet and Nutrition Survey Rolling Programme, detailed on the gov.uk website(4) and is summarised in the following table.

Table 2 UK Official Figures for the Consumption of Poultry Products (g/kg/day)

Food Category	UK Adult Mean (g/kg BW/day)	UK Infant Mean (g/kg BW/day)
Poultry Meat	0.54	1.90
Eggs	0.29	0.69

The above figures are based upon the average values for men and women to give an overall average for an adult member of the population. The values relate to the average daily consumption of eggs and chicken meat in terms of g/kg body weight/day, and are derived from the National Diet and Nutrition Survey results from years 1 to 4 (2008 to 2012).

The values in Table 2 are the average values for consumption of eggs and chicken by males and females normalised for daily consumption on the basis of an average adult weighing 70 kg, and an average child weighing 14.5 kg, in line with the US EPA HHRAP approach. The National Nutrition and Diet Survey covers adults between the ages of 19 and 64, and values for infants were based upon the data for children aged between 4 and 10 years.

For home-reared or allotment-reared eggs and poultry meat, it is unlikely that meat consumption rates would be as high as those for eggs, as the birds are the source of the eggs. Accordingly, the majority of poultry meat consumed is likely to have come from sources outside the area, and the assessment is likely to overestimate considerably the potential impact of poultry meat consumption.

2.5.3 Consumption of Fruit and Vegetables

Values for the consumption of fruit and vegetables are provided in the US EPA HHRAP methodology as follows:

Table 3 US EPA HHRAP Estimates for the Consumption of Fruit and Vegetables

Category	Ingestion Rate (kg/kg-day DW)			
	Farmer	Farmer Child	Resident	Resident Child
Exposed Aboveground fruit and vegetables	0.00047	0.00113	0.00032	0.00077
Protected Aboveground fruit and vegetables	0.00064	0.00157	0.00061	0.00150
Belowground Produce	0.00017	0.00028	0.00014	0.00023

As can be seen the values for the case of the “Farmer” indicate a higher level of consumption due to the increased likelihood of consuming home-produced fruit and vegetables. To provide a worst-case assessment for potential dietary intake of Dioxins, the consumption figures for the “Farmer” and “Farmer Child” were used in the assessment.

2.5.4 Consumption of Milk

Similarly to the consumption rates for poultry meat and eggs, information on the intake of milk was obtained from the National Diet and Nutrition Survey and is summarised in the following table.

Table 4 UK Official Figures for the Consumption of Milk (g/kg/day)

Food Category	UK Adult Mean	UK Infant Mean
Whole Milk	0.34	5.93

The above figures are based upon the average values for men and women, including non-consumers, to give an overall average for an adult member of the population. The values relate to the average daily consumption of whole milk in terms of g/kg body weight/day, and are derived from the National Diet and Nutrition Survey results from years 1 to 4 (2008 to 2012). Whole milk has a higher fat content than semi-skimmed or skimmed milk, and therefore provides a worst-case basis for assessment.

It has been assumed that all of the milk consumed has been produced on pastures in the vicinity of the development site. This will overestimate considerably the potential impact of milk consumption.

2.5.5 Ingestion of Soil

Values for the ingestion of soil are provided in the US EPA HHRAP methodology as follows:

Table 5 US EPA HHRAP Estimates for Soil Ingestion

	Adult	Child
Soil Intake Rate (kg day^{-1})	0.0001	0.0002

The higher value for a child reflects the greater likelihood of soil ingestion by children playing outdoors.

2.6 Emissions and Deposition Scenario

The Enviroparks resource recovery and energy production plant will be subject to regulation by NRW in line with the achievable emission limit values (ELVs) for Dioxins and Furans for incineration plant as recommended by the recently revised BREF Note for Waste Incineration, and stipulated in the BAT Conclusions. Dispersion modelling was therefore undertaken on the basis of normal operation with emissions of Dioxins at the 0.04 ng Nm^{-3} ELV stipulated in the BAT Conclusions document, and this will be the design point and performance guarantee for the proposed gasification technology.

It is expected that Dioxin emissions from the Enviroparks process will actually remain well within the ELVs specified by the site's environmental permit and therefore, the results from this assessment are likely to overestimate significantly the situation that might be expected when the facility becomes operational.

Exposure via the dietary route was assessed by modelling Dioxin deposition in both the gaseous and particulate phases. The results from deposition modelling were then taken in conjunction with the US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion for calculating the intake of Dioxins into the soil, fruit and vegetables, dairy products and poultry products to provide an estimate of dietary intake of Dioxins as a result of the operation of the new facility. Partitioning of Dioxins between the vapour phase and the particulate phase was assumed to be in the proportions 66.4:33.6 as provided by HHRAP guidance(5), and the modelling results were adjusted accordingly. The results were compared against the Tolerable Daily Intake (TDI) value of 2 pg kg^{-1} day^{-1} recommended by the UK Committee on Toxicity(6), as well as a Tolerable Weekly Intake (TWI) value of 2 pg/kg/week for Dioxins and Dioxin-like PCBs recommended by the European Food Standards Agency (EFSA)(7).

The values predicted by modelling represent Process Contributions due to emissions from the proposed Enviroparks facility, but in certain instances also take into account estimated background atmospheric concentrations for rural areas in the UK. Where necessary, estimated background values for atmospheric Dioxin concentrations have been used as input values for some of the equations in the HHRAP methodology.

2.6.1 Supporting Data and Specific Receptors Included in the Assessment

Atmospheric dispersion modelling using ADMS Version 5.2 was undertaken to estimate likely ground level concentrations of Dioxins at nearby sensitive receptors arising from emissions from the Enviroparks facility. Meteorological data from the Sennybridge measurement station for 2015 to 2019 were used in the modelling and the results reported are based upon the maximum Process Contributions over the five-year period. The model was also run in dry deposition mode to estimate likely Dioxin deposition rates in the vicinity of the development site.

A 6 km x 6 km modelling grid was applied and sensitive human health receptors local to the Enviroparks facility were included in the model, in order to provide relevant results at specific locations where human exposure could occur. The approximate location of the modelled receptors and the multi-flue chimney associated with the Enviroparks facility were shown in Figure 1.

2.7 Results from Detailed Modelling - Concentration Mode

The results from modelling emissions of Dioxins from the Enviroparks resource recovery and energy production plant, based upon the BREF Note for Waste Incineration ELV of 0.04 ng Nm^{-3} gave a maximum Process Contribution of about 1.97 fg m^{-3} (1.97×10^{-15} g m^{-3}) expressed as a daily average value, located approximately 917 metres to the North-East of the discharge points. The corresponding annual average Process Contribution was about 0.24 fg m^{-3}.

2.8 Deposition Mode

Wet deposition is usually considered to be the most significant mode of deposition close to the point of release of buoyant plumes from waste incineration processes, as a result of “wash out” by rain droplets falling through the plume. At greater distances, plume expansion and the associated pollutant dilution, brings particulates and vapours in the plume into contact with the surface vegetation, and the “dry deposition” mechanism assumes greater importance. It is important therefore that both aspects of pollutant deposition from the plume are considered within the assessment.

The ADMS model was run in deposition mode, and based on previous guidance on undertaking risk assessments, as specified in Horizontal Guidance Note IPPC H1, the value for dry deposition was multiplied by a factor of 3 to provide an estimate of total deposition, i.e., the combination of both dry and wet deposition.

> The value of 3 is a nominal factor to convert dry deposition to total deposition.
> *Source: Horizontal Guidance Note H1, July 2003*

The results from deposition modelling of emissions from the proposed Enviroparks facility, assuming emissions at the revised BREF Note ELV of 0.04 ng Nm^{-3}, gave a maximum value for total Dioxin deposition of 1.12×10^{-12} µg m^{-2} s^{-1} for Dioxins in the gaseous and particulate phases. The results showed that deposition rates for Dioxins decrease markedly with distance from the point of release.

2.8.1 Specific Receptor Locations and Exposure Pathways

Exposure is potentially possible at any location to a greater or lesser degree, and nearby locations shown in Figure 1 were included in the modelling study as specific receptors, including residential areas, key infrastructure and nearby places of employment.

The ADMS model incorporated twenty specific receptors representing locations where members of the general public may be present for significant periods of time, either through residency or through their workplace, although two of these were located more than 2.75 km form the Enviroparks facility and have not been included within the Dioxin and Furan Health Impact Assessment. Results for the other eighteen specific receptors have been assessed and are included in this report.

3. Results and Discussion

Health risk estimates are directly affected by several factors, which include:

- The location of the receptor with regard to exposure to emissions from the proposed facility;
- The proportion of time spent by an individual at locations where Dioxin concentrations may increase as a result of emissions from the operational Enviroparks plant;
- Proportions of each food type consumed that are produced at locations where Dioxin concentrations may increase as a result of emissions from the proposed facility; and
- The emissions scenario.

The results from the assessment of health impacts from Dioxins are reported in the following sections and represent the point of maximum contribution across the modelled grid. This location is approximately 917 m to the North-East of the discharge points and is not located at a specific receptor point. The results for the eighteen discrete receptor locations will naturally all be lower than the maximum values reported here, although have been calculated in the same way, and are summarised in Table 13.

The assessment is based on each of the pathways outlined in Section 2.3, based upon emissions of Dioxins at the ELV of 0.04 ng Nm^{-3} recommended by the revised BREF Note for Waste Incineration, which is the design point and performance guarantee for the proposed ERF technology. When operational, emissions of Dioxins from the facility are expected to be significantly lower than the BREF Note ELV, and therefore the results in this report are considered to represent a worst-case assessment.

The intake of Dioxins was estimated on the basis of the maximum daily intake due to inhalation as well as dietary consumption. The combined results were then compared against the 2 pg kg^{-1} Tolerable Daily Intake (TDI) reference value to determine whether there is likely to be a significant risk to health as a result of potential exposure to Dioxins released from the facility.

3.1 Exposure via Inhalation

The following equation was used in the calculation of the Maximum Daily Intake due to inhalation of Dioxins as a result of exposure to emissions from the proposed Enviroparks facility, at the point of maximum contribution across the modelled grid. The equation is taken from HMIP Report, *Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes, 1996*:

Equation 1 Maximum Daily Intake Due to Inhalation

Maximum Daily Intake Due to Inhalation = $\frac{((C+B)x\ IR)}{BW}$

Where:
C = Maximum daily average Dioxin concentration (pg m^{-3})
B = Estimated background concentration (pg m^{-3})
IR = Inhalation rate (m^3 day^{-1})
BW = Body weight (kg).

The following input data were assumed:

- The estimated background Dioxin concentration (B) was taken to be 0.00655 pg m^{-3}. This is the average of the 2016 annual average values for the rural measurement stations (Auchencorth Moss, Hazelrigg, High Muffles and Weybourne) in the TOMPS (Toxic Organic Micro Pollutants) monitoring stations within the UK network(2). It is assumed that the data are representative of the Enviroparks facility, which is located in a largely rural area, with relatively small and localised urban areas;
- The inhalation rate (IR) was 19.92 m^3 day^{-1} for an adult and 5.1 m^3 day^{-1} for an infant (US EPA recommended value);
- Body weight (BW) was taken as 70 kg for an adult and 14.5 kg for an infant (US EPA recommended value).

Using these data, the maximum daily intake of Dioxins across the modelled grid due to inhalation by adults was calculated to be 0.00242 pg kg^{-1} day^{-1}. For infants the corresponding figure was 0.003 pg kg^{-1} day^{-1}. The Tolerable Daily Intake (TDI) for Dioxins is 2 pg kg^{-1} day^{-1}; accordingly the estimated exposure via inhalation for adults represents approximately 0.12 % of the TDI, while the estimated value for infants is about 0.15 % of the TDI.

It is noted that the reported exposure via inhalation has therefore reduced significantly on the previous reported (2017) Health Impact Assessment(8), which reported both the adult and infant inhalation at approximately 0.2 % of the TDI.

3.2 Potential Increase in Concentration of Dioxins in Soil Due To Emissions from the Enviroparks facility

Any increase in Dioxin concentration in the soil has the potential to transfer into the food chain and to add to the daily intake via the dietary pathway. An assessment was made of the maximum potential increase in Dioxin concentration across the modelled grid, as a result of deposition due to emissions from the proposed Enviroparks facility.

Deposition modelling of Dioxins was carried out using ADMS Version 5.2. The likelihood is that the majority of Dioxins released from the facility would be associated with the particulates in the emission to atmosphere. As the proposed resource recovery and energy production plant will be equipped with a high efficiency bag filtration system, the majority of any particulate emission will be 1 μm or less in size. Accordingly, the model predictions for Dioxin deposition associated with the particulates with a diameter of 1 μm represents an appropriate worst-case value for assessment of Dioxin deposition to soils in the vicinity of the Enviroparks facility. The following deposition rates were predicted at each of the specific receptor locations in the vicinity of the development site, and the maximum predicted deposition is included for comparison. It can be seen that the maximum deposition rate is significantly higher than that predicted at the majority of the receptor locations, with the next highest value predicted at Ty Newydd Cottage, located approximately 700 m to the North-East of the chimney location.

Table 6 Deposition Modelling of Dioxins in the Gaseous and Particulate Phases Based Upon Normal Operating Conditions at an ELV of 0.04 ng Nm^{-3}

Receptor Number	Total Deposition Rate* (Gaseous and Particulate) (μg m^{-2} s^{-1})	Annual Deposition Rate (ng m^{-2} $annum^{-1}$)
Maximum Gridded	1.12E-12	0.035
26	5.88E-14	0.002
27	2.68E-14	0.001
28	3.68E-13	0.012
29	9.05E-13	0.029
30	1.32E-13	0.004
31	1.74E-13	0.005
32	1.49E-13	0.005
33	1.02E-12	0.032
34	9.60E-13	0.030
35	5.99E-13	0.019
36	9.74E-14	0.003
39	7.11E-14	0.002
40	1.12E-13	0.004
41	2.66E-13	0.008
42	3.21E-13	0.010
43	8.01E-14	0.003
44	9.87E-13	0.031
45	1.84E-13	0.006
46	1.12E-13	0.004

Note: * Total Deposition Rate calculated according to H1 guidance (3 x dry deposition rate)

The above values represent a worst-case based upon the ELV of 0.04 ng Nm^{-3} recommended by the revised BREF Note for Waste Incineration, however, when operational, emissions of Dioxins from the facility are expected to be significantly lower than the ELV.

Little of the deposited Dioxins are likely to penetrate far into the ground due to the low solubility of Dioxins in water. Absorption of Dioxins by the soil is also likely to decrease mobility. The US EPA HHRAP database quotes a value of 0.19 ng $litre^{-1}$ for the solubility in water.

The following assessment is based upon the maximum deposition rate at the point of maximum contribution across the modelled grid.

3.2.1 Increase in Soil Concentration

The increase in Dioxin loading of soils as a result of deposition was estimated using the equations in Table B-3-1 in Appendix B of the US EPA Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities.

Equation 2 The Increase in Dioxin Concentration in the Soil Due to Deposition

$$Cs = \frac{\left(\frac{Ds \cdot tD - Cs_{tD}}{ks}\right) + \left(\frac{Cs_{tD}}{ks} \cdot [1 - exp(-ks \cdot (T_2 - tD))]\right)}{(T_2 - T_1)};$$

$$Cs_{tD} = \frac{Ds \cdot [1 - \exp(-ks \cdot tD)]}{ks}; and$$

$$Ds = \frac{100 \cdot Q}{Z_s \cdot BD} \cdot [F_v \cdot (Dydv + Dywv) + (Dydp + Dywp) \cdot (1 - F_v)]$$

Where:

- Cs = Maximum average incremental increase in soil concentration over exposure duration based on Dioxin deposition at the point of maximum contribution;
- Cs_{tD} = Soil concentration at time tD - calculated;
- Ds = Deposition Term – mg/kg soil/yr;
- tD = Time period over which deposition occurs – 30 years;
- ks = Dioxin soil loss constant due to all mechanisms – calculated;
- T_2 = Length of exposure duration – 30 years;
- T_1 = Time period at the beginning of combustion – 0;
- 100 = Conversion Factor;
- Q = Dioxin emission rate (g s^{-1});
- Z_s = Soil Mixing Zone depth – 2 cm;
- BD = Soil Bulk Density – 1.5 kg m^3;
- F_v = Fraction of Dioxin air concentration in the vapour phase – 0.664 (US EPA HHRAP value);
- Dydv = Unitised annual average dry deposition from vapour phase – derived from ADMS output;
- Dywv = Unitised annual average wet deposition from vapour phase – derived from ADMS output;
- Dydp = Unitised annual average dry deposition from particulate phase – derived from ADMS output; and
- Dywp = Unitised annual average dry deposition from particulate phase – derived from ADMS output.

Using the above equations and input parameters, gave a value for the increase in soil Dioxin concentration due to deposition of approximately 0.00043 ng kg^{-1}. This value represents the case at the point of maximum contribution across the modelled grid based upon normal operating conditions at an emissions limit value of 0.04 ng Nm^{-3}, and is about 0.009 % of the maximum concentration of Dioxin in soils in rural locations (about 4.7 ng kg^{-1}) reported by the Environment Agency(9).

The value reported above suggests a significant reduction in the increase in soil Dioxin concentration due to deposition from the 2017 study[8], which due in part to a higher emission limit value and a lower release point, reported a contribution of approximately 0.06 % of the rural background concentration.

3.3 Exposure from Dietary Intake of Poultry and Eggs

The potential link between human receptors and the consumption of locally reared poultry meat or eggs is not known, and it is unclear to what extent chickens are reared locally. Nevertheless, the consumption of chickens and eggs could be a potential exposure pathway to residents rearing their own chickens, or commercial developments in the area in the future. This is a foreseeable scenario since there is no requirement for a householder or allotment holder to seek permission to keep chickens or other livestock and to notify the owners of a nearby industrial process if they did. As such, this could be a key pathway for Dioxin exposure and it is appropriate that it should be investigated.

Accordingly, an assessment for exposure to Dioxins has been undertaken for the intake of Dioxins via the consumption of eggs and chicken in order to represent a possible future scenario where the rearing of free-range eggs and poultry became significant.

The US EPA Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities methodology was used to assess the potential exposure to Dioxins arising from emissions from the new facility. The equation in Table B-3-13 in Appendix B of the HHRAP was used to determine the concentration of Dioxins in eggs at locations in the in the vicinity of the development site, and the equation in Table B-3-14 was used to determine the corresponding concentration of Dioxins in poultry meat.

The results presented in the following section relate to the deposition rate at the point of maximum contribution across the modelled grid based upon normal operating conditions.

3.3.1 Dioxin Concentration in Eggs

The following formula was used to estimate the potential Dioxin concentration in eggs due to ingestion of soil and grain by free-range chickens reared in the locality:

Equation 3 The Intake of Dioxin in Eggs Due to Foraging on Contaminated Soil

$$A_{egg} = \left(\sum (F_i \cdot Qp_i \cdot P_i) + Q_s \cdot C_s \cdot B_s \right) \cdot Ba_{egg}$$

Where:

- A_{egg} = Concentration of Dioxin in egg based on Dioxin deposition at the location of maximum contribution;
- F_i = Fraction of grain grown on contaminated soil and ingested by chickens – assumed to be 1.0;
- Qp_i = Quantity of grain ingested by chickens – assumed to be 0.2 (US EPA HHRAP);
- P_i = Concentration of Dioxin in grain – derived from separate equation below;
- Q_s = Quantity of soil ingested by chicken – assumed to be 0.022 kg day^{-1} (US EPA HHRAP);
- C_s = Maximum annual average incremental increase in Dioxin concentration in soil at the point of maximum contribution – estimated by modelling to be 0.00043 ng kg^{-1};
- B_s = Soil bioavailability factor – assumed to be 1.0 (US EPA HHRAP);
- Ba_{egg} = Biotransfer factor for chicken eggs – assumed to be 1.09984 (US EPA HHRAP Database).

The value of P_i was derived using the equation in Table B-3-9 of Appendix B of the HHRAP:

Equation 4 The Intake of Dioxin in Grain Due to Increase in Soil Concentration

$$P_i = C_s \cdot Br_{forage}$$

Where:

- P_i = Concentration of Dioxin in grain;

- C_s = Maximum annual average incremental increase in Dioxin concentration in soil at the point of maximum contribution – estimated by modelling to be 0.00043 ng kg^{-1};
- Br_{forage} = Plant-soil bioconcentration factor for grain – assumed to be 0.00455 (US EPA HHRAP Database);

Using the above equations, a value of 1.1 x 10^{-11} mg kg^{-1} Fresh Weight (FW) basis (approximately 0.011 pg kg^{-1}) was derived for the Dioxin concentration in eggs due to the foraging of chickens on soil with an incremental annual average increase in Dioxin concentration in the soil of 0.00043 ng kg^{-1} at the point of maximum contribution across the modelled grid.

3.3.2 Dioxin Concentration in Chicken Meat

The following formula was used to estimate the potential Dioxin concentration in chicken meat due to ingestion of soil and grain by free-range chickens reared in the locality:

Equation 5 The Intake of Dioxin in Chicken Meat Due to Foraging on Contaminated Soil

$$A_{Chicken} = \left(\sum \left(F_i \times Qp_i \times P_i\right) + Q_s \times C_s \times B_s\right) \times Ba_{Chicken}$$

Where:

- $A_{Chicken}$ = Concentration of Dioxin in chicken meat based on Dioxin deposition at the point of maximum contribution;
- F_i = Fraction of grain grown on contaminated soil and ingested by chickens – assumed to be 1.0;
- Qp_i = Quantity of grain ingested by chickens – assumed to be 0.2 (US EPA HHRAP);
- P_i = Concentration of Dioxin in grain – derived from the equation in Section 3.3.1 above;
- Q_s = Quantity of soil ingested by chickens – assumed to be 0.022 kg day^{-1} (US EPA HHRAP);
- C_s = Maximum annual average incremental increase in Dioxin concentration in soil at the point of maximum contribution – estimated by modelling to be 0.00043 ng kg^{-1};
- B_s = Soil bioavailability factor – assumed to be 1.0 (US EPA HHRAP);
- Ba_{egg} = Biotransfer factor for chicken carcase – assumed to be 1.09984 (US EPA HHRAP Database).

Using the above equations, a value of approximately 1.9 x 10^{-11} mg kg^{-1} (about 0.019 pg kg^{-1}) of fresh meat was derived for the Dioxin concentration in chicken meat due to the foraging for food on soil at the point of maximum contribution with an incremental annual average increase in Dioxin concentration in the soil, due to the operation of the Enviroparks facility, of 0.00043 ng kg^{-1}.

3.3.3 Dietary Intake Due to the Combined Consumption of Chicken Meat and Eggs

Data from the National Diet and Nutrition Survey rolling programme gave the following dietary intakes of eggs and chicken for adults and infants in the UK:

Table 1 UK Data on the Consumption of Eggs and Chicken

Food Category	UK Adult Mean (g/kg BW/day)	UK Infant Mean (g/kg BW/day)
Poultry Meat	0.54	1.90
Eggs	0.29	0.69

The above figures are based upon the average values for men and women, and boys and girls, to give an overall average for an adult or infant member of the population. The values relate to the average daily consumption of eggs and chicken meat in terms of g/kg body weight/day, and the values are derived from the rolling programme of the National Diet and Nutrition Survey, years 1 – 4 (2008 – 2012)[(2)].

The values in Table 7 are the average values for consumption of eggs and chicken by males and females, normalised for daily consumption on the basis of an average adult weighing 70 kg, and an average child weighing 14.5 kg, in line with the US EPA HHRAP approach. The National Nutrition and Diet Survey covers adults between the ages of 19 and 64, and the data for infants relate to children aged between 4 years and 10 years.

For home-reared or allotment-reared eggs and poultry meat, it is unlikely that meat consumption rates would be as high as those for eggs, as the birds are the source of the eggs. Accordingly, the majority of poultry meat consumed is likely to have come from sources outside the area, and the assessment is likely to overestimate considerably the potential impact of poultry meat consumption.

When the dietary intake data are combined with the estimated Dioxin concentration data for eggs and chicken meat calculated above for the point of maximum contribution across the modelled grid, the following daily intake values were derived for adults with a body weight of 70 kg, and infants with a body weight of 14.5 kg:

Table 8 Dietary Intake of Dioxins via the Consumption of Eggs and Chicken Reared at the Location of the Maximum Process Contribution

Food Category	UK Adult Mean	UK Infant Mean
Food Type	**pg day^{-1}**	
Chicken	0.0007	0.00053
Eggs	0.00022	0.00011
Food Type	**Percentage of Tolerable Daily Intake (2 pg kg^{-1})**	
Chicken	0.036%	0.026%
Eggs	0.011%	0.0055%

As can be seen in the above table, the estimated daily intake of Dioxins due to the consumption of chicken meat, arising from the maximum incremental annual average increase in Dioxin concentration in the soil of 0.00043 ng kg^{-1}, represent values that are less than 0.05 % of the Tolerable Daily Intake value of 2 pg kg^{-1} day^{-1}. The values for egg consumption are generally about three to five times lower than those for the consumption of chicken meat, and an order of magnitude lower than the results determined in the 2017 assessment(8).

As stated earlier, it is likely that the consumption of chicken meat would be significantly lower under this scenario as the chickens reared by local residents would likely be required to supply eggs, and therefore a significant proportion of the chicken meat consumed would very likely be sourced from outside of the area. Furthermore, the assessment is based upon a worst-case scenario with emissions at an ELV of 0.04 ng Nm^{-3} recommended by the revised BREF Note for Waste Incineration. However, when operational, emissions of Dioxins from the facility are expected to be significantly lower than the ELV.

3.4 Exposure from the Dietary Intake of Milk

The potential link between human receptors and the consumption of locally produced milk is not known. Nevertheless, to provide a worst-case basis for assessment, exposure to Dioxins via the consumption of milk has been undertaken.

The US EPA Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities methodology was used to assess the potential exposure to Dioxins arising from emissions from the facility. The equation in Table B-3-11 in Appendix B of the HHRAP was used to determine the concentration of Dioxins in milk at locations in the vicinity of the proposed Enviroparks facility.

The results presented in the following section relate to the deposition rate at the point of maximum contribution across the modelled grid. The assessment assumes that individuals solely obtain their milk supply from cows grazing in the vicinity of the Enviroparks facility, which is unlikely due to the fact that the majority of dairy farms send their milk to a pasteurisation plant for processing and onward distribution. Such plant do not necessarily distribute milk back into the local area.

3.4.1 Dioxin Concentration in Milk

The following formula was used to estimate the potential Dioxin concentration in milk due to ingestion of soil and grass by cows reared at the point of maximum contribution:

Equation 6 The Intake of Dioxin in Milk Due to Grazing on Contaminated Soil

$$A_{milk} = \left(\sum \left(F_i \times Qp_i \times P_i \right) + Q_s \times C_s \times B_s \right) \times Ba_{milk} \times MF$$

Where:

- A_{milk} = Concentration of Dioxin in milk based on Dioxin deposition at the point of maximum contribution;
- F_i = Fraction of forage grown on contaminated soil and ingested by cows – assumed to be 1.0;
- Qp_i = Quantity of forage ingested by cows – assumed to be 13.2 (US EPA HHRAP);
- P_i = Concentration of Dioxin in forage – derived from separate equation below;
- Q_s = Quantity of soil ingested by cows – assumed to be 0.04 kg day^{-1} (US EPA HHRAP);
- C_s = Maximum annual average incremental increase in Dioxin concentration in soil at the point of maximum contribution – estimated by modelling to be 0.00043 ng kg^{-1};
- B_s = Soil bioavailability factor – assumed to be 1.0 (US EPA HHRAP);
- Ba_{milk} = Biotransfer factor for milk – assumed to be 5.499 (US EPA HHRAP Database).

The value of Pi was derived using the equation in Table B-3-9 of Appendix B of the HHRAP:

Equation 7 The Intake of Dioxin in Forage Due to Increase in Soil Concentration

$$P_i = C_s \times Br_{forage}$$

Where:

- P_i = Concentration of Dioxin in forage;
- C_s = Maximum annual average incremental increase in Dioxin concentration in soil at the point of maximum contribution – estimated by modelling to be 0.00043 ng kg^{-1};
- Br_{forage} = Plant-soil bioconcentration factor for forage – assumed to be 0.00455 (US EPA HHRAP Database).

Using the above equations, a value of 1.1×10^{-9} mg kg^{-1} Fresh Weight (FW) basis (1.1 pg kg^{-1}) was derived for the Dioxin concentration in milk due to the grazing of cows on grass and soil at the point of maximum contribution across the modelled grid, with an incremental annual average increase in Dioxin concentration in the soil of 0.00043 ng kg^{-1}, due to the operation of the proposed Enviroparks facility.

3.4.2 Dietary Intake Due to the Consumption of Milk

Data from the National Diet and Nutrition Survey rolling programme gave the following dietary intake of whole milk for adults and infants in the UK:

Table 9 UK Data on the Consumption of Milk

Food Category	UK Adult Mean (g/kg BW/day)	UK Infant Mean (g/kg BW/day)
Whole Milk	0.34	5.93

The above figures are based upon the average values for men and women, and boys and girls between the ages of 4 and 10, to give an overall average for an adult or infant member of the population. The values relate to the average daily consumption of whole milk in terms of g/kg body weight/day, and the values are derived from the rolling programme of the National Diet and Nutrition Survey, years 1 – 4 (2008 – 2012)(2).

The value for whole milk was selected because Dioxins tend to collect in fats and fatty tissue, and thus are likely to be more concentrated in whole milk than in semi-skimmed milk. Therefore, the results represent a worst-case for Dioxin intake via milk consumption. Furthermore, the assessment assumes that the milk is produced by cows grazing at the point of maximum contribution reported across the modelled grid for the whole of the year, which is unrealistic, and highlights further the fact that the assessment represents a worst-case scenario.

The values in Table 9 are the average values for consumption of milk by males and females, and boys and girls between the ages of 4 and 10, normalised for daily consumption on the basis of an average adult weighing 70 kg, and an average child weighing 14.5 kg, in line with the US EPA HHRAP approach.

When the dietary intake data are combined with the estimated Dioxin concentration data for milk calculated above, the following daily intake values were derived for adults and infants:

Table 10 Dietary Intake of Dioxins via the Consumption of Milk Produced at the Location of the Maximum Process Contribution

Food Category	UK Adult Mean	UK Infant Mean
Whole milk	pg day^{-1}	
	0.026	0.094
	Percentage of Tolerable Daily Intake (2 pg kg^{-1})	
	1.3%	4.7%

As can be seen in the above table, the estimated daily intake of Dioxins due to the consumption of potentially contaminated milk, arising from the maximum incremental annual average increase in Dioxin concentration in the soil of 0.00043 ng kg^{-1} at the point of maximum contribution, represents a value that is approximately 1.3 % of the Tolerable Daily Intake for adults and 4.7 % for infants. These values are significantly higher than those for eggs and chicken meat and reflect the fact that Dioxins tend to concentrate in fats and fatty tissues, which includes an animal's lactate system. However, similarly to the results calculated for dietary intake from chicken and eggs, the results are significantly lower than those determined in 2017(8).

The above assessment is based upon the consumption of whole milk, and as such the results probably overestimate the significance of Dioxin intake via the consumption of milk for many people. It should also be noted that this assessment is based upon potential Dioxin deposition at the maximum point of contribution across the modelled grid, and assumes continuous emissions of Dioxins at 0.04 ng Nm^{-3}, for individuals who source all of their milk from animals grazing at this location for the whole of the year. Accordingly, this represents an absolute worst-case assessment for the potential impact of emissions of Dioxins from the facility, on Dioxin intake via the consumption of locally produced milk.

3.5 Exposure from the Dietary Intake Due to Ingestion of Soil

The formula in Table C-1-1 in Appendix C of the US EPA HHRAP was used to estimate the potential intake of Dioxins due to the ingestion of soil in the locality of the Enviroparks facility:

Equation 8 The Intake of Dioxin Due to Ingestion of Soil

$$I_{Soil} = \frac{Cs \times CR_{Soil} \times F_{Soil}}{BW}$$

Where:

- I_{Soil} = Daily intake of Dioxin via soil ingestion based on Dioxin deposition at the location of the maximum process contribution;
- Cs = Maximum incremental increase in Dioxin concentration in the soil due to deposition at the location of the maximum process contribution - estimated by modelling to be 0.00043 ng kg^{-1};
- CR_{Soil} = Consumption rate of soil (US EPA HHRAP Values);
- F_{Soil} = Fraction of soil contaminated by Dioxins – US EPA HHRAP recommends the use of 1.0; and,
- BW = Body weight.

Using the above equation, a Dioxin intake as a result of soil ingestion of 0.00000062 pg kg^{-1} day^{-1} for adults and 0.0000058 pg kg^{-1} day^{-1} for infants was predicted at the location of the maximum process contribution, due to the operation of the Enviroparks facility. These values represent approximately 0.000031% and 0.00029% respectively of the TDI of 2 pg day^{-1} and are considered to be negligible.

3.6 Exposure from Dioxin Intake Due to the Consumption of Fruit and Vegetables

An assessment for exposure to Dioxins has been undertaken for the consumption of fruit and vegetables in order to represent a scenario where local residents are obtaining their dietary intake of fruit and vegetables from plants grown in soil that could potentially be contaminated by Dioxins in the emissions from the operation of the Enviroparks facility.

The equation in Table C-1-2 in Appendix C of the HHRAP methodology was used to estimate the daily intake of Dioxins via the consumption of fruit and vegetables:

Equation 9 The Intake of Dioxin in Produce Due to Increase in Concentration in the Soil

$$I_{ag} = \left[\left(\left(Pd \times Pv \times \Pr_{ag}\right) \times CR_{ag}\right) + \left(\Pr \times CR_{pp}\right) + \left(\Pr_{bg} \times CR_{bg}\right)\right] \times F_{ag}$$

Where:

- I_{ag} = Daily intake of Dioxins from the consumption of fruit and vegetables based on Dioxin deposition at the location of the maximum process contribution;
- Pd = Aboveground exposed fruit and vegetables concentration due to direct deposition onto plant surfaces – calculated using Equation B-2-7 in Appendix B of HHRAP methodology;
- Pv = Aboveground exposed fruit and vegetables concentration due to air-to-plant transfer – calculated using Equation B-2-8 in Appendix B of HHRAP methodology;
- Pr_{ag} = Aboveground exposed and protected fruit and vegetables concentration due to root intake – calculated using Equation B-2-9 in Appendix B of HHRAP methodology;
- Pr_{bg} = Belowground exposed and protected fruit and vegetables concentration due to root intake – calculated using Equation B-2-10 in Appendix B of HHRAP methodology;
- CR_{ag} = Consumption rate of aboveground fruit and vegetables (US EPA HHRAP Value);
- CR_{pp} = Consumption rate of protected aboveground fruit and vegetables (US EPA HHRAP Value);
- CR_{bg} = Consumption rate of belowground fruit and vegetables (US EPA HHRAP Value);
- F_{ag} = Fraction of fruit and vegetables that is contaminated – assumed to be 1.0

3.6.1 Calculation of P_d

Equation B-2-7 in Appendix B of the US EPA HHRAP methodology was used for the calculation of P_d and is as follows:

Equation 10 The Increase in Dioxin Concentration in Aboveground Produce Due to Deposition

$$Pd = \frac{1000 \times Q \times \left(1 - F_v\right) \times \left[Dydp + \left(Fw \times Dywp\right)\right] \times Rp \times \left[1.0 - e^{\left(kp \times Tp\right)}\right]}{Yp \times kp}$$

Where:

- Pd = Concentration of Dioxins in aboveground fruit and vegetables due to direct deposition at the location of the maximum process contribution;
- Q = Dioxin emission rate;
- F_v =Fraction of Dioxin in the vapour phase – US EPA HHRAP value for Dioxins = 0.664;
- Dydp = Unitised yearly average dry deposition from particulate phase – ADMS modelling;
- Fw = Fraction of Dioxin that adheres to plant surfaces – US EPA HHRAP value = 0.6 for organics;
- Dywp = Unitised yearly average wet deposition from particulate phase – ADMS modelling;

- Rp = Interception fraction of the edible portion of the plant – US EPA HHRAP value = 0.39;
- Kp = Plant surface loss coefficient – US EPA HHRAP value = 18;
- To = Length of plant exposure to deposition per harvest of edible portion of plant – US EPA HHRAP value = 0.16;
- Yield of standing crop biomass of the edible portion of the plant (productivity) – US EPA HHRAP value = 2.24.

Using the above equation, a value of 5.99 x 10^{-12} mg Dioxin per kg Dry Weight was obtained for P_d at the location of the maximum process contribution.

3.6.2 Calculation of P_v

Equation B-2-8 in Appendix B of the US EPA HHRAP methodology was used for the calculation of P_v and is as follows:

Equation 11 The Increase in Dioxin Concentration in Aboveground Produce Due to Air-Plant Transfer

$$Pv = Q \times F_v \times \frac{Cyv \times Bv_{ag} \times Vg_{ag}}{\rho_a}$$

Where:

- Pv = Concentration of Dioxins in aboveground fruit and vegetables due to air-to-plant transfer;
- Q = Dioxin emission rate;
- F_v =Fraction of Dioxin in the vapour phase – US EPA HHRAP value for Dioxins = 0.664;
- Cyv = Unitised annual average atmospheric concentration – ADMS modelling;
- Bv_{ag} = Dioxin air-to-plant Biotransfer factor for above-ground fruit and vegetables – US EPA HHRAP value = 6.55 x 10^{-4};
- Vg_{ag} = Empirical correction factor for aboveground fruit and vegetables – US EPA HHRAP value = 0.01;
- P_a = Density of air (1,200 g m^{-3}).

Using the above equation, a value of 7.76 x 10^{-11} mg Dioxin per kg Dry Weight was obtained for P_v at the location of the maximum process contribution.

3.6.3 Calculation of Pr_{ag}

Equation B-2-9 in Appendix B of the US EPA HHRAP methodology was used for the calculation of Pr_{ag} and is as follows:

Equation 12 The Increase in Dioxin Concentration in Aboveground Produce Due to Root Intake

$$\mathrm{Pr}_{ag} = Cs \times Br_{ag}$$

Where:

- Pr_{ag} = Concentration of Dioxins in aboveground fruit and vegetables due to root intake;
- Cs = Incremental increase in Dioxin concentration in the soil at the location of the maximum process contribution over exposure period;
- Br_{ag} = Plant-soil bioconcentration factor for aboveground fruit and vegetables – US EPA HHRAP value for Dioxins = 0.00455.

Using the above equation, a value of 2.0 x 10^{-12} mg Dioxin per kg Dry Weight was obtained for Pr_{ag} at the location of the maximum process contribution.

3.6.4 Calculation of Pr_{bg}

Equation B-2-10 in Appendix B of the US EPA HHRAP methodology was used for the calculation of Pr_{bg} and is as follows:

Equation 13 The Increase in Dioxin Concentration in Belowground Produce Due to Deposition

$$\mathrm{Pr}_{bg} = Cs \times Br_{rootveg} \times Vg_{rootveg}$$

Where:

- Pr_{bg} = Concentration of Dioxins in belowground fruit and vegetables due to root intake;
- Cs = Incremental increase in Dioxin concentration in the soil at the location of the maximum process contribution over exposure period;
- $Br_{rootveg}$ = Plant-soil bioconcentration factor for belowground fruit and vegetables – US EPA HHRAP value for Dioxins = 1.03;
- $Vg_{rootveg}$ = Empirical correction factor for belowground fruit and vegetables – US EPA HHRAP value = 0.01.

Using the above equation, a value of 4.5 x 10^{-12} mg Dioxin per kg Dry Weight was obtained for Pr_{bg} at the location of the maximum process contribution.

3.6.5 Calculation of Dioxin Intake from the Consumption of Fruit and Vegetables

Equation C-1-2 in Appendix C of the US EPA HHRAP methodology was used to calculate the overall intake of Dioxins due to the consumption of fruit and vegetables:

Equation 14 The Daily Intake of Dioxins Due to the Consumption of Fruit and Vegetables

$$I_{ag} = \left[\left(\left(Pd \times Pv \times \mathrm{Pr}_{ag}\right) \times CR_{ag}\right) + \left(\mathrm{Pr} \times CR_{pp}\right) + \left(\mathrm{Pr}_{bg} \times CR_{bg}\right)\right] \times F_{ag}$$

Where:

- I_{ag} = Daily intake of Dioxins from the consumption of fruit and vegetables based on Dioxin deposition at the location of the maximum process contribution;
- P_d = Aboveground exposed fruit and vegetables concentration due to direct deposition onto plant surfaces – calculated using Equation B-2-7 in Appendix B of HHRAP methodology = 5.99 x 10^{-12} mg/kg-day DW;
- P_v = Aboveground exposed fruit and vegetables concentration due to air-to-plant transfer – calculated using Equation B-2-8 in Appendix B of HHRAP methodology = 7.76 x 10^{-11} mg/kg-day DW;
- Pr_{ag} = Aboveground exposed and protected fruit and vegetables concentration due to root intake – calculated using Equation B-2-9 in Appendix B of HHRAP methodology = 2.0 x 10^{-12} mg/kg-day DW;
- Pr_{bg} = Belowground exposed and protected fruit and vegetables concentration due to root intake – calculated using Equation B-2-10 in Appendix B of HHRAP methodology = 4.5 x 10^{-12} mg/kg-day DW;
- CR_{ag} = Consumption rate of aboveground fruit and vegetables (US EPA HHRAP Value) = 0.00047 kg/kg-day DW for adults and 0.00113 kg/kg-day DW for children;
- CR_{pp} = Consumption rate of protected aboveground fruit and vegetables (US EPA HHRAP Value) = 0.00064 kg/kg-day DW for adults and 0.00157 kg/kg-day DW for children;
- CR_{bg} = Consumption rate of belowground fruit and vegetables (US EPA HHRAP Value) = 0.00017 kg/kg-day DW for adults and 0.00028 kg/kg-day DW for children;
- F_{ag} = Fraction of fruit and vegetables that is contaminated – assumed to be 1.0

Using the above equation, a value of 0.00004 pg kg^{-1} Dioxin per kg Dry Weight for adults was obtained for I_{ag}, the dietary intake via the consumption of fruit and vegetables grown at the location of the maximum process contribution, and a value of 0.0001 pg kg^{-1} Dioxin per kg Dry Weight for children. These results are approximately 5 – 6 times lower than the results obtained in 2017(8).

3.7 Combined Dietary Intake via the Consumption of Chicken and Eggs, Milk, Fruit and Vegetables and the Ingestion of Soil

When the results from the above calculation procedures for dietary intake of Dioxins are added together with the estimated intake via inhalation, the following results are obtained:

Table 11 Intake of Dioxins at the Location of Maximum Process Contribution

Food Category	UK Adult Mean (pg kg^{-1})	UK Infant Mean (pg kg^{-1})
Chicken	0.0007	0.00053
Eggs	0.00022	0.00011
Whole Milk	0.026	0.094
Soil Ingestion	0.00000062	0.0000058
Fruit and Vegetables	0.00004	0.00010
Inhalation	0.00242	0.003
Total	**0.03**	**0.10**

Table 12 Intake of Dioxins at the Location of Maximum Process Contribution as a Percentage of the Tolerable Daily Intake

Food Category	UK Adult Mean	UK Infant Mean
Chicken	0.036%	0.026%
Eggs	0.011%	0.0055%
Whole Milk	1.3%	4.7%
Soil Ingestion	0.000031%	0.00029%
Fruit and Vegetables	0.002%	0.005%
Inhalation	0.12%	0.15%
Total	**1.5%**	**4.9%**

The results presented in Tables 11 and 12 represent a worst-case estimate, based upon Dioxin deposition rates due to emissions at the revised BREF Note for Waste Incineration ELV (0.04 ng Nm^{-3}), at the point across the modelled grid which received the maximum process contribution from the proposed Enviroparks facility. This is not a discrete sensitive receptor and as such, it is highly unlikely that any individual would ever be subject to such exposure. It is also assumed that total dietary intake of eggs, chicken meat, milk, and fruit and vegetables is derived from produce grown at that specific location.

Nevertheless, the results show that the potential impact of Dioxin release from the proposed Enviroparks facility on Dioxin concentrations in the soil, and on the associated increase in dietary intake through the consumption of eggs, chicken meat, fruit and vegetables, as well as via the ingestion of soil through working of the land or play at this point, is likely to be well below the recommended Tolerable Daily Intake of 2 pg kg^{-1} day^{-1}, and is also significantly reduced from the previous assessment in 2017, which confirmed total contributions at one of the discrete receptors (the House at the Penderyn Reservoir) would equate to 11 % of the TDI for adults, and approximately 28 % of the TDI for children.

As such, this latest assessment confirms that, due to the reduced Emission Limit Value that will be applied to emissions of Dioxins and Furans at the site, and the increase in stack height, the contribution of Dioxins and Furans to local sensitive receptors is significantly reduced.

It should be noted that in defining a TDI of 2 pg kg^{-1} for Dioxins, the Committee on Toxicity acknowledged the uncertainties associated with the approach:

We concluded that the available human data did not provide a sufficiently rigorous basis for establishment of a tolerable intake. This was because:

- *The epidemiological studies do not reflect the most sensitive population identified by animal studies,*
- *There are considerable uncertainties in the exposure assessments and inadequate allowance for confounding factors;*

- *The patterns of exposure did not reflect exposures experienced in the general UK population, which are mainly from diet.*
- *We therefore found it necessary to base our evaluation on the data from studies conducted in experimental animals.*

Accordingly, the results from this assessment, which are based upon a series of overly pessimistic assumptions relating to emissions of Dioxins and the associated deposition, should be viewed within the context that they are low relative to an inexact assessment level. This is particularly the case with regard to the predictions for the consumption of milk. These values reflect the fact that Dioxins tend to concentrate in fats and fatty tissues, and pass through into an animal's lactate system.

The corresponding calculated values for the modelled sensitive receptors local to the Enviroparks facility are shown in Table 13.

Table 13 Exposure to Dioxins at Specific Receptors in the Vicinity of the Enviroparks Facility

Receptor Number	Percentage of Tolerable Daily Intake (Adult)	Percentage of Tolerable Daily Intake (Infant)
26	0.2%	0.4%
27	0.1%	0.2%
28	0.6%	1.7%
29	1.2%	4.0%
30	0.3%	0.7%
31	0.3%	0.9%
32	0.3%	0.8%
33	1.3%	4.4%
34	1.3%	4.2%
35	0.8%	2.7%
36	0.2%	0.5%
39	0.2%	0.4%
40	0.2%	0.6%
41	0.4%	1.2%
42	0.5%	1.5%
43	0.2%	0.5%
44	1.3%	4.3%
45	0.3%	0.9%
46	0.2%	0.6%

The assessment indicates that the risk to the health of the local population due to exposure to Dioxins in emissions from the Enviroparks facility once operational is likely to be very low in comparison to the recommended Tolerable Daily Intake of 2 pg/kg/day.

It should also be remembered that the above results are based upon emissions at the Dioxin ELV of 0.04 ng Nm^{-3} recommended by the revised BREF Note for Waste Incineration, and that when operational, emissions of Dioxins are likely to be significantly lower, with the proportionate benefit of lower exposure levels for individuals living in the vicinity of the site.

When the above exposure data are translated into the associated potential for cancer risk, the following values were obtained.

Table 14 Cancer Risk Due to Exposure to Dioxins at Residential Receptors in the Vicinity of the Enviroparks Facility

Receptor Number	Cancer Risk (Adult)		Cancer Risk (Infant)	
	Risk Level	Increase of 1 in	Risk Level	Increase of 1 in
26	2.22E-07	4,510,993	4.80E-07	2,084,278
27	1.68E-07	5,959,211	3.01E-07	3,318,994
28	7.12E-07	1,405,001	2.17E-06	460,356
29	1.55E-06	645,863	5.09E-06	196,283
30	3.37E-07	2,965,977	8.81E-07	1,135,221
31	4.09E-07	2,444,103	1.12E-06	895,657
32	3.67E-07	2,721,383	9.80E-07	1,020,839
33	1.72E-06	581,805	5.69E-06	175,626
34	1.63E-06	614,433	5.39E-06	185,419
35	1.06E-06	942,854	3.42E-06	292,321
36	2.79E-07	3,588,847	6.86E-07	1,456,691
39	2.36E-07	4,241,580	5.42E-07	1,846,363
40	3.02E-07	3,307,122	7.68E-07	1,301,294
41	5.38E-07	1,858,804	1.57E-06	636,696
42	6.34E-07	1,577,716	1.91E-06	523,579
43	2.58E-07	3,879,499	6.00E-07	1,666,437
44	1.67E-06	600,595	5.53E-06	180,918
45	4.14E-07	2,415,021	1.16E-06	862,120
46	3.06E-07	3,264,501	7.71E-07	1,296,363

The above Cancer Risk estimates represent the incremental probability that an individual, living continuously at a particular receptor location, will develop cancer over that person's lifetime as a result of a specific exposure to Dioxins emitted from the chimney of the Enviroparks facility. The position in the UK at present is that a risk level of 1E-05 is considered to be appropriate for use as the basis for assessment for carcinogenic contaminants such as Dioxins[10 and 11]. Accordingly, the above results can be screened out as insignificant at each of the specified receptors.

It should be noted that the above results are based upon a series of worst-case, conservative assumptions:

- Emissions of Dioxins are at an ELV of 0.04 ng Nm^{-3} recommended by the revised BREF Note for Waste Incineration, which is unlikely as emissions are generally expected to be significantly lower than this value when the Enviroparks facility is operational.
- The HHRAP calculation procedure requires estimates of both dry deposition and wet deposition of Dioxins in both the particulate and vapour phases. It was assumed that total deposition (wet plus dry) was three times the figure for dry deposition. Accordingly, deposition assessments for Dioxins in the particulate phase are likely to significantly overestimate the situation in the vicinity of the development site.
- It is assumed that all of the food consumed by individuals is grown at that location, which is highly unlikely given the probability that for the majority of the population food is purchased from supermarkets, or other outlets, and is grown outside of the area; and,
- All of the milk consumed is produced by cows grazing at the specific receptor location for the entire year, which is highly unlikely. Furthermore, the consumption of milk accounts for the vast majority of the estimated dietary intake, due to the propensity for Dioxins to accumulate in fatty body tissue and pass through into the cows' lactate system

Accordingly, the above results are considered to provide an overly conservative assessment of the potential exposure to Dioxins in the vicinity of the Enviroparks facility, and it is expected that emission values will be significantly lower when the facility is operational.

To put the Cancer Risk data into perspective, information is presented below relating to risk of death from a range of causes[12].

Table 15 Risk of an Individual Dying in Any One Year

Activity	Risk
Smoking 10 cigarettes a day	1 in 200
All natural causes, age 40	1 in 850
All violence and poisoning	1 in 3,300
Influenza	1 in 5,000
Accident on the road	1 in 8,000
Leukaemia	1 in 12,000
Accident at home	1 in 26,000
Accident at work	1 in 43,000
Murder	1 in 100,000
Accident on railway	1 in 500,000
Hit by lightning	1 in 10,000,000
Radiation from nuclear reactor	1 in 10,000,000

These values are not absolute, but indicative, and enable the Cancer Risk estimates to be viewed in perspective with other activities that individuals may be associated with. As can be seen, when compared to the Cancer Risk scores for Receptor Number 33, the residential receptor with the highest Dioxin deposition rate, (approximately 1 in 581,800 for adults), the risk of dying in a road traffic accident more than seventy times higher than the risk of developing cancer due to exposure to Dioxins released from the Enviroparks facility once operational.

3.8 Combined Effect of Dioxins, Furans and Dioxin-Like PCBs

Within the revised BREF Note for Waste Incineration and the associated BAT Conclusions document[3], Poly Chlorinated Biphenyls (PCBs) are provided with a release rate which is combined with Dioxins and Furans, increasing the Dioxin and Furan ELV from 0.04 ng Nm^{-3} to 0.06 ng Nm^{-3} for Dioxins, Furans and Dioxin-like PCBs. Therefore, an assessment of the impact of these combined species can be undertaken simply by multiplying the impact of Dioxins by 1.5, as presented below.

Table 2 Exposure to Dioxins and Dioxin-Like PCBs at Specific Receptors in the Vicinity of the Enviroparks Facility

Receptor Number	Percentage of Tolerable Daily Intake (Adult)	Percentage of Tolerable Daily Intake (Infant)
26	0.3%	0.6%
27	0.2%	0.4%
28	0.8%	2.5%
29	1.8%	5.9%
30	0.4%	1.0%
31	0.5%	1.3%
32	0.4%	1.1%
33	2.0%	6.6%
34	1.9%	6.3%
35	1.2%	4.0%
36	0.3%	0.8%
39	0.3%	0.6%
40	0.4%	0.9%
41	0.6%	1.8%
42	0.7%	2.2%
43	0.3%	0.7%
44	1.9%	6.4%
45	0.5%	1.4%
46	0.4%	0.9%

3.9 Assessment Relative to the European Food Standards Agency's Recommended Tolerable Weekly Intake Value of 2 pg/kg/Week

The European Food Standards Agency (EFSA) recently published its scientific opinion on the risks for animal and human health related to the presence of Dioxins (PCDD/Fs) and Dioxin-like-PCBs in feed and food(7), and recommended a Tolerable Weekly Intake (TWI) value of 2 pg/kg/week. Although this has yet to be formally adopted by the UK Committee on Toxicity(13), the Dioxin health risk assessment has been adapted to consider the impact of emissions of Dioxins and Dioxin-like PCBs relative to the EFSA TWI of 2 pg/kg/week.

The assessment was based upon the combined emissions of Dioxins and Dioxin-like PCBs at the revised BREF and BAT Conclusions document value of 0.06 ng Nm^{-3}, which will be the maximum allowed under the conditions of the environmental permit to be issued by NRW prior to commissioning. It was also assumed that the weekly average intake was seven times the daily intake, and so the values in Table 16 were increased accordingly.

Table 17 Exposure to Dioxins and Dioxin-like PCBs at Specific Receptors in the Vicinity of the Enviroparks Facility Relative to the EFSA TWI of 2 pg/kg/Week

Receptor Number	Percentage of the EFSA Weekly Tolerable Daily Intake (Adult)	Percentage of the EFSA Weekly Tolerable Daily Intake (Infant)
26	2%	4%
27	1%	2%
28	6%	18%
29	13%	42%
30	3%	7%
31	3%	9%
32	3%	8%
33	14%	47%
34	13%	44%
35	9%	28%
36	2%	6%
39	2%	4%
40	2%	6%
41	4%	13%
42	5%	16%
43	2%	5%
44	14%	45%
45	3%	9%
46	3%	6%

As can be seen the weekly average intake values at all of the nearby sensitive receptor locations are well below EFSA's recommended TWI of 2 pg/kg/week. Values for adults reach a maximum of approximately 14 % of the TWI, and values for infants peak at approximately 47 % of the TWI.

The results from the assessment indicate that the risk to the health of the local population due to exposure to Dioxins and Dioxin-like PCBs in emissions from the Enviroparks facility once operational will be low in comparison to EFSA's recommended Tolerable Weekly Intake of 2 pg/kg/week.

6. Conclusions

A health impact assessment has been undertaken to assess the risk to the health of people living and working in the vicinity of the proposed Enviroparks resource recovery and energy production plant to be developed on the Hirwaun Industrial Estate near Hirwaun. Although the site already has planning consent for the scheme, and earlier Health Impact Assessments have confirmed that there is no significant health risk associated with potential exposure to emissions of pollutants from the plant, proposed changes to the scheme require an application to amend the extant consent and hence the Dioxin and Furan Health Impact Assessment has been reviewed and updated to confirm the earlier conclusions.

All of the activities associated with the EWL facility will take place within fully enclosed buildings, minimising the potential for the fugitive release of pollutants from process areas. The principal sources of emissions to atmosphere are those from the three gasification lines and energy recovery process with associated discharges to atmosphere via 90 m high flues.

Emissions from the three gasification lines will be discharged through individual flues, co-located within a single chimney structure, and will include pollutants associated with both acute effects (noticeable effects soon after exposure), such as Oxides of Nitrogen, Sulphur Dioxide, particulate matter and Hydrogen Chloride, or chronic effects (noticeable effects after prolonged exposure), which might include Volatile Organic Compounds, heavy metals such as Lead, Polycyclic Aromatic Hydrocarbons (PAH), or Dioxins and Furans.

Detailed atmospheric dispersion modelling of emissions from the 90 metre high chimney was undertaken using the ADMS Version 5.2 model to predict increases in pollutant concentrations at nearby sensitive receptors such as residential properties, schools, playing fields and locations where people may congregate for significant periods of time. The US EPA Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities was then applied to assess the potential risk to the health of people living and working in the locality of the facility due to emissions of Dioxins and Furans, and Dioxin-like PCBs. The assessment considered the potential health risks associated with the intake of Dioxins from the consumption of potentially contaminated foodstuffs due to emissions to atmosphere from the chimney of the Enviroparks facility. The assumptions used within the assessment are conservative and therefore the study was undertaken on a conservative worst-case basis.

The assessment indicates that the risk to health of the local population due to exposure to Dioxins in emissions from the facility is likely to be very low, and at 15 out of 19 receptors equates to less than 1 % of the Tolerable Daily Intake (TDI) of 2 pg/kg for adults and less than 2.5 % of the TDI for children at 14 locations out of 19. A similar assessment undertaken in 2017 calculated exposure at the same receptors equating to as much as approximately 19 % for adults and approximately 46 % for children. However, the proposed amendments to the scheme which include a regulated reduction in the emission concentrations of Dioxins, Furans and PCBs, as stipulated by the revised BREF and BAT Conclusions document, and an increase in the height of the discharge point for the emissions, has resulted in a significant reduction in the potential impact of these pollutants.

When the combined emissions of Dioxins, Furans and Dioxin-like PCBs was considered in relation to the European Food Standards Agency’s recommended Tolerable Weekly Intake (TWI) value of 2 pg/kg/week, the results showed that Process Contributions due to the operation of the Enviroparks facility were likely to be a small percentage of the TWI, being less than 7 % in all cases.

Additionally, when considering the impacts against the proposed Tolerable Weekly Intake (TWI) value of 2 pg/kg/week, the risk to health of the local population due to exposure to Dioxins, Furans and Dioxin-like PCBs in emissions from the facility, remained within 50 % of the TWI.

In conclusion, the results from the health impact assessment confirm that there is no significant health risk associated with potential exposure to emissions of pollutants from the proposed Enviroparks facility to be located on the Hirwaun Industrial Estate in South Wales.

7. References

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APPENDIX 8.1

Landscape and visual methodology

Chapter Eight
APPENDIX 8.1

LANDSCAPE AND VISUAL METHODOLOGY

8.1 This assessment has been undertaken in accordance with:

- **The Guidelines for Landscape and Visual Impact Assessment** (third edition), published April 2013 by the Landscape Institute and Institute of Environmental Management and Assessment; and

- **Photography and Photomontage in Landscape and Visual Impact Assessment** (Advice Note 01/11), published February 2011 by the Landscape Institute and **Visual Representation of Development Proposals** TGN 06/19 published Sept 2019 by the Landscape Institute.

8.2 The assessment considers two separate (but inter-related) components:

- Effects on **the Landscape**; and

- Effects on **Views**.

8.3 As the two components are inter-related, the assessment of one has been undertaken alongside the other and this resultant document referred to as the **Landscape and Visual Impact Assessment (LVIA)**.

8.4 The assessment process aims to:

- Establish the baseline situation;

- Identify potential sources of direct and indirect impact;

- Identify impact receptors and estimate their sensitivity;

- Estimate the magnitude and nature of effects;

- Appraise alternatives and indicate additional/alternative measures of impact avoidance, mitigation or offset, where possible;

- Re-estimate the magnitude and nature of effects; and
- Provide an assessment of the significance of the mitigated effects and relate this back to the relevant Landscape Planning Policies.

8.5 In the presentation of this assessment, item 5 in the list above has been summarised only, in the interests of conciseness, i.e. the assessment of alternativeness is not presented in detail within this report.

8.6 The assessment includes a combination of objective and subjective judgements. Subjective judgements are avoided where possible, focussing on what would be *experienced* rather than making assumptions regarding people's expected *responses*.

8.7 The assessment allows for worst-case scenarios, although indications are given as to the effects under 'normal conditions' also, e.g. seasonal effects of vegetation.

8.8 No specific assessment has been made, in this report, of impacts on the historic landscape character of the area or any cultural heritage receptors such as Conservation Areas, Scheduled Monuments and Listed Buildings.

8.9 The detailed assessment process and terminology used is **specific to this assessment**. This is further described below with the intended meaning of some specific terms explained in the glossary provided.

BASELINE SITUATION – GENERAL

8.10 Both the landscape and visual assessment components have been undertaken against a set of Baseline Conditions (the **Baseline Situation**), which has been established during the first stage of the assessment process, using a combination of desk study and field survey work. This provides a transparent basis from which assessment results have been determined and against which professional judgements have been made.

8.11 The baseline used may be different for the landscape and visual impact assessment of specific development proposals assessed:

- In isolation (i.e. where development is assessed on its own merits); and
- Where applicable, in combination with other developments creating a similar effect (i.e. the cumulative landscape and visual effects of a number of similar developments).

8.12 The baseline used has been detailed in the assessment assumptions, in the relevant section.

8.13 The study of the Baseline Situation includes a review of available document sources (e.g. published Landscape Character Assessments, landscape policy guidance), Ordnance Survey map data, historical maps, aerial photographs and the undertaking of a field survey.

8.14 During the field survey, the principal landscape elements and features were recorded which, depending on their prominence and importance, contribute to the overall character of the area. Typical elements may include landform, land use, watercourses, vegetation, built development/infrastructure and routes or areas of public access.

8.15 A check of the likely visibility of the development proposals is also made during the field survey, with a photographic record made and visual receptor information noted.

BASELINE SITUATION – LANDSCAPE ASPECTS

8.16 A description of the landscape characteristics is provided in relation to the Site itself and the surrounding landscape with reference to the published LANDMAP aspect areas.

Baseline Situation – Visual Aspects

Zones of Theoretical Visibility (ZTVs)

8.17 The visual baseline includes examination of the visibility of the existing Site and the proposals using ZTV computer analyses and the use of photographic records from field studies, limited to an area within which there lies the potential for significant visual effects to occur. The main study area for this assessment covers an area up to a distance of circa 5 kilometres from the Site boundary.

8.18 The ZTV examinations have been determined using a combination of computer-aided ground modelling software and 3D Ordnance Survey data (allowing for buildings, woodland blocks, curvature of the earth and atmospheric refraction). The ZTV does not take into account other topographical features such as tree belts, individual trees and hedgerows.

Viewpoints

8.19 During the field study, which was undertaken in December 2016, a photographic record was made to represent the range of potential views towards the Site, from available viewpoints within the study area. These locations are mapped, the visual receptor types recorded and viewpoint landscape context described. No access to private properties has been obtained during the field study. The area was visited again during April 2020 to establish that the landscape and development context had remained largely unchanged and where minor changes to the development context occurred (as set out in Chapter 2 of this Addendum) these minor changes would have no material impact upon the assessment of landscape and visual effects.

8.20 The photographs have been taken using a Canon EOS 5D SLR camera using a 50mm focal length (35mm format equivalent) lens. From the record of identified visual receptors and general visibility viewpoints have been determined and used in the assessment process. These have been included to reflect the locations which represent a range of available views and which are typically representative of views that may have the potential to incur significant visual effects.

8.22 The photographs used to illustrate the assessment have been 'stitched' together using digital imaging software to provide a 'panorama image', thus providing a visual context to the focus of the centre photograph. The photographs have been corrected for lens distortion and to correct changes of scale across the photograph and a cylindrical projection used to ensure consistency of scale across the panorama, vertically and horizontally when viewed on printed paper.

General

8.23 Landscape receptors can be described in a number of ways. Landscape effects derive from changes to landscape receptors which include the physical landscape (**landscape elements**), which may give rise to change in how the landscape is experienced. These individual contributors to landscape character are termed '**landscape characteristics'**. Areas with similar landscape characteristics can be described as having a certain **landscape character** or of being a particular **Landscape Character Type (LCT)**. Where these are specific to a geographical area they are referred to as **Landscape Character Areas (LCAs)**. These can be described and categorised at different scales depending on criteria used. LANDMAP (the National Landscape Character Assessment for Wales) contains Aspect Areas within the 5 layers that are described in more detail within the LVIA Chapter.

8.24 The context of a location, in its wider setting, can influence the experience of the landscape and therefore its landscape character. Therefore, changes in the landscape character at one location can potentially affect the context of another landscape character type. In certain situations this can have an effect on the setting of valued or important landscape elements.

8.25 The landscape impact assessment describes the likely nature and scale of changes to individual landscape elements and characteristics and the consequential effect on the landscape character in relation to the development site itself and on the wider landscape. Due to the inherently dynamic nature of the landscape, it can be accepted that change arising from a development may not necessarily be significant.

LANDSCAPE SENSITIVITY

8.26 **Landscape sensitivity** can vary for landscape characteristics and landscape character. The specific sensitivity of landscape character to change is referred to as **landscape character sensitivity**.

8.27 Landscape (character) sensitivity relates to the combination of:

- The (non-monetary) **value** of the landscape receptors, which is established at the baseline stage; and
- The **susceptibility** of the landscape receptors to change in relation to the Proposed Development.

Landscape Value

8.28 Value of landscape receptors is affected by a number of factors and the values are attributed in accordance with the LANDMAP published assessment evaluations contained at Appendix 8.2 as follows:

Outstanding = Very High
High = High
Moderate = Medium
Low = Low (or Very Low)

Landscape Susceptibility

8.29 Susceptibility refers to the ability of landscape receptors to accommodate changes brought about by the Proposed Development. Relevant criteria are provided in Table 11.

Table 11: Susceptibility to Change of Landscape Receptors

Susceptibility	Relevant Criteria
Very High	Key landscape characteristics highly susceptible to change and very difficult to replace without affecting the existing character. Strong landscape structure with many distinct characteristics worthy of conservation.
High	Landscape characteristics susceptible to change and fairly difficult to mitigate without affecting the existing character. Typically of recognisable landscape structure and some features worthy of conservation.
Medium	Landscape characteristics with a degree of susceptibility to change; some scope to replace these elements without adversely affecting the character. Distinguishable landscape structure, few or no features worthy of conservation; may contain occasional detracting
Low	Landscape characteristics of low susceptibility to change or easily replaced and potentially enhanced. Weak landscape structure or transitional in nature; some evidence of degradation and a number of detracting features.
Very Low	Landscape characteristics are not susceptible to change. High probability to mitigate or replace the lost elements and to enhance the existing landscape. Damaged landscape structure, evidence of severe disturbance or dereliction; detracting features dominate.

Assessment of Landscape Sensitivity

8.30 Landscape Susceptibility and Landscape Value are then assessed in combination to provide an overall rating in terms of Landscape Sensitivity, with professional judgement applied. Typical examples include where a Medium Susceptibility and a Medium Landscape Value results in a Medium Landscape Sensitivity. A High Susceptibility and Low Landscape Value typically result in a Medium Sensitivity and a High Susceptibility and a High Landscape Value would typically result in a High Landscape Sensitivity.

Magnitude of Landscape Effects

8.31 The Magnitude of change is concerned with the scale of change to the landscape characteristics, the geographical extent of this change and the duration/reversibility of the changes. The magnitude of landscape effects have been categorised as follows in Table 12.

Table 12: Magnitude of Landscape Effects

Magnitude of Landscape Effect	Landscape Criteria
Very Large	Typically, large scale changes and/or numerous changes to important landscape characteristics
Large	Typically, large scale changes to some landscape characteristics, or a high number of medium scale changes to the landscape characteristics
Medium	Typically, some medium scale changes to some landscape characteristics
Small	Typically, a low number of medium scale changes to landscape characteristics, or a number of small scale changes to landscape characteristics
Very Small	Typically, occasional, small scale changes to unimportant landscape characteristics

8.32 In general, the duration weighting applied to magnitude is as follows:

- Very Long term effect: 15+ years
- Long term effect: 8 to 15 years
- Medium term effect: 3 to 8 years
- Short term effects: 1.5 to 3 years
- Temporary effect: Less than 18 months

8.33 Where variations between relevant criteria, duration etc. occur, reasoned professional judgement is applied and described in the assessment to determine the magnitude of effect.

NATURE AND SIGNIFICANCE OF LANDSCAPE EFFECT

8.34 Changes to landscape characteristics can be of a **positive**, **negative** or **neutral** nature. The determination of the nature of effect on landscape receptors is related to the Baseline Situation and what is recognised to be either a desirable or an undesirable change (e.g. from assessments of landscape quality, landscape policy guidance). A neutral effect may occur, for example, if a characteristic element is replaced with a different but equally characteristic element. Therefore, it is possible for there to be a large magnitude of change but with a neutral effect overall. All effects are considered to be **negative** unless otherwise stated.

8.35 The significance of a landscape effect (from an impact) is a function of the sensitivity of the affected landscape receptor, the magnitude of change and the nature of effect. While the methodology is designed to be robust and transparent, professional judgement is ultimately applied to determine the significance of each effect.

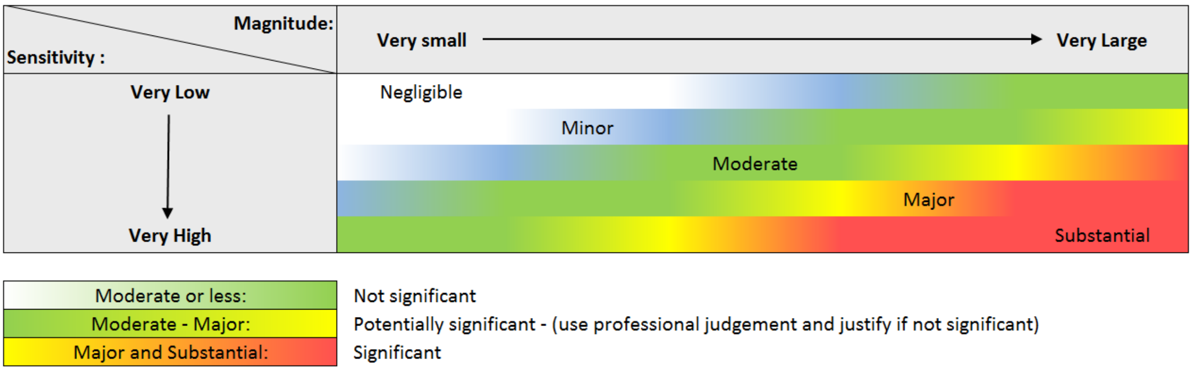
8.36 The degree of landscape significance is defined in Table 12 below. These are different for beneficial and adverse effects. Generally, an effect, which is greater than 'Moderate', is likely to be Significant and a 'material consideration' in the decision-making process.

Table 13: Significance of Landscape Effects

Significance	Adverse Landscape Effects	Beneficial Landscape Effects
Negligible	Overall, typically, there may be some Small scale, Short-term impacts but virtually no lasting adverse effect on existing landscape character.	Overall, typically, there may be some Small scale Short-term positive impacts but virtually no lasting beneficial effect on existing landscape character
Minor	Typically: Some Small-Medium scale effects on existing landscape character in poor condition. Very Small or Temporary changes to Medium sensitivity landscape. Minimal effect on landscape character.	Overall, typically, landscape character and condition is slightly improved via strengthening of some valued characteristic landscape elements for a Long-term duration, in high and Very High sensitivity landscapes where limited scope to provide improvement exists, or Some shorter duration improvements to landscapes of lower sensitivity
Moderate	Typically: Large scale and Long term changes to landscapes and/or landscape receptor of low sensitivity. Some Medium scale changes to Medium sensitivity landscape and/or landscape receptor. Very Small or Temporary changes to highly sensitive landscape and/or landscape receptor. Noticeable effect on the landscape and/or landscape receptor without exceeding the landscape capacity threshold.	Overall, typically, landscape character and condition is improved via the introduction of characteristic landscape elements and the removal of incongruous landscape elements: Permanently and greatly in highly sensitive areas; For a number of characteristics for a Medium-Long-term duration in areas of Medium landscape sensitivity; For a small number of characteristics for a Short- Medium-term duration in lower sensitivity landscapes
Major	Typically: Numerous Long-term effects on Medium sensitivity landscape and/or landscape receptor. Small permanent effects on highly sensitivity landscape and/or landscape receptor. Landscape receptor and/or character is affected to a significant degree.	Overall, typically, landscape character and condition is significantly improved via removal of some existing incongruous landscape elements and introduction/restoration of some valued characteristic landscape elements in lower and Medium sensitivity landscapes where much scope to provide improvement exists
Substantial	Proposals are at complete variance with many key characteristics of a very highly valued landscape.	Proposals would remove substantial numbers of existing incongruous landscape elements and introduce a number of highly desirable landscape elements to substantially restore an area of landscape character of high potential landscape value for a Very Long-term period

8.37 The derivation of the level of significance (of effect) uses professional judgement taking into consideration the contributing factors of sensitivity, magnitude and nature of effect and generally follows a pattern by which the relationship between sensitivity and magnitude contributes to the level of significance as shown in **Diagram 1** below. It should be noted that only *Significant* effects need to be determined, not the assessed level of the effect, however it is acknowledged that levels of effects can be a useful aid when reading and understanding the assessment.

Diagram 1: General Relationship Between Magnitude, Sensitivity and Significance



ASSESSMENT OF VISUAL EFFECTS

General

8.38 Visual effects relate to the experienced changes that arise in the composition of available views due to changes in a landscape scene, and to the overall effects with respect to visual amenity. Effects are defined as the relationship between the **visual sensitivity**, the **magnitude of change** and the **nature** of the effect.

Visual Sensitivity

8.39 The sensitivity of the visual receptor will be influenced by the **value** attached to views (which is established at the baseline stage) and the **susceptibility to change**, in relation to the development proposed.

8.40 Judgements on **value** take into account any recognised importance of the view (e.g. in relation to valued landscapes or features, or through planning designations) and any indicators of value attached to views by visitors e.g. guidebooks and tourist maps.

8.41 **Susceptibility to change**, in relation to the development proposed, is influenced by the following factors:

- Location and context of the viewpoint;
- Characteristics of the view, e.g. whether it is continuous or intermittent and static or transient; and
- The activity or expectations of the receptor at the viewpoint.

8.42 In terms of private residential receptors, whilst it is an accepted planning principle that there is 'no right to a view' residents are recognised as having the potential to be particularly susceptible to changes in their visual amenity. Locations (rooms) normally used in waking or daylight hours are usually considered more sensitive than other locations.

8.43 The indicative terminology in Table 14 was used as a guide to describe sensitivity with regard to **visual** receptors.

Table 14: Sensitivity of Visual Receptors

Visual Sensitivity	Value and Susceptibility to Change Criteria	Typical Receptor Types/Locations
Very High	Prominent location or vista with high visual amenity **value** that is recognised in published sources. Very high **susceptibility to change** as a very high level of attention focussed on the landscape and particular views.	Protected View/s recognised in planning policy designation. Private views from primary living space regularly used in daylight hours where the focus is on a landscape of recognised very high value.
High	Well-known area, typically designated for scenic value or otherwise recognised for a high landscape **value**. High **susceptibility to change** as a high level of attention focused on the landscape and particular views.	Users of promoted recreational or well-used footpath routes and open access land where primary enjoyment is from the landscape and visual amenity. Private views from main living space or property curtilage regularly used where the focus is on the landscape of a high value beyond the private curtilage.
Medium	Locations afford views of some **value**, but visual amenity not well recognised beyond locality. Moderate **susceptibility to change** as a moderate level of attention focussed on the landscape and particular views.	Main access routes (road and rail routes) with some landscape interest. Views from recreational sport areas which may involve some incidental appreciation of views of the wider landscape, e.g. golf or fishing. Private views from residential properties from rooms not normally occupied in waking or daylight hours, e.g. bedrooms.

Low	Viewpoint context and location is of lesser **value** than similar views from nearby visual receptors that may be more accessible. Low **susceptibility to change** as low level of attention focussed on the landscape and particular views.	Views from recreational sport areas which does not involve or depend upon appreciation of views of the landscape, e.g. football, rugby, speedway. Minor road routes where passengers would have limited focus on a landscape of no recognised value. People at their places of work where the
Very Low	Viewpoint context is such that views have a very low **value**. Expectations of visual amenity are very low. Activity at viewpoint is incidental to the view.	People at their place of work where there the type of activity has no relationship to the surrounding landscape context.

MAGNITUDE OF VISUAL EFFECTS

8.44 The magnitude or scale of visual change is described by reference to:

- Scale of Change;
- Geographical Extent; and
- The Duration and Reversibility of the effect.

8.45 The Scale of Change takes into account the loss or addition of features in the view and changes in the composition of the view including the proportion of the view occupied by the Proposed Development. The extent of contrast or integration of any new features or changes in the landscape scene with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and texture is also considered.

8.46 The Geographical Extent will vary with different viewpoints and is likely to reflect:

- The angle of view in relation to the main activity of the receptor;
- The proximity of the viewpoint to the Proposed Development; and
- The extent of the area over which the changes would be visible.

8.47 Viewpoint proximity to the Site was classed as follows:

Close-range:	Within 0.5km
Medium-range:	Between 0.5km and 1km
Long-range:	Over 1km

8.48 In general, the Duration and reversibility considerations applied to magnitude are as follows:

- Very Long term effect: 15+ years
- Long term effect: 8 to 15 years
- Medium term effect: 3 to 8 years
- Short term effects: 1.5 to 3 years
- Temporary effect: Less than 18 months

8.49 The terminology in Table 15 was adopted for the definition of magnitude of visual effects:

Table 15: Magnitude of Visual Effects

Magnitude of Visual Effect	Visual Criteria
Very Large	Where the proposals become the only dominant feature in the view and to which all other elements become subordinate. Typically involves direct views at close range over a wide horizontal and vertical extent.
Large	Where the proposals would form a significant and immediately apparent element of the scene and would affect the overall impression of the view. Typically involves direct or oblique views at close range with notable changes over the horizontal and vertical extent.
Medium	Where proposals would form a visible and recognisable new development but where it is not intrusive within the overall view. Typically involves direct or oblique views at medium range with a moderate horizontal and/or vertical extent of the view affected.
Small	Where proposals constitute only a minor component of the wider view, where awareness does not affect the overall quality of the scene. Typically involves an oblique view at medium or long range or a direct view at long range with a small horizontal/vertical extent of the view affected.
Very Small	Where only a very small part of the development is discernible or that it is at such a distance that the effects are scarcely appreciated.

8.50 Where variations between relevant criteria occur, reasoned professional judgement is applied and described in the assessment to determine the magnitude of effect.

NATURE OF VISUAL EFFECT

8.51 Changes to view can be of a **positive**, **negative** or **neutral** nature. The determination of the nature of effect on view is related to the Baseline Situation and what is considered to be either a desirable or an undesirable change. The assessment of the nature of visual effect focuses on what is *experienced*, although some professional judgement has (by necessity) been applied to consider the subjective matter of whether the change could generally be received by the visual receptors as positive, negative or neutral. All changes are assumed to be **negative** unless otherwise stated.

SIGNIFICANCE OF VISUAL EFFECTS

8.52 The significance of visual effects (from an impact) is a function of the sensitivity of the affected visual receptor, the magnitude of change and the nature of effect. While the methodology is designed to be robust and transparent, professional judgement is ultimately applied to determine the significance of each effect.

8.53 The results of the assessment have been presented by providing a brief description of the existing view from each principal representative viewpoint/receptor, followed by a description of changes to the view and the landscape scene and an analysis of the magnitude and nature of the effects.

8.54 The significance of visual effects is defined in Table 16. These are different for beneficial and adverse effects. Generally, an effect which is greater than a 'Moderate' significance is likely to be a pertinent 'material consideration' in the decision-making process.

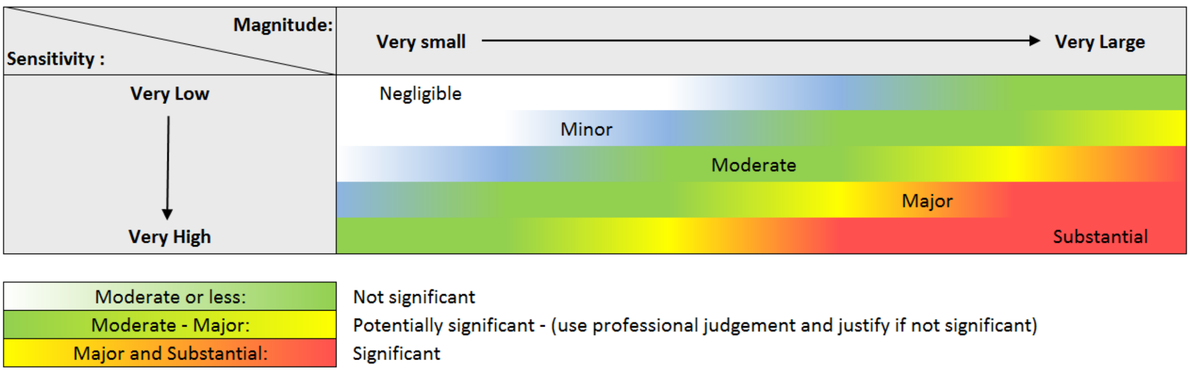
Table 16: Significance of Visual Effects

Significance	Adverse Visual Effects	Beneficial Visual Effects
Negligible	Adverse effect has minimal significance due to low visual amenity even from otherwise sensitive viewpoints. Produces only very slight deterioration to views.	Beneficial effect has minimal significance due to limited scope to improve existing view even from sensitive viewpoints. Provides only very slight improvement to
Minor	Typically: Large-very large scale deterioration to low sensitivity views of low quality. Small scale deterioration to lower and Medium sensitivity views of high quality. Very Small-Medium scale deterioration to higher sensitivity receptors with low existing visual amenity.	Typically: Medium scale improvements to existing views with high visual amenity and Medium sensitivity. Small scale improvements to views of low visual amenity from low sensitivity viewpoints. Very Small scale improvements to low
Moderate	Typically: Noticeable Long-term or Large scale deterioration in low sensitivity but high quality views. Medium scale deterioration to Medium sensitivity high quality views and Very Large changes to low quality views. Small scale and Temporary deterioration in Highly sensitive and high amenity value views and larger scale deterioration in low quality views.	Typically: Noticeable large-scale improvement in unimportant views with low existing visual amenity and visual sensitivity. Small to Medium scale improvements to views from Medium and High sensitivity viewpoints with low existing visual amenity. Very Small scale improvements in existing low visual amenity from Very High sensitivity viewpoints.

Major	Typically: Medium scale deterioration in High sensitivity, high quality views, or larger scale deterioration in High sensitivity but lower quality views. Small scale deterioration to higher sensitivity views of high quality. Considerable Long-term deterioration in Medium sensitivity views of high amenity value.	Typically: Large to Very Large scale improvements at Medium to High sensitivity locations. Medium to Large scale improvements to High sensitivity viewpoints with low existing visual amenity.
Substantial	Clear and obvious Very Large-scale adverse changes resulting in considerable and Long-term deterioration in Highly sensitive and important views.	Clear and obvious very large scale changes resulting in considerable and Long-term improvement in existing poor view for High sensitivity receptors.

8.55 The derivation of the level of significance (of effect) uses professional judgement taking into consideration the contributing factors of sensitivity, magnitude and nature of effect and generally follows a pattern by which the relationship between sensitivity and magnitude contributes to the level of significance as shown diagrammatically in Diagram 2. It should be noted that, strictly, *Significant* effects only need to be determined, not the assessed level of all effects, however it is acknowledged that levels of effect can be a useful aid when reading and understanding the assessment.

Diagram 2: General Relationship Between Magnitude, Sensitivity and Significance



GLOSSARY

Landscape
An area, as perceived by people (in relation to past experiences, education etc.), whose character is the result of the action and interaction of natural and/or human factors. Landscape may comprise areas of rural land, urban fringe, urban land (townscape), coastal land, the sea (seascape) etc.

Landscape Element
A component part of the landscape (e.g. landform, roads, hedges, woods).

Landscape Feature
A prominent eye-catching element (e.g. wooded hilltop or church spire).

Landscape Characteristics
Combinations of elements and experiential characteristics (e.g. noise, smell) that make a particular contribution to a Landscape Character Type.

Landscape Scene
The landscape characteristics discernible from a given viewpoint/location. The visual aspects of this can be illustrated in a static two-dimensional manner in photographs to represent a sample **view** of the landscape scene.

Landscape Character
The distinct recognisable pattern of elements that occurs consistently in a particular landscape and how people perceive this, creating a particular sense of place.

Landscape Value
The desirability of landscape characteristics (including scenic beauty, tranquillity, wildness, cultural associations, conservation interests etc.) and the acceptability of their loss to different stakeholders (i.e. valued for different reasons by different people and on different scales, e.g. local, national).

landscape Condition
The strength of expression of landscape character and intactness of constituent characteristic elements from visual, functional, ecological and cultural perspectives. This is not the same as Scenic Beauty.

Landscape Character Sensitivity
The landscape value of the landscape character and the degree to which the *combination* of landscape characteristics (including landscape structure and quality) present can resist or recover from change or be replicated.

Landscape Receptor
Landscape element, characteristic or character that would potentially receive/experience an effect.

Visual Receptor
Individuals, special interest groups, a community or population that would potentially experience an effect on their view.

Scenic Beauty
Subjective value attributed to the emotional response of an individual to a landscape scene, which, although heavily influenced by intrinsic condition, is also conditioned by an individual's perception (memories, associations, cultural influences and preference).

Visual Amenity
The subjective value attributed to the degree of pleasure gained from what is seen in a given view (quality of view).

Visual Sensitivity
The estimated level of susceptibility or likely viewer's response to a change in view from a given viewpoint in relation to its context, the existing visual amenity, the activity and expectations of the viewer and the number of viewers affected.

Tranquillity
Subjective experience from being at a location that provides individuals with the space and conditions to relax, achieve mental balance and a sense of distance from stress. **Tranquil areas** are often associated with quiet, remote (or appearing remote), natural, non-developed (nonbuilt) and non-busy areas.

Significant Effect
A landscape or visual effect that is likely to be a pertinent 'material consideration' (i.e. an important matter that should be taken into account in deciding a planning application) due to the context and intensity of the effect. This is directly related to set criteria and terminology as set out within the assessment process.

Site visibility
The areas within which the subject site can be seen, the amount of site visible and the numbers able to see the subject site.

Zone of Theoretical Visibility (ZTV)
Also known as a Zone of Visual Influence (ZVI), Visual Envelope Map (VEM) and Viewshed. This represents the area over which a development can theoretically be seen, based on a digital terrain model and including visual barriers screening structures including woodland blocks and main areas of built development. This information is usually presented upon a map base.

Digital Terrain Model (DTM)
Also known as a digital elevation model (DEM). This is a digital representation of the ground surface (landform or terrain) created by linking co-ordinate points of surveyed elevation values to create a 3D 'model' which computers can use to undertake calculations relating to slope angles, point visibility, flood risk etc.

enviroparks

APPENDIX 8.2

Landscape Character

Chapter Eight
APPENDIX 8.2

LANDMAP BASELINE

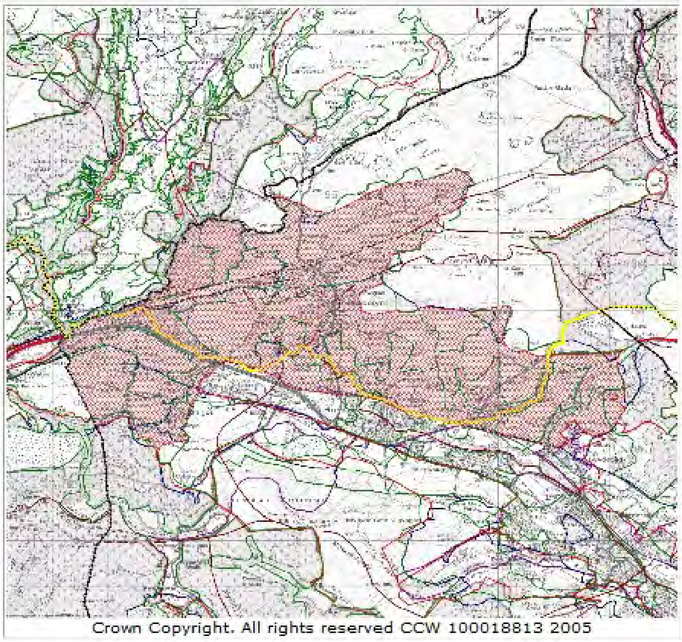
Review of Aspect Areas

8.1 The sheets overleaf have been saved from the LANDMAP online database from the NRW website and cover all aspect areas located within the Study Area and ZTV.

Visual and Sensory

Aspect Area Name	**penderyn**
Aspect Area Classification	**Upland/Hills, Lower Plateau & Scarp Slopes/Hillside & Scarp Slopes Mosaic (Level 3)**
Aspect Area Code	**CYNONVS833**

Date Of Survey : 26/01/2004



Description

Physical Form And Elements: Topographic Form?	Hills/Valleys
Physical Form And Elements: Landcover Pattern?	Field Pattern/Mosaic
Aesthetic Qualities: Scale?	Large
Aesthetic Qualities: Sense of Enclosure?	Open
Aesthetic Qualities: Diversity?	Simple
Aesthetic Qualities: Texture?	Coarse
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Moderate Contrasts
Aesthetic Qualities: Balance?	Balanced
Aesthetic Qualities: Unity?	Neutral
Aesthetic Qualities: Pattern?	Regular
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Infrequent
Other Factors: Night Time Light Pollution?	Moderate
Other Factors: Use of Construction Materials?	Generally Appropriate
What materials? Give Details:	n/a
There are attractive views...	...both in and out (n/a)
There are detractive views...	....out (urban edge)
Perceptual and Other Sensory Qualities	Exposed (n/a)
What is the sense of place/local distinctiveness	Moderate (Upper valley sides with upland feel and tinged by urban edge, slight incongruous mix)

Evaluation

Value:	Moderate (n/a)
Condition:	Unassessed
Trend:	Unassessed

Recommendations

Define the key qualities that should be conserved:	n/a
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	n/a
Define the key elements that should be conserved:	n/a
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	n/a
Principal management recommendation:	prevent overgrazing

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	landform,contour, urban edge to south. South west boundary at Rhigos altered at change detection to exclude part of Tower Colliery land.

Bibliography

List the key sources used for this assessment	os data

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Moderate (Valley sides with pattern of field boundaries/woodland, but detractive elements eg urban

Evaluation Criteria: Overall Evaluation	edge,pylons traffic noise, of local importance)
Justification of overall evaluation	all criteria moderate
Evaluation Criteria: Scenic quality	Moderate (some attractive view to uplands but visual detractors eg urban edge, pylons)
Evaluation Criteria: Integrity	Moderate (n/a)
Evaluation Criteria: Character	Moderate (moderate sop)
Evaluation Criteria: Rarity	Moderate (n/a)

Description

Summary Description	Upper valley sides with strong upland feel-both from the strong visual link that exists and the rough grazing with some woodland/conifer elements... slight urban feel on lower slopes but dominant character is that of an upland area... visual detractors include pylons and the sharply defined urban edge... noise and movement from the A465... scatterred farmsteads. Minor boundary change at monitoring, adjacent to Tower Colliery.
Physical form and elements: Settlement pattern	Scattered Rural/Farm
Physical form and elements: Boundary type	Mixture

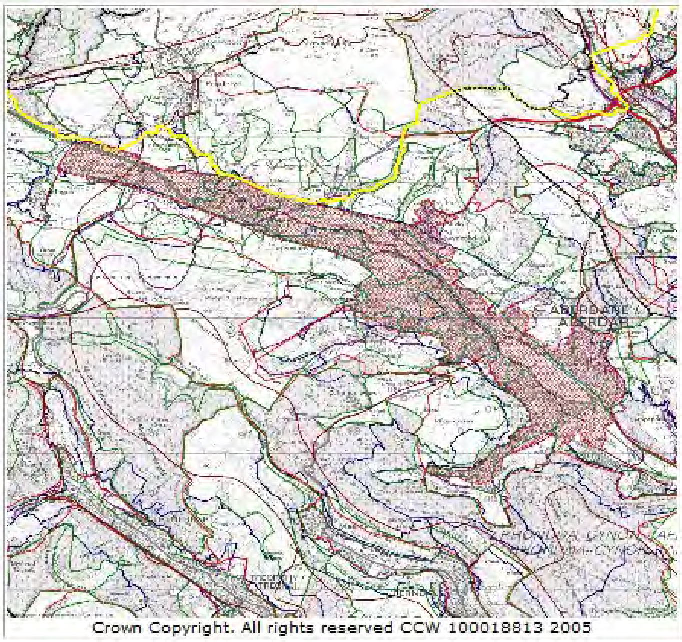
Recommendations

Guideline	Immediate (soften urban edge) Medium Term (restrict pylons) Medium Term (reduce impact of A465 eg planting)
Existing management	Unassessed
Existing management remarks:	agriculture, conifer plantation

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	Yes (strong visual link with upland area)
During which season(s) was fieldwork carried out?	Winter
Date of monitoring?	2012-12-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, inconsultation with LPA
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs
What has changed?	

Visual and Sensory

Aspect Area Name	**aberdare**	
Aspect Area Classification	**Development/Built Land/Urban (Level 3)**	
Aspect Area Code	**CYNONVS522**	
Date Of Survey : 29/01/2004		

Description

Physical Form And Elements: Topographic Form?	Hills/Valleys
Physical Form And Elements: Landcover Pattern?	Development
Aesthetic Qualities: Scale?	Medium
Aesthetic Qualities: Sense of Enclosure?	Enclosed
Aesthetic Qualities: Diversity?	Complex
Aesthetic Qualities: Texture?	Coarse
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Moderate Contrasts
Aesthetic Qualities: Balance?	Discordant
Aesthetic Qualities: Unity?	Disunity
Aesthetic Qualities: Pattern?	Regular
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Constant
Other Factors: Night Time Light Pollution?	Substantial (street/buildings)
Other Factors: Use of Construction Materials?	Generally Inappropriate
What materials? Give Details:	n/a
There are attractive views...	....out (uplands)
There are detractive views...	...within (urban)
Perceptual and Other Sensory Qualities	Unattractive (n/a)
What is the sense of place/local distinctiveness	Weak (n/a)

Evaluation

Value:	Low
Condition:	Unassessed
Trend:	Constant

Recommendations

Define the key qualities that should be conserved:	n/a
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	n/a
Define the key elements that should be conserved:	n/a
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	n/a
Principal management recommendation:	n/a

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 4
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	limit of urban edge

Bibliography

List the key sources used for this assessment	os data

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Low (without any positive visual and sensory qualities, this urban area with remnants of past mining industry has little or no importance... the views out to the adjacent upland areas are the only limited

	visual quality, and these are usually compromised by an element of built form)
Justification of overall evaluation	all criteria low
Evaluation Criteria: Scenic quality	Low (n/a)
Evaluation Criteria: Integrity	Low (n/a)
Evaluation Criteria: Character	Low (weak sop)
Evaluation Criteria: Rarity	Low (n/a)

Description

Summary Description	urban development in floor of relatively wide valley... range of built form creates visual compexity eg houses/ industrial estate/spoil heaps... some views out to neighbouring upland areas provide a partial antidote to teh unnattractive built environment and contribute to its sense of place within the wider upland setting... background traffic noise from A4059 ...
Physical form and elements: Settlement pattern	Urban
Physical form and elements: Boundary type	Mixture

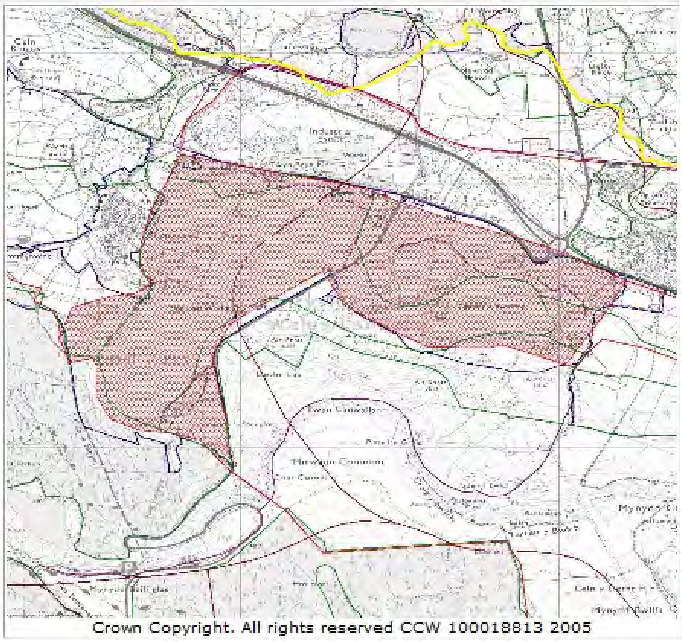
Recommendations

Guideline	Medium Term (careful development control to limit housing/urban sprawl)
Existing management	Unassessed
Existing management remarks:	n/a

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	No
During which season(s) was fieldwork carried out?	
Date of monitoring?	2012-12-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, inconsultation with LPA
Has this record been updated following monitoring work?	

Visual and Sensory

Aspect Area Name	**Tower Colliery**	
Aspect Area Classification	**Development/Developed Unbuilt Land/Excavation (Level 3)**	
Aspect Area Code	**CYNONVS001**	
Date Of Survey : 06/01/2012		

Description

Physical Form And Elements: Topographic Form?	Disturbed
Physical Form And Elements: Landcover Pattern?	Mixture
Aesthetic Qualities: Scale?	Medium
Aesthetic Qualities: Sense of Enclosure?	Open
Aesthetic Qualities: Diversity?	Diverse
Aesthetic Qualities: Texture?	Coarse
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Moderate Contrasts
Aesthetic Qualities: Balance?	Discordant
Aesthetic Qualities: Unity?	Disunity
Aesthetic Qualities: Pattern?	Random
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Infrequent
Other Factors: Night Time Light Pollution?	Slight (Lighting of yards, etc)
Other Factors: Use of Construction Materials?	Generally Inappropriate
What materials? Give Details:	Mix of concrete, metal etc.
There are attractive views...	....out (To Rhigos mountain, and other scarp above.)
There are detractive views...	...into (open cast mining, clutter of scattered buildings, yards, o/h cables and conveyors seen from above from road over Rhigos mountain)
Perceptual and Other Sensory Qualities	Unattractive (n/a) Noisy Threatening
What is the sense of place/local distinctiveness	Strong (One of few open cast coal mines in Wales, with history of workers' ownership.)

Evaluation

Value:	Low (Although distinct and relatively rare, its disturbed and unattractive qualities means that it is overall low)
Condition:	Fair
Trend:	Declining (As coal is extracted)

Recommendations

Define the key qualities that should be conserved:	openness
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	disruption and neglect
Define the key elements that should be conserved:	Moorland/grassland habitats
Define the key elements that should be enhanced:	Mix of habitats
Define the key elements that should be changed:	unused structures
Principal management recommendation:	Efficient extraction of coal followed by restoration

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	limit of excavation and associated land. Boundaries expanded to north west, and east to take in all associated land, at change detection monitoring (from former aspect area)

Bibliography

List the key sources used for this assessment	os data

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Low (Although distinct and relatively rare, its disturbed and unattractive qualities means that it is overall low)
Justification of overall evaluation	50% criteria low 50% moderate
Evaluation Criteria: Scenic quality	Low (Generally disturbed land, with vehicles, buildings and other clutter)
Evaluation Criteria: Integrity	Low (disturbed)
Evaluation Criteria: Character	Moderate (Distinct but unattractive character)
Evaluation Criteria: Rarity	Moderate (One of few open cast mines remaining in Valleys)

Description

Summary Description	New aspect area created at change detection monitoring. Area of opencast mining, started in 2012, following on from long history of deep mining and workers' takeover. In state of change as extraction expands, currently with much restored grassland. Although in parts unsightly, seen from road over Rhigos mountain and nearby village, it has interest and rarity value, and fine views out to adjacent scarp.
Physical form and elements: Settlement pattern	No settlements
Physical form and elements: Boundary type	Mixture

Recommendations

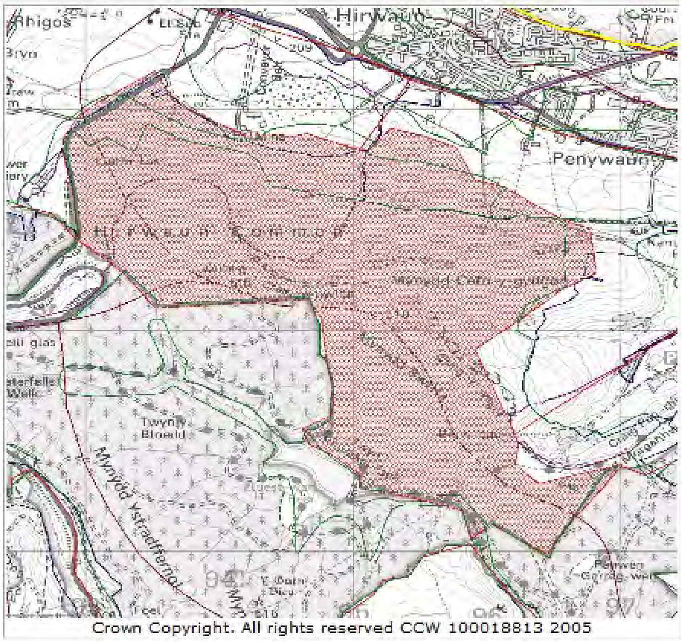
Guideline	Immediate (Ensure minimum disturbance to land not being used for extraction) Immediate (Keep noise, dust to minimum) Medium Term (On-going restoration of disturbed land to grassland)
Existing management	Generally Appropriate
Existing management remarks:	Open cast coal mining and grassland

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	No
During which season(s) was fieldwork carried out?	Winter
Date of monitoring?	2013-01-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, in consultation with LPA. Based on 2011/12 change detection.
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Policies, plans & information resources Fieldwork
What has changed?	

Visual and Sensory

Aspect Area Name	**Hirwaun Common**
Aspect Area Classification	**Upland/Exposed Upland/Plateau/Upland Grazing (Level 3)**
Aspect Area Code	**CYNONVS430**
Date Of Survey : 28/01/2005	



Description

Physical Form And Elements: Topographic Form?	High Hills/Mountains
Physical Form And Elements: Landcover Pattern?	Open Land
Aesthetic Qualities: Scale?	Vast
Aesthetic Qualities: Sense of Enclosure?	Exposed
Aesthetic Qualities: Diversity?	Uniform
Aesthetic Qualities: Texture?	Medium
Aesthetic Qualities: Lines?	Curved
Aesthetic Qualities: Colour?	Muted
Aesthetic Qualities: Balance?	Balanced
Aesthetic Qualities: Unity?	Unity
Aesthetic Qualities: Pattern?	Regular
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Rare
Other Factors: Night Time Light Pollution?	Negligible
Other Factors: Use of Construction Materials?	Appropriate
What materials? Give Details:	Stone walling
There are attractive views...	...both in and out (Uplands)
There are detractive views...	...within (Some electricity pylons but not on skyline...)
Perceptual and Other Sensory Qualities	Attractive Exposed
What is the sense of place/local distinctiveness	Strong (Upland sense of place results from rough ground, rocky outcrops and exposure...)

Evaluation

Value:	High (n/a)
Condition:	Unassessed
Trend:	Unassessed

Recommendations

Define the key qualities that should be conserved:	open, exposed, wild...
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	n/a
Define the key elements that should be conserved:	Grazing
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	n/a
Principal management recommendation:	Grazing management

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	Other (OS Raster, Phase 1 habitat)
If OS Data was used, what was the scale?	1:10,000
What is the justification for the Aspect Area boundaries?	Landform, contour, edge of plantation to west...Western boundary altered at change detection monitoring to exclude expansion of Tower Colliery.

Bibliography

List the key sources used for this assessment	OS data, Phase 1 habitat

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High (Attractive largely unspoilt upland area with strong sense of place and good views)
Justification of overall evaluation	All criteria high
Evaluation Criteria: Scenic quality	High (Attractive upland views)
Evaluation Criteria: Integrity	High (Largely unspoilt, some elec pylons present but not on skyline so not as intrusive...)
Evaluation Criteria: Character	High (Strong upland fell giving sense of place...)
Evaluation Criteria: Rarity	High (n/a)

Description

Summary Description	Dramatic landscape of rough grazed grassland with rock outcrops and some marshy areas lying between approximately 200m and 515mAOD... Wind noise is a dominant aesthetic factor which evokes particular experience of exposure and wildness... Attractive upland views within and attractive rolling terrain to north... A475 is a visual detractor...Adjacent Tower Colliery has expanded, so aspect area boundary in west has been altered at change detection.
Physical form and elements: Settlement pattern	No settlements
Physical form and elements: Boundary type	Stone Walls

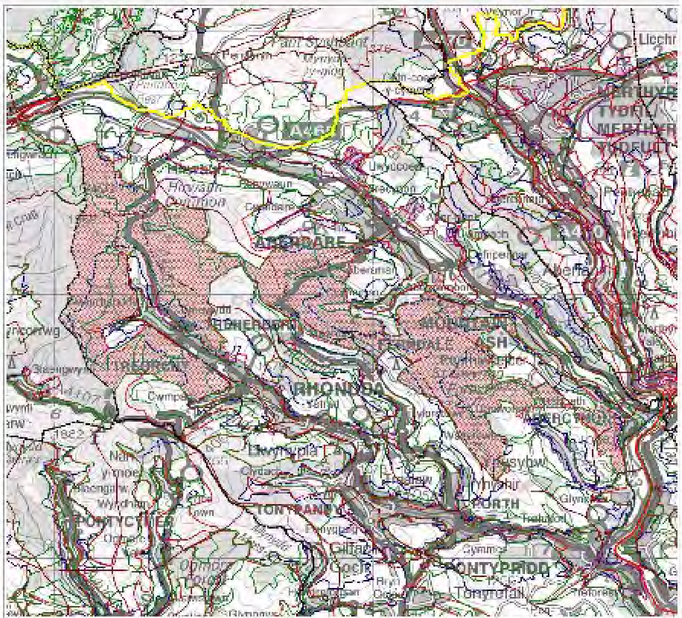
Recommendations

Guideline	Long Term (Prevent over grazing)
Existing management	Unassessed
Existing management remarks:	Grazing

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	No
During which season(s) was fieldwork carried out?	Winter
Date of monitoring?	2013-01-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, in consultation with LPA. Based on 2011/12 change detection.
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Fieldwork
What has changed?	

Visual and Sensory

Aspect Area Name	**St Gwynno**	
Aspect Area Classification	**Upland/Exposed Upland/Plateau/Wooded Upland & Plateaux (Level 3)**	
Aspect Area Code	**CYNONVS580**	
Date Of Survey : 26/01/2004		

Description

Physical Form And Elements: Topographic Form?	High Hills/Mountains
Physical Form And Elements: Landcover Pattern?	Woodland
Aesthetic Qualities: Scale?	Large
Aesthetic Qualities: Sense of Enclosure?	Enclosed
Aesthetic Qualities: Diversity?	Simple
Aesthetic Qualities: Texture?	Coarse
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Moderate Contrasts
Aesthetic Qualities: Balance?	Balanced
Aesthetic Qualities: Unity?	Neutral
Aesthetic Qualities: Pattern?	Regular
Aesthetic Qualities: Seasonal Interest?	Winter (Evergreen colour)
Other Factors: Level of Human Access?	Rare
Other Factors: Night Time Light Pollution?	Negligible (n/a)
Other Factors: Use of Construction Materials?	Generally Appropriate
What materials? Give Details:	n/a
There are attractive views...	....out (partially filtered/screened views out to adjacent upland areas)
There are detractive views...	...neither in or out (n/a)
Perceptual and Other Sensory Qualities	Sheltered Other (wind noise in trees)
What is the sense of place/local distinctiveness	Moderate (lack of specific sop)

Evaluation

Value:	Moderate (n/a)
Condition:	Unassessed
Trend:	Unassessed

Recommendations

Define the key qualities that should be conserved:	shelter
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	angularity
Define the key elements that should be conserved:	trees
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	soften edges
Principal management recommendation:	introduce broadleaf woodland mix

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	forest edge, study area boundary to east and south

Bibliography

List the key sources used for this assessment	os data

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Moderate (fairly typical upland plantation with moderate sop and limited views, mainly from higher open

Evaluation Criteria: Overall Evaluation	areas...)
Justification of overall evaluation	all criteria moderate for this typical upland plantation... it should be noted that the area has a recreational amenity value, indicated by picnic sites, trails and carparking
Evaluation Criteria: Scenic quality	Moderate (limited views)
Evaluation Criteria: Integrity	Moderate (the conifer plantation is generally intact, but some dumping of refuse/cars visual detractor)
Evaluation Criteria: Character	Moderate (moderate sop)
Evaluation Criteria: Rarity	Moderate (n/a)

Description

Summary Description	upland landscape dominated by coniferous forest with small areas of rough grazing/open land interspersed... strongly defined undulating topography with ridges and valleys creates a multi-scaled landscape with a variety of spaces... limited views out to upland areas... some car/refuse dumping minor eyesore/visual detractor...Appears to have been large areas felled on western edge recently. Unable to verify on site.
Physical form and elements: Settlement pattern	No settlements
Physical form and elements: Boundary type	Mixture

Recommendations

Guideline	Medium Term (maintain open spaces) Immediate (Implement Forest Design Plans) Immediate (broadleaf planting along edge/stream course)
Existing management	Unassessed
Existing management remarks:	forestry

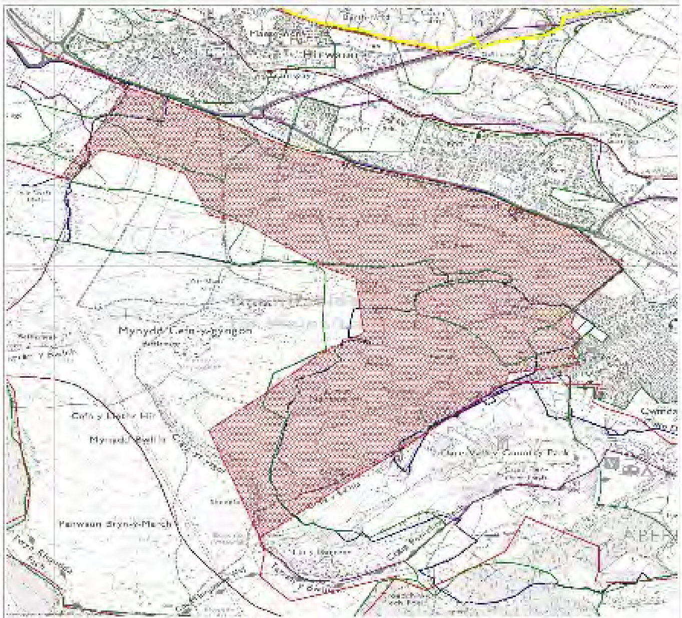
Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	No
During which season(s) was fieldwork carried out?	Winter
Date of monitoring?	2013-01-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, in consultation with LPA. Based on 2011/12 change detection.
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Satellite Imagery Interpretation Policies, plans & information resources
What has changed?	

Visual and Sensory

Aspect Area Name	**Craing Nantmelyn**
Aspect Area Classification	**Upland/Hills, Lower Plateau & Scarp Slopes/Hillside & Scarp Slopes Grazing (Level 3)**
Aspect Area Code	**CYNONVS890**

Date Of Survey : 28/01/2005



Description

Physical Form And Elements: Topographic Form?	Hills/Valleys
Physical Form And Elements: Landcover Pattern?	Mixture
Aesthetic Qualities: Scale?	Medium
Aesthetic Qualities: Sense of Enclosure?	Open
Aesthetic Qualities: Diversity?	Diverse
Aesthetic Qualities: Texture?	Coarse
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Moderate Contrasts
Aesthetic Qualities: Balance?	Balanced
Aesthetic Qualities: Unity?	Neutral
Aesthetic Qualities: Pattern?	Regular
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Infrequent
Other Factors: Night Time Light Pollution?	Moderate
Other Factors: Use of Construction Materials?	Generally Appropriate
What materials? Give Details:	n/a
There are attractive views...	....out (To uplands of Hirwaun Common)
There are detractive views...	....out (To urban area of Hirwaun)
What is the sense of place/local distinctiveness	Moderate (Caught between mixture of upland (on upper slopes) and urban(on lower slopes) influences slightly incongruous mix...)

Evaluation

Value:	Moderate (n/a)
Condition:	Unassessed
Trend:	Unassessed

Recommendations

Define the key qualities that should be conserved:	Openness
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	n/a
Define the key elements that should be conserved:	n/a
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	n/a
Principal management recommendation:	Land management(grazing, bracken control)

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	Other (OS Raster, Phase 1 habitat)
If OS Data was used, what was the scale?	1:10,000
What is the justification for the Aspect Area boundaries?	Penywaun to the north and more upland areas of hirwaun common to the south west...North west boundary altered at chnage detection monitoring to exclude expansion of Tower Colliery activities.

Bibliography

List the key sources used for this assessment	OS data, Phase 1 habitat

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Moderate (No single defining feature of regional importance to justify more than local importance... Scenic quality and integrity both reduced by the presence of urban areas)

	quality and integrity both reduced by the presence of urban areas)
Justification of overall evaluation	All criteria moderate...
Evaluation Criteria: Scenic quality	Moderate (Some attractive views out to neighbouring upland , and slightly detractive views to urban areas in valley floor...)
Evaluation Criteria: Integrity	Moderate (Urban edge detracts from overall integrity)
Evaluation Criteria: Character	Moderate (Moderate sense of place...)
Evaluation Criteria: Rarity	Moderate (n/a)

Description

Summary Description	Lower slopes to the east of Hirwaun Common... Generally grazing land with bracken and small scattered clumps of woodland...Open character and more upland feel is tempered by urban edge presence to north (Penywaun)... Views similarly polarised into upland to south west and urban to north east... Some more distant upland views to north past Penywaun however...Expansion of Tower Colliery activities has reduced aspect area at change detection.
Physical form and elements: Settlement pattern	Scattered Rural/Farm
Physical form and elements: Boundary type	Mixture

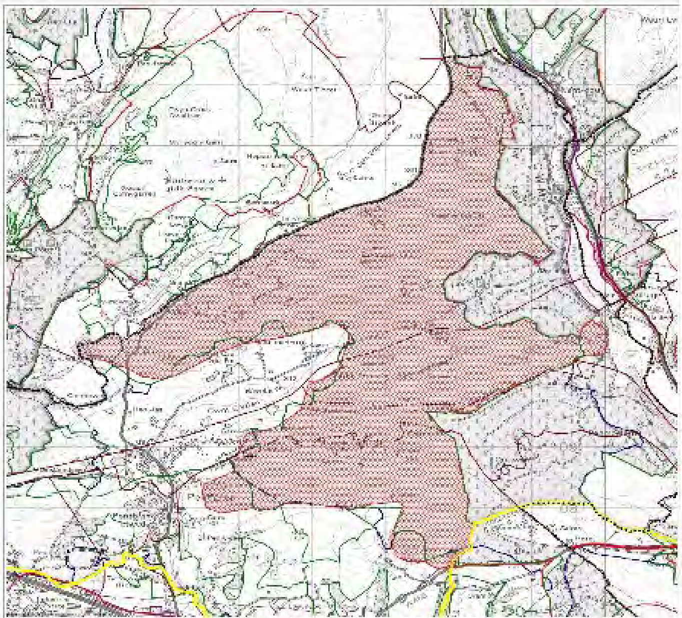
Recommendations

Guideline	Medium Term (Limit urban spread up valley sides, reduce well defined edge)
Existing management	Unassessed
Existing management remarks:	Grazing...

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	No
During which season(s) was fieldwork carried out?	Winter
Date of monitoring?	2013-01-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, in consultation with LPA. Based on 2011/12 change detection.
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Fieldwork
What has changed?	

Visual and Sensory

Aspect Area Name	**cadair fawr**	
Aspect Area Classification	**Upland/Exposed Upland/Plateau/Upland Grazing (Level 3)**	
Aspect Area Code	**CYNONVS735**	
Date Of Survey : 26/01/2004		

Description

Physical Form And Elements: Topographic Form?	High Hills/Mountains
Physical Form And Elements: Landcover Pattern?	Open Land
Aesthetic Qualities: Scale?	Large
Aesthetic Qualities: Sense of Enclosure?	Exposed
Aesthetic Qualities: Diversity?	Uniform
Aesthetic Qualities: Texture?	Medium
Aesthetic Qualities: Lines?	Angular
Aesthetic Qualities: Colour?	Muted
Aesthetic Qualities: Balance?	Balanced
Aesthetic Qualities: Unity?	Unity
Aesthetic Qualities: Pattern?	Formal
Aesthetic Qualities: Seasonal Interest?	None
Other Factors: Level of Human Access?	Rare
Other Factors: Night Time Light Pollution?	Negligible (n/a)
Other Factors: Use of Construction Materials?	Appropriate
What materials? Give Details:	n/a
There are attractive views...	....out (uplands)
There are detractive views...	...neither in or out (n/a)
Perceptual and Other Sensory Qualities	Attractive Exposed Wild (n/a)
What is the sense of place/local distinctiveness	Strong (upland sop results from rough ground, rocky outcrops and exposure, augmented by views of brecon beacons)

Evaluation

Value:	High (n/a)
Condition:	Unassessed
Trend:	Constant

Recommendations

Define the key qualities that should be conserved:	open,wild
Define the key qualities that should be enhanced:	n/a
Define the key qualities that should be changed:	n/a
Define the key elements that should be conserved:	rough grazing
Define the key elements that should be enhanced:	n/a
Define the key elements that should be changed:	n/a
Principal management recommendation:	grazing management

Tolerance To Change

Are there any significant threats to the current integrity and condition of the visual & sensory features of the area?	Not known

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	Most
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	landform, contour, edge of plantation to east

Bibliography

List the key sources used for this assessment	os data

Assessment

Additional Assessments	n/a
Additional Comments	n/a

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High (Attractive largely unspoilt upland area with strong sop and good views)
Justification of overall evaluation	all criteria are high
Evaluation Criteria: Scenic quality	High (attractive views of upland areas, particularly north)
Evaluation Criteria: Integrity	High (largely unspoilt)
Evaluation Criteria: Character	High (strong sop)
Evaluation Criteria: Rarity	High (n/a)

Description

Summary Description	Dramatic landscape of rough grazed grassland with rock outcrops and some marshy areas lying between approximately 300m and 485mAOD. Wind noise is a dominant aesthetic factor which evokes particular experience of exposure and wildness. Spectacular upland views dominated by large expanse of sky/clouds. Strong visual link with Brecon Beacons.
Physical form and elements: Settlement pattern	No settlements
Physical form and elements: Boundary type	Stone Walls

Recommendations

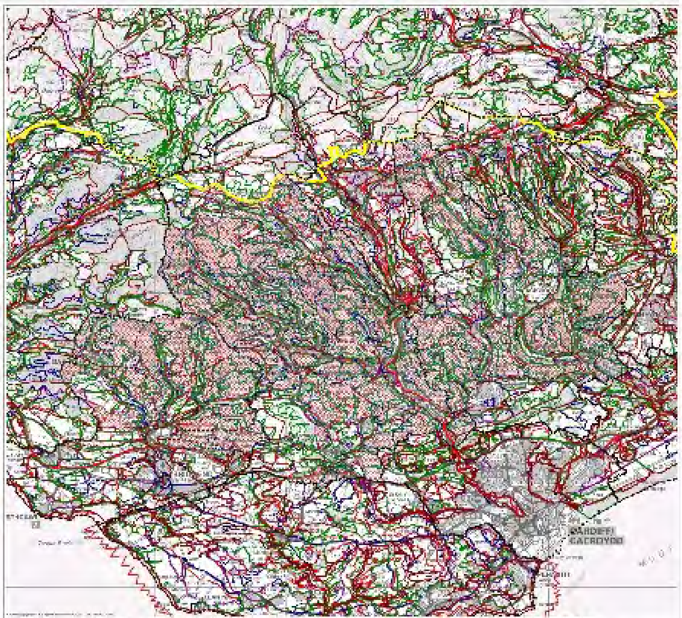
Guideline	Medium Term (prevent overgrazing)
Existing management	Unassessed
Existing management remarks:	agriculture/grazing

Monitoring

Has the information ever been verified in the field?	Yes (1:25000)
Does this area have a special or functional link with an adjacent area?	Yes (Close association with Brecon Beacons.)
Date of monitoring?	2012-12-01
Monitoring undertaken by	Bronwen Thomas Landscape Architect, plus White Consultants at initial change detection stage, inconsultation with LPA
Has this record been updated following monitoring work?	

Cultural Landscape

Aspect Area Name	**Designated Landscape Areas**
Aspect Area Classification	**Associations/Notional Expressions/Institutions/Other Institutions (specify) (Level 4)**
Aspect Area Code	**CYNONCL056**
Date Of Survey : 24/05/2005	



Monitoring

Has the information ever been verified in the field?	No
Does this area have a special or functional link with an adjacent area?	Yes (The whole Study Area)

Description

The classification at level 3 describes the dominant cultural context, but which other contexts are important to the cultural landscape of this area?	Rural
Which level 4 classes are particularly significant to the cultural landscape character of this area - Influences?	Agricultural Forestry Rural Settlement Other Infrastructure (specify) ("Other institutions" is selected as the Level 4 classification as these very large areas are variously protected by landscape and environmental designations)
To what extent do the context and level 4 details selected contribute to the cultural identity, local distinctiveness or sense of place of the area?	Moderate (Level 4 Associations and Influences provide some limited context for these landscape designations)
To what extent is the cultural information widely recognised or appreciated?	Specialist (Known principally to planners, environmental, historical specialists)
Are there any artistic expressions that are particularly famous or associated with the Aspect Area?	No
Are there any people / movements / institutions that are particularly famous or associated with the Aspect Area?	No
Is there any folklore or are there legends that are particularly famous or associated with the Aspect Area?	No
Are there any events/traditions that are particularly famous or associated with the Aspect Area?	No
Are there any technical / scientific discoveries that are particularly famous or associated with the Aspect Area?	No
What are the attributes of the cultural elements in the Aspect Area?	Modern (20/21st Century)
What chronological periods are culturally dominant in the area?	Post 1950
Are there certain place-names in the area that are particularly significant?	No
Summary Description: (no more than 150 words)	Large expanses of (mostly) upland and moorland landscape that are present throughout the Study Area. They have been variously designated statutorily as Sites of Special Scientific Interest by the Countryside Council for Wales, or by Unitary Authorities as Special Landscape Areas, Sites of Interest for Nature Conservation or as part of the Coalfield Plateaux.Such designations are a reflection of 20th/21st century perceptions of the value of protecting both natural habitats and of rural areas of lesser importance though possessing much aesthetic and sensory value. They contain variously historic and contemporary evidence of human occupation and exploitation in the form of prehistoric monuments, redundant industrial workings and transport systems, and of forestry. As such they are a commodity for leisure enjoyment as well as providing very extensive "green lungs" to supplement those identified in urban landscapes that they surround.

Tolerance To Change

Are there any significant threats to the current integrity and condition of the Cultural Landscape features of the area?	Not known

Description

If yes, give examples of the place-names and their significance	n/a

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	None (Imprecise largely because the boundaries are set by the Study Area boundaries and those of individual Aspect Areas, some of which extend into or are part of the landscape designations)
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	These large landscape areas are mapped outside mapped built areas and within the Study Area boundaries

Bibliography

List the key sources used for this assessment	Unitary Development Plans and Local Plans of authorities within the Study Area

Assessment

Additional Assessments	none

Additional Comments	none

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High (High as examples of policy determination to protect the natural and visual attributes of large areas of landscape from being overrun by development, and for the benefi of both people and wildlife)
Justification of overall evaluation	see Q40
Evaluation Criteria: Recognition/transparency	Regional recognition (Greatly appreciated by both local people and by those who travel through the Study Area)
Evaluation Criteria: Period	Very apparent (20th/21st century designations reflecting contemporary values of the need to protect landscapes from inappropriate development)
Evaluation Criteria: Rarity (Culture)	Commonplace (The Study Area is replete with such designations)
Evaluation Criteria: Documentation	Limited (Mapped on Unitary Development Plans and Local Plans)
Evaluation Criteria: Group Value	Exceptional (Outstanding for the variety of terrain, topography and habitats)
Evaluation Criteria: Survival	N/A (The landscapes have survived - and long may they continue to do so - untrammelled by modernity (except, perhaps, forestry))
Evaluation Criteria: Vulnerability	Highly vulnerable (Low because of designations)
Evaluation Criteria: Diversity	Complex (These multi-faceted landscapes represent outstanding assets for the variety of terrain, topography and habitats contained within them)
Evaluation Criteria: Potential (Culture)	Unassessed

Description

Which level 4 classes are particularly significant to the cultural landscape character of this area - Associations?	Sense of Place Other Institutions (specify) ("Other institutions" is selected as the Level 4 classification as these very large areas are variously protected by landscape and environmental designations)

Evaluation

Condition:	Unassessed
Value:	High (High as examples of policy determination to protect the natural and visual aspects of large areas of landscape from being overrun by development)
Trend:	Unassessed

Recommendations

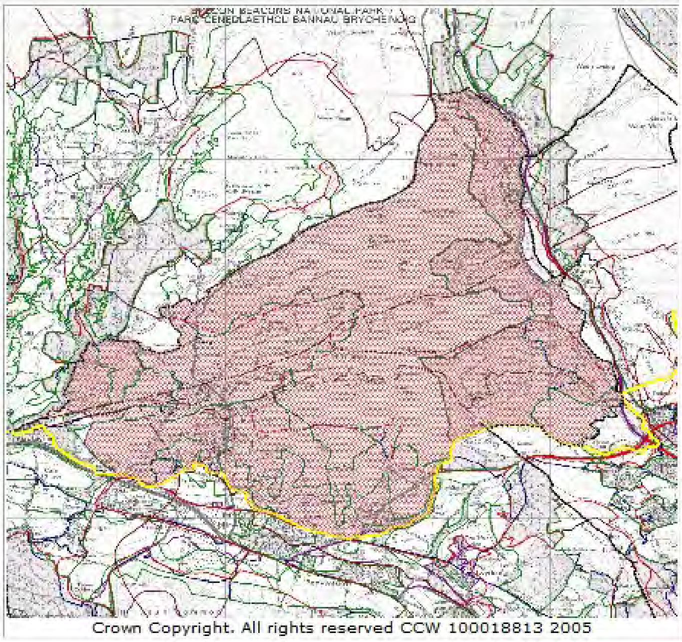
Existing management:	Generally Appropriate
Existing management remarks:	Designation affords some protection
Principal management recommendations	Continue to respect local and national designations
Guideline	Long Term (There is a case for the development of a more robust policy for managing the historic environment as these areas contain a wealth of archaeology from all periods, perhaps especially the Industrial/Modern period)

Description

If Classification is "Other", specify here	

Cultural Landscape

Aspect Area Name	**Brecon Beacons National Park**
Aspect Area Classification	**Associations/Notional Expressions/Institutions/Land Divisions (Level 4)**
Aspect Area Code	**CYNONCL044**
Date Of Survey : 20/05/2005	



Monitoring

Has the information ever been verified in the field?	Yes (Site visit and 1:25000)
Does this area have a special or functional link with an adjacent area?	No

Description

The classification at level 3 describes the dominant cultural context, but which other contexts are important to the cultural landscape of this area?	Rural Industrial Institutions
Which level 4 classes are particularly significant to the cultural landscape character of this area - Influences?	Agricultural Rural Settlement Minerals & Mining Tourism
To what extent do the context and level 4 details selected contribute to the cultural identity, local distinctiveness or sense of place of the area?	Strong (Level 4 Associations and Influences are few for this small part of the National Park, but they combine to explain the breadth of its cultural essence)
To what extent is the cultural information widely recognised or appreciated?	Nationally (The National Park is recognised nationally and internationally)
Are there any artistic expressions that are particularly famous or associated with the Aspect Area?	No
Are there any people / movements / institutions that are particularly famous or associated with the Aspect Area?	Yes (Brecon Beacons National Park Authority; "Dic Penderyn" (Richard Lewis), executed for his alleged role in riots in Merthyr Tydfil in the mid-19th century)
Is there any folklore or are there legends that are particularly famous or associated with the Aspect Area?	Not known
Are there any events/traditions that are particularly famous or associated with the Aspect Area?	No
Are there any technical / scientific discoveries that are particularly famous or associated with the Aspect Area?	No
What are the attributes of the cultural elements in the Aspect Area?	Mixed
What chronological periods are culturally dominant in the area?	Post 1950
Are there certain place-names in the area that are particularly significant?	No
Summary Description: (no more than 150 words)	Brecon Beacons National Park has been designated over 1344 sq km. There is a relatively small portion of its southern part in the Study Area, though larger tracts of land abut it. The landscape here typifies the contrast between high moorland to the north of the Coal Measures and A465 trunk road, and the deeply incised valleys to the south. The portion within the Study Area lies to the south of the looming bulk of Pen-y-Fan, and consists mostly of sheep-grazed moorland which contains much evidence of prehistoric occupation and exploitation. On its western edge there are extensive eroded landscapes, cave systems and a spectacular series of waterfalls in the Neath River''s headwaters.

Tolerance To Change

Are there any significant threats to the current integrity and condition of the Cultural Landscape features of the area?	Not known

Description

If yes, give examples of the place-names and their significance	n/a

Aspect Area Boundary

To what level was this information site-surveyed?	Level 4
At 1:10,000, how much of the Aspect Area boundary is precise?	Most (Boundaries follow OS mapped boundaries to the extent of the Study Area boundary)
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	Boundaries follow OS mapped boundaries to the extent of the Study Area boundary

Bibliography

List the key sources used for this assessment	OS Explorer maps; personal observation; vast library of recorded sources

Assessment

Additional Assessments	none
Additional Comments	none

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Outstanding (Outstanding as a component part of the wider Brecon Beacons National Park, itself a widely recognised cultural area of outstanding designated landscape)

Justification of overall evaluation	see Q40
Evaluation Criteria: Recognition/transparency	Internationally/nationally recognised (The Park is recognised internationally)
Evaluation Criteria: Period	Strongly apparent (Outstanding as an example of the UK''s National Parks designations)
Evaluation Criteria: Rarity (Culture)	Commonplace (Wales has only 3 National Parks, but there are many more in the UK)
Evaluation Criteria: Documentation	Substantial (Extensive documentation exists)
Evaluation Criteria: Group Value	Considerable (The special character of the National Park contributes strongly to the group)
Evaluation Criteria: Survival	N/A (Protected by statute)
Evaluation Criteria: Vulnerability	Highly vulnerable (Protected by statute)
Evaluation Criteria: Diversity	Simple (This portion of the Park is mostly moorland, and therefore lacks topographical diversity)
Evaluation Criteria: Potential (Culture)	Unassessed

Description

Which level 4 classes are particularly significant to the cultural landscape character of this area - Associations?	Sense of Place Land Divisions Leisure/Recreation Famous People

Evaluation

Condition:	Good (The landscape benefits from not being over managed)
Value:	Outstanding (Outstanding as a protected landscape)
Trend:	Constant (The National Park Authority is likely to continue its current management regime)

Recommendations

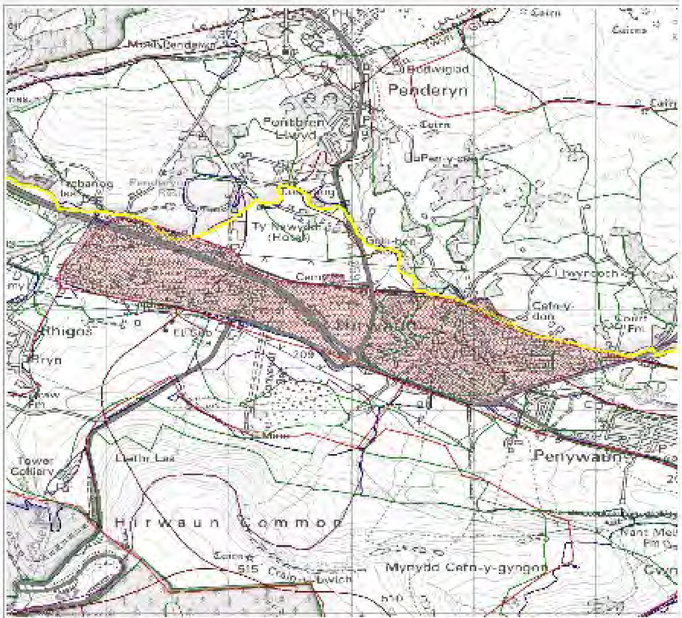
Existing management:	Generally Appropriate
Existing management remarks:	The landscape is not over-managed and benefits thereby
Principal management recommendations	Continue as now
Guideline	

Description

If Classification is "Other", specify here	

Cultural Landscape

Aspect Area Name	**Hirwaun**
Aspect Area Classification	**Influences/Material expressions/Industrial/Heavy Industry (Level 4)**
Aspect Area Code	**CYNONCL042**
Date Of Survey : 20/05/2005	



Monitoring

Has the information ever been verified in the field?	No
Does this area have a special or functional link with an adjacent area?	Yes (Communications (A470, A465) Heads of the Valleys road (CynonCL002))

Description

The classification at level 3 describes the dominant cultural context, but which other contexts are important to the cultural landscape of this area?	Industrial Urban Infrastructure
Which level 4 classes are particularly significant to the cultural landscape character of this area - Influences?	Minerals & Mining Heavy Industry Urban Settlement Communications & Transport
To what extent do the context and level 4 details selected contribute to the cultural identity, local distinctiveness or sense of place of the area?	Strong (Level 3 and $ Influences are strong in the area, though there are no Level 4 Associations of note)
To what extent is the cultural information widely recognised or appreciated?	Locally (Hirawaun is a settlement passed by by most travellers on the A465 whose lasting impression is the incongruity of the pair of residential tower blocks)
Are there any artistic expressions that are particularly famous or associated with the Aspect Area?	No
Are there any people / movements / institutions that are particularly famous or associated with the Aspect Area?	No
Is there any folklore or are there legends that are particularly famous or associated with the Aspect Area?	No
Are there any events/traditions that are particularly famous or associated with the Aspect Area?	No
Are there any technical / scientific discoveries that are particularly famous or associated with the Aspect Area?	No
What are the attributes of the cultural elements in the Aspect Area?	Mixed
What chronological periods are culturally dominant in the area?	Post 1950 Inter War Victorian & Edwardian Georgian
Are there certain place-names in the area that are particularly significant?	No
Summary Description: (no more than 150 words)	Hirwaun is siuated on a ridge above the Neath and Cynon Valleys... It was an early centre of ironworking, being the first place in Wales where iron was smelted using coke... The Ironworks was established in 1757 on the site of an earlier charcoal-fuelled furnace... The settlement is surrounded by evidence of coal mining - in modern times, mostly open cast... Inside the settlement street patterns follow the lines of tram roads; externally, the image of Hirwaun to passers-by is conveyed by the bulk of the pair of high-rise tower blocks, incongruous both in this terrain and in the vernacular culture of residential development in the Valleys...

Tolerance To Change

Are there any significant threats to the current integrity and condition of the Cultural Landscape features of the area?	Not known

Description

If yes, give examples of the place-names and their significance	n/a

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	None (see Q30)
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	Boundaries are drawn at 1:25000 around mapped built areas

Bibliography

List the key sources used for this assessment	OS Explorer map 1:25000; The Buildings of Wales: Glamorgan, John Newman; Penguin, 1995

Assessment

Additional Assessments	none
Additional Comments	none

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High (High as a ridge-top settlement where signs of sequential development are still evident, and benefiting from proximity to the A465 Heads of the Valleys road...)
Justification of overall evaluation	see Q40
Evaluation Criteria: Recognition/transparency	Local recognition (Little known outside the area)
Evaluation Criteria: Period	Apparent (There is evidence of 300-400 years of development)
Evaluation Criteria: Rarity (Culture)	Unassessed
Evaluation Criteria: Documentation	Unassessed
Evaluation Criteria: Group Value	Unassessed
Evaluation Criteria: Survival	Unassessed
Evaluation Criteria: Vulnerability	Unassessed
Evaluation Criteria: Diversity	Unassessed
Evaluation Criteria: Potential (Culture)	Unassessed

Evaluation

Condition:	Unassessed
Value:	High
Trend:	Unassessed

Recommendations

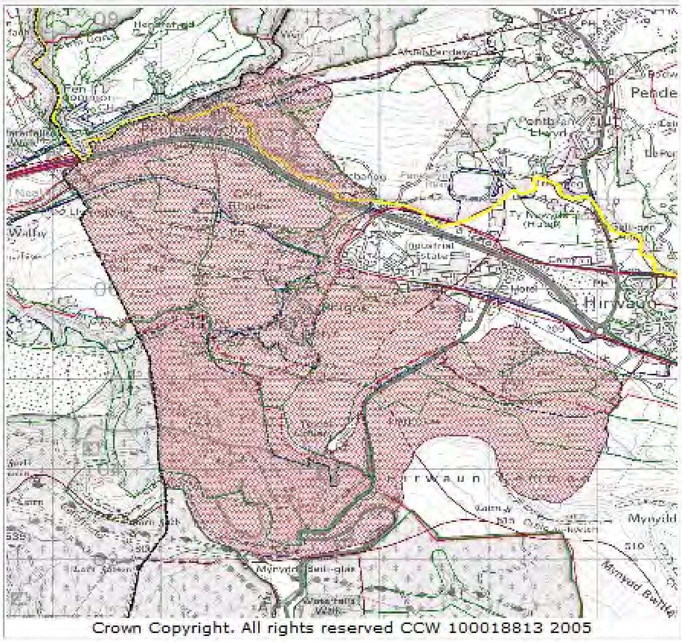
Existing management:	Unassessed
Existing management remarks:	none
Principal management recommendations	none
Guideline	

Description

If Classification is "Other", specify here	

Cultural Landscape

Aspect Area Name	**The Rhigos**
Aspect Area Classification	**Associations/Notional Expressions/Places/Sense of Place (Level 4)**
Aspect Area Code	**CYNONCL041**
Date Of Survey : 20/05/2005	



Monitoring

Has the information ever been verified in the field?	Yes (Site visit and 1:25000)
Does this area have a special or functional link with an adjacent area?	Yes (Designated Landscape Areas (CynonCL056); Tower Colliery (CynonCL043) - large tracts of landscape, including the Colliery, are visible from this high vantage point)

Description

The classification at level 3 describes the dominant cultural context, but which other contexts are important to the cultural landscape of this area?	Rural Industrial Urban Infrastructure Places
Which level 4 classes are particularly significant to the cultural landscape character of this area - Influences?	Agricultural Forestry Rural Settlement Minerals & Mining Light Industry & Technology Urban Settlement Communications & Transport Tourism
To what extent do the context and level 4 details selected contribute to the cultural identity, local distinctiveness or sense of place of the area?	Very Strong (At Levels 3 and 4 Influences are the principal cultural elements that give this Aspect Area its identity even though its Level 4 classification is Sense of Place - a classification chosen to reflect the perceptions of those who view the landscape from this high roadside point)
To what extent is the cultural information widely recognised or appreciated?	Regionally (The Rhigos mountain road and the viewpoint are known more widely than simply locally, more so now with the advent of the Sustrans National Cycle Network which passes this point)
Are there any artistic expressions that are particularly famous or associated with the Aspect Area?	Not known
Are there any people / movements / institutions that are particularly famous or associated with the Aspect Area?	No
Is there any folklore or are there legends that are particularly famous or associated with the Aspect Area?	No
Are there any events/traditions that are particularly famous or associated with the Aspect Area?	No
Are there any technical / scientific discoveries that are particularly famous or associated with the Aspect Area?	No
What are the attributes of the cultural elements in the Aspect Area?	Mixed
What chronological periods are culturally dominant in the area?	Post 1950 Inter War Victorian & Edwardian Pre-Roman
Are there certain place-names in the area that are particularly significant?	No
Summary Description: (no more than 150 words)	The name "The Rhigos" is not so much one place as an idea. It exists physically, but its value is in what can be seen. The Aspect Area is based on a small informal viewpoint in a pull-off from the mountain road above the Rhondda Valleys. From here can be seen a microcosm of the cultural influences of the Study Area - man-made reservoirs, roads, prehistoric remains, colliery workings, relict quarries and small industrial workings, forestry.

Tolerance To Change

Are there any significant threats to the current integrity and condition of the Cultural Landscape features of the area?	Not known

Description

If yes, give examples of the place-names and their significance	n/a

Aspect Area Boundary

To what level was this information site-surveyed?	Level 4
At 1:10,000, how much of the Aspect Area boundary is precise?	Some (It is not possible to map a notion, but effort has been made at 1:25000 to encompass the important elements in the vista)
What baseline information source was used for Aspect Area boundary mapping?	OS Raster
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	It is not possible to map a notion, but effort has been made at 1:25000 to encompass the important elements in the vista within the Study Area boundary

Bibliography

List the key sources used for this assessment	Observation; OS Explorer map 1:25000

Assessment

Assessment

Additional Assessments	none
Additional Comments	none

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High (High because there is a palpable sense of history and of place, leading to an idea of small-scale exploitation and use over millennia)
Justification of overall evaluation	see Q40
Evaluation Criteria: Recognition/transparency	Sub-regional recognition (Moderate simply because The Rhigos is not heavily visited)
Evaluation Criteria: Period	Very apparent (The vista contains multi-period elements)
Evaluation Criteria: Rarity (Culture)	Unassessed
Evaluation Criteria: Documentation	Unassessed
Evaluation Criteria: Group Value	Considerable (The vista contains multi-period elements)
Evaluation Criteria: Survival	N/A (Much of the history of the area is still represented in the landscape)
Evaluation Criteria: Vulnerability	Tolerant (Vulnerable to permitting large-scale development in the vista''s landscape)
Evaluation Criteria: Diversity	Complex (The vista contains multi-period elements of considerable diversity)
Evaluation Criteria: Potential (Culture)	Unassessed

Description

Which level 4 classes are particularly significant to the cultural landscape character of this area - Associations?	Sense of Place Leisure/Recreation

Evaluation

Condition:	Good (The ideas conveyed by a relatively unchanged landscape remain strong)
Value:	High (High as location that conveys a strong sense of place)
Trend:	Unassessed

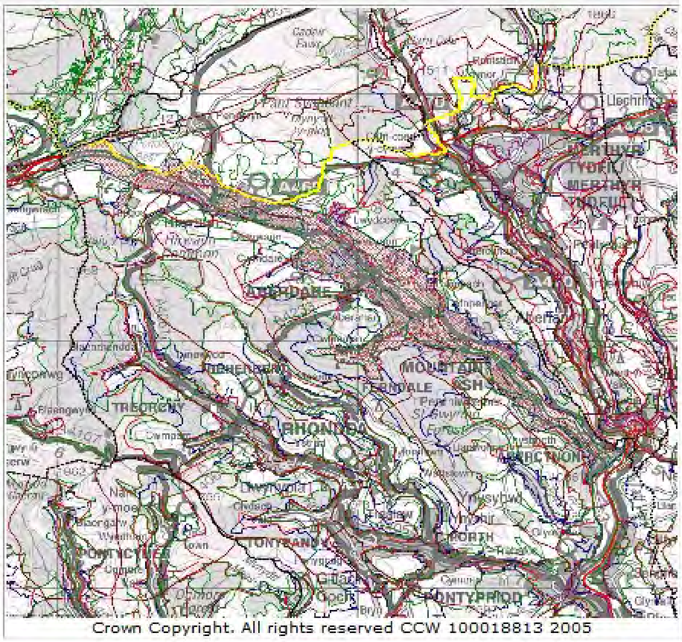
Recommendations

Existing management:	Generally Appropriate
Existing management remarks:	The informal pull-off is sufficient to welcome people, but not modernised or over-engineered
Principal management recommendations	Leave as it now appears; seek to prevent intrusively large development in the vista
Guideline	

Description

If Classification is "Other", specify here	

Historic Landscape

Aspect Area Name	**Cynon Valley Corridor**	
Aspect Area Classification	**Built environment/Settlement/Nucleated Settlement (Level 3)**	
Aspect Area Code	**CYNONHL117**	
Date Of Survey : 23/10/2003		

Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Extractive Processing/Manufacturing Communications Irregular Fieldscapes Woodland Water & Wetland Non-nucleated Settlement

Monitoring

Has the information ever been verified in the field?	Yes (Level 3/1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	Yes (HL977: similar integrated transport and settlement characteristics, development and transport through links... Both are adjacent urban industrial ribbon settlement and transport corridors with through routes to the shipping points at Barry and cardiff... HL409: Disused and reclaimed workings closely associated with the industrial settlements and transport networks which characterise HL117...)

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Hedgerow Hedgerow With Trees Dry Stone Walls Mortared Wall Post & Wire Fence Cut Drainage
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Relict-Earthworks Relict-Stone Monuments Industrial Archaeology
Which chronological period is dominant in the area?	Prehistoric Industrial
Has a Historic Landscape Characterisation been undertaken here?	No
Are there SMR sites here?	Yes
Are there SAMs here?	Yes
Are there Listed Buildings here?	Yes
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	No
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	No

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	Area dominated by the settlement corridor that follows the major transport route through the region, specifically the A4059...

Bibliography

List the key sources used for this assessment	Barrie, DSM, 1980, A Regional History of the Railways of Great Britain... Vol... 12: South Wales... Narin... Cadw and ICOMOS, 2000, Register of Landscapes, Parks and Gardens of Special Historical Interest in Wales: Pt1 Parks and Gardens of Glamorgan... Cardiff... Hughes, S, et al, 1992... Collieries of Wales Engineering & Architecture... RCAHMW, Mid Wales Litho Limited, Pontypool... Newman, J, 1995, The Buildings of Wales: Glamorgan... University of Wales Press, Penguin Books, London... Ordnance Survey, 1884/5, First Edition 6' Map... Ordnance Survey, 1900/1, Second Edition 6' Map... Ordnance Survey, 1921, Third Edition 6' Map... Ordnance Survey, 1998, Rhondda and Merthyr Tydfil... 1:25000, Explorer 166... Southampton... RCAHMW, 1976a, An inventory of the ancient monuments in Glamorgan... Vol 1: Pre-Norman, Part I, The Stone and Bronze Ages... Cardiff (HMSO)... RCAHMW 1976b, An Inventory of the Ancient Monuments in Glamorgan... Vol I: Pre-Norman, Part II, The Iron Age and Roman Occupation... Cardiff (HMSO)... RCAHMW 1976c, An Inventory of the Ancient Monuments in Glamorgan... Vol I: Pre-Norman, Part III, The Early Christian Period... Cardiff (HMSO)... RCAHMW 1981, An Inventory of the Ancient Monuments in Glamorgan... Vol IV: Domestic Architecture from the Reformation to the Industrial Revolution, Part I, The Greater Houses... Cardiff (HMSO)... RCAHMW 1988, An Inventory of the Ancient Monuments in Glamorgan... Vol IV: Domestic Architecture from the Reformation to the Industrial Revolution, Part II, The Farmhouses and Cottages... Cardiff (HMSO)...

Assessment

Additional Assessments	
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Outstanding
Justification of overall evaluation	An area of outstanding historic importance, based on the fact that it contains some of the best preserved industrial monuments surviving not only within the Caerphilly/RCT historic landscape, but in South Wales generally.

Evaluation

Condition:	Unassessed
Value:	Outstanding (An area of outstanding historic importance, based on the fact that it contains some of the best preserved industrial monuments surviving not only within the Caerphilly/RCT historic landscape, but in South Wales generally.)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	
Principal management recommendations	
Guideline	Immediate Medium Term Long Term

Description

Summary Description / Key Patterns and Elements	This aspect area is characterised as an urban and industrial transport and communication corridor stretching along the length of the Cynon Valley from Abercynon, north to Pontneddfechan. This aspect area includes the settlements of Mountain Ash, Cwmaman, Aberdare and Hirwaun. The aspect area has a strong prehistoric presence to the north of the valley corridor; many Bronze Age funerary cairns adorn the valley slopes. Abercynon was once a hamlet called Navigation before the main colliery and new town took the name in the 1880s. Aberdare was one of the county''s ancient upland parishes (strictly, a chapelry of Llantrisant), as humble medieval St John''s church indicates. Industrial growth began early in the 19th century with the Gadlys Ironworks opening in 1827, and the first steam-coal mine a decade later. During the middle decades of the century, the Cynon Valley, with Aberdare at its head, became the most prolific centre of steam-coal production. By 1856 Aberdare''s output of coal exceeded one million tons. Industry retreated in the latter half of the 19th century, leaving Aberdare with the air of a market town. What survives of Aberdare''s early industry is of great historical importance. Gadlys Ironworks, is one of the most complete remaining groups of ironworks buildings in South Wales. Matthew Wayne, ironmaster and coal-owner of Merthyr Tydfil, in conjunction with G.R.Morgan and E.M.Williams, founded the works in 1827. Two large masonary blast furnaces and a blowing engine house remain intact (Newman 1995, 133/9). Mountain Ash''s urban and industrial growth came about through the actions of Henry Austin Bruce, later Lord Aberdare, Thomas Powell and John Nixon. Thomas Powell was sinking pits on the Duffryn estate by the 1840s, and John Nixon''s company worked the famous Deep Duffryn mine from the 1850s. By 1863 the population of Mountain Ash was already 6000. In the last twenty years of the 19th century Miskin developed, and Penrhiwceiber Woods were felled as a
If Classification is "Other", specify here	

Evaluation Matrix

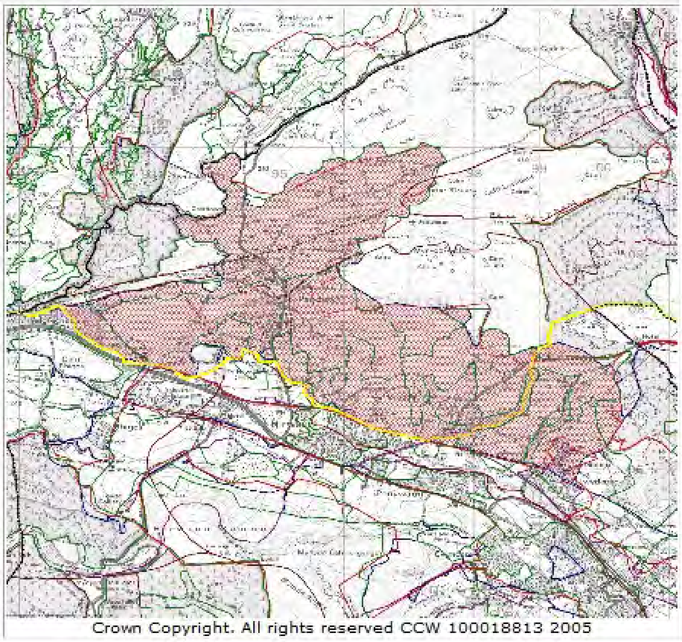
Evaluation Criteria: Integrity	Outstanding (The dominant landscape pattern in this area, characterised as an industrial settlement/communications corridor, is very well defined and visually coherent.)
Evaluation Criteria: Potential	Outstanding (This area has not yet been subject to a detailed historic landscape characterisation. There is considerable potential for a comprehensive survey of the exceptionally rich industrial heritage contained within this aspect area. Improvement of visitor information relating to specific sites (e.g. Overton's causeway at Hirwaun and the Robertstown Tramroad Bridge) would certainly be merited.)
Evaluation Criteria: Rarity	High (Although other industrial settlement/transport corridors exist within the Caerphilly/RCT historic landscape (Cynon HL378; Cynon HL465), this area is of exceptional significance as it contains some of the earliest surviving monuments to the industrial heritage of South Wales, which can justly be regarded as being of national importance.)
Evaluation Criteria: Survival	N/A (The survival of many Bronze Age funerary cairns on the elevated slopes of the Cynon Valley attest to a long history of settlement in this area. 18th-20th century industrial activity predominates in the archaeological record for this area, which contains some of the best preserved industrial monuments within the Caerphilly/RCT historic landscape, including the remains of the Robertstown Tramroad Bridge (GGAT PRN 00969m) the earliest dated iron railway bridge in the world and the Gadlys Ironworks at Aberdare (GGAT PRN 02162m), one of the most complete remaining groups of ironworks buildings in South Wales, the remains of four substantial blast furnaces of late 18th-early 19th century date at Hirwaun Ironworks (NPRN 85173-85176), to the E of which is the impressive survival of a high drystone causeway built by George Overton in 1806-8, the longest structure of its type to survive in South Wales (GGAT PRN 01093.0m).)
Evaluation Criteria: Condition	Moderate

Monitoring

Date of monitoring?	2013-03-01
Monitoring undertaken by	Trysor at monitoring and implementation stage 3 plus CPAT at stage 2, Govannon and/or Border at stage 1, all in consultation with LPA
Has this record been updated following monitoring work?	

Historic Landscape

Aspect Area Name	**Penderyn**
Aspect Area Classification	**Rural environment/Agricultural/Other fieldscapes (Level 3)**
Aspect Area Code	**CYNONHL176**
Date Of Survey : 23/10/2003	



Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Regular Fieldscapes Woodland Water & Wetland Non-nucleated Settlement Extractive Communications

Monitoring

Has the information ever been verified in the field?	Yes (Level 3/1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	Yes (This aspect, dominated by rural fieldscapes, has an agricultural relationship with the unenclosed upland of CYNONHL580...)

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Hedgerow With Trees Dry Stone Walls Boulder Wall Earth/Turf Bank Cloddiau Variants/Stone & Earth Banks Post & Wire Fence Cut Drainage
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Relict-Stone Monuments Buildings & Structures Industrial Archaeology
Which chronological period is dominant in the area?	Prehistoric Post Medieval (1536+) Industrial
Has a Historic Landscape Characterisation been undertaken here?	No
Are there SMR sites here?	Yes
Are there SAMs here?	Yes
Are there Listed Buildings here?	Yes
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	Yes
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	Yes

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	The northern, western and eastern boundary of the aspect is defined by the Unitary Authority boundary and the unenclosed upland of CYNONHL580 and CYNONHL150... The transport corridor CYNONHL117 defines the southern limits of the aspect...

Bibliography

List the key sources used for this assessment	Newman, J, 1995, The Buildings of Wales: Glamorgan... University of Wales Press, Penguin Books, London... Ordnance Survey, 1884/5, First Edition 6' Map... Ordnance Survey, 1900/1, Second Edition 6' Map... Ordnance Survey, 1921, Third Edition 6' Map... Ordnance Survey, 2002, Breacon Beacons National Park, West and Central Areas... 1:25000, Explorer OL12... Southampton...

Assessment

Additional Assessments	
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Outstanding
Justification of overall evaluation	An important, multi-period landscape with significant evidence of prehistoric funerary activity/field clearance incorporated into a later medieval/post medieval fieldscape, with substantial remains of 18th-20th century industrial activity superimposed onto this landscape.

Evaluation

Condition:	Unassessed
	Outstanding (An important, multi-period landscape with significant evidence of prehistoric funerary

Value:	activity/field clearance incorporated into a later medieval/post medieval fieldscape, with substantial remains of 18th-20th century industrial activity superimposed onto this landscape.)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	
Principal management recommendations	
Guideline	

Description

Summary Description / Key Patterns and Elements	A large rural aspect characterized by regular fieldscapes interspersed with natural woodland. Several large reservoirs define the character area's most southerly and easterly aspect. The dominant field boundary within the aspect is drystone boulder dykes and earth and stone banks, although deteriorated post and wire fencing has patched some breeches in the afore mentioned boundaries. The aspect is bounded to the north and east by the interface between the unenclosed upland of Cefn Cadlan, Cefn Sychbant and Mynydd-y-glog, and Cwm Cadlan's enclosed fieldscape. The now dismantled Trappenden's tramroad from Bryngwyn to Glyn-neath defines the aspect's limit to the south, whilst the unenclosed aspect CynonHL150 borders the west. The eastern and northern area of this aspect belong to the Registered Historic Landscape HLW(MGl/P)3. The dramatic landscape south of Fforest Fawr was first manipulated in the Neolithic and Bronze Ages. These periods are represented by the numerous lithic monuments,
If Classification is "Other", specify here	

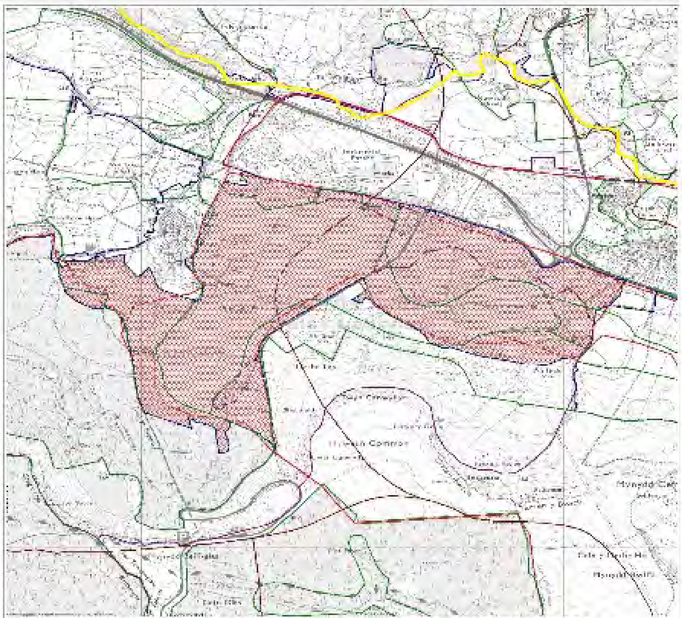
Evaluation Matrix

Evaluation Criteria: Integrity	Outstanding (This area may be characterised as a multi-period upland valley landscape, occupying the valley of the Nant Cadlan and Ceunant Du streams, exhibiting evidence of a prehistoric domestic and funerary landscape incorporated into a later fieldscape of medieval/post-medieval origin incorporating elements of regular and irregular enclosure defined by a network of drystone walls and stone banks, and a diffuse settlement pattern of isolated, often abandoned farmsteads. These dominant characteristics have remained mostly intact although extensive industrial extractive activity in this area from the 18th century through to the present has disrupted this landscape pattern to a certain extent.)
Evaluation Criteria: Potential	Outstanding (This area has been subject to a detailed historic landscape characterisation (CPAT, 2008) (forming HLCA 1202 Cwm Cadlan within the East Fforest-Fawr and Mynydd-y-Glog HL), while the prehistoric monuments within this landscape have been surveyed in the RCAHMW Brecknockshire Inventory (RCAHMW, 1997); however, there remains significant potential for further investigation. Apart from the round cairn at Nant-maden, few of the prehistoric sites have been subject to comprehensive archaeological investigation. Similarly, the ruined farmsteads of medieval/post-medieval origin scattered throughout this landscape have yet to be thoroughly investigated. There remains potential for more prehistoric sites to be identified through study of aerial reconnaissance and field survey. The extensive remains of 18th-20th century industrial activity within this landscape also await detailed investigation and recording.)
Evaluation Criteria: Rarity	Moderate (Shares common characteristics with neighbouring areas of enclosed upland with evidence of multi-period occupation disturbed by later post-medieval industrial activity within the northern periphery of the Caerphilly/RCT historic landscape (e.g. Cynon HL 150; Cynon HL409).)
Evaluation Criteria: Survival	N/A (The archaeological record for this area is remarkably diverse, with evidence of human activity dating back to the Neolithic/Bronze Age periods, represented by a concentration of monuments in the northern part of the aspect area, including round cairns, clearance carns and burnt mounds at Cwm Cadlan(GGAT PRN 00773;(and Nant-maden (GGAT 00741m) situated close to the moorland edge, some of which have been incorporated into the existing field boundaries. Evidence of prehistoric settlement activity, represented by hut circles and field systems, is located immediately E of the aspect area boundary. It is likely that similar features within the aspect area were cleared during the establishment of the existing fieldscape (of medieval, post-medieval origin). There are extensive visible remains of 18th-20th century industrial extractive activity across the area, represented by quarries, limekilns and associated communications features (dismantled tramroads, railways), which survive in reasonably good condition.)
Evaluation Criteria: Condition	High

Monitoring

Date of monitoring?	2013-03-01
Monitoring undertaken by	Trysor at monitoring and implementation stage 3 plus CPAT at stage 2, Govannon and/or Border at stage 1, all in consultation with LPA
Has this record been updated following monitoring work?	

Historic Landscape

Aspect Area Name	**Tower Colliery**	
Aspect Area Classification	**Rural environment/Non agricultural/Reclaimed land (Level 3)**	
Aspect Area Code	**CYNONHL183**	
Date Of Survey : 23/10/2003		

Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Extractive

Monitoring

Has the information ever been verified in the field?	Yes (Level 3/1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	No

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Hedgerow Hedgerow With Trees Post & Wire Fence Cut Drainage
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Industrial Archaeology
Which chronological period is dominant in the area?	Industrial
Has a Historic Landscape Characterisation been undertaken here?	No
Are there SMR sites here?	Yes
Are there SAMs here?	No
Are there Listed Buildings here?	Yes
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	No
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	No

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	The area encompasses a distinct zone of reclaimed land......... It is bordered on the north by the Cynon valley settlement corridor (Cynon HL117) and on the west, south and east by the marginal and woodland of Cynon HL687.........

Bibliography

List the key sources used for this assessment	Hughes, S, et al, 1992......... Collieries of Wales Engineering & Architecture......... RCAHMW, Mid Wales Litho Limited, Pontypool......... Ordnance Survey, 1884/5, First Edition 6' Map......... Ordnance Survey, 1900/1, Second Edition 6' Map......... Ordnance Survey, 1921, Third Edition 6' Map......... Ordnance Survey, 2002, Brecon Beacons National Park, West and Central Areas......... 1:25000, Explorer OL12......... Southampton.........

Assessment

Additional Assessments	
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High
Justification of overall evaluation	The high value of this aspect area is chiefly due to the survival of substantial and historically important remains of 19th - 20th century industrial extractive activity (in particular the Tower No...4 Colliery); extensive modern opencast mining and forestry plantation has largely obliterated earlier patterns of settlement and consequently the archaeological record for this area prior to the 19th century is very limited...

Evaluation

Condition:	Unassessed
Value:	High (The high value of this aspect area is chiefly due to the survival of substantial and historically important remains of 19th - 20th century industrial extractive activity (in particular the Tower No...4 Colliery); extensive modern opencast mining and forestry plantation has largely obliterated earlier patterns of settlement and consequently the archaeological record for this area prior to the 19th century is very limited...)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	
Principal management recommendations	
Guideline	

Description

Summary Description / Key Patterns and Elements	This aspect represents the extent of opencast industrial activity to the west of Hirwaun common (CynonHL903), north of the Rhondda Uplands (CynonHL687), and south of the Hirwaun transport corridor (CynonHL117). This radically altered landscape is the result of recent opencast exploitation of the mineral resource over the past several centuries. The landscape, once open moorland, has been irrevocably altered by this industry and recently altered once more by the complete reclamation and drainage of this area converting coal faces and tips into open improved pasture. The industrial activity within this landscape seems to have obliterated all evidence of past human activity; however not without record. During the Bronze Age this aspect was predominantly open moorland; within this landscape funerary activities have been suggested to have taken place with the construction of stone cairns. Partly excavated before destruction by opencast mining in 1992, none of the excavated cairns gave any evidence for burials, or any structure other than the piling of smaller stones around naturally occurring slabs or boulders. Aerial photography by the RAF has suggested a possible oval earthwork feature c20m in width immediately south of the afore mentioned cairns (Ref: RAF 58/1452 0091-009), which could well have been a cairn or barrow. During opencast working a bronze spearhead was recovered in the Hugh Patches Colliery site. The implement was in a badly corroded condition; however this find does indicate that, whether casually discarded as an isolated incident or lost by the occupants of a busy landscape, such as CynonHL176 and CynonHL580 a little farther north, some sort of occupation activity did exist here in the Bronze Age. Roman influence within the area is represented by a Follis (coin) of Constantius I (''Chlorus'') recovered from the extreme east of this aspect, another coin is said to have been found on the same coal site; however this is remains unsubstantiated. An inscribe
If Classification is "Other", specify here	

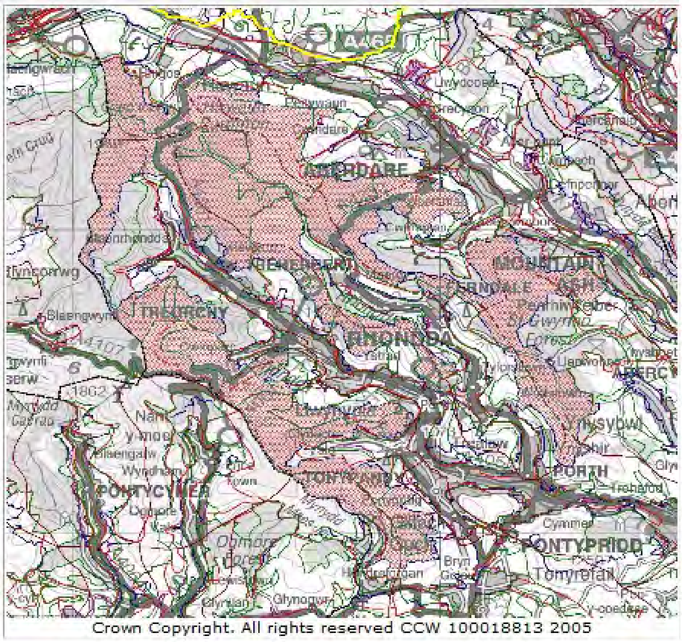
Evaluation Matrix

Evaluation Criteria: Integrity	High (The dominant landscape pattern in this area is characterised by 19th-20th century industrial extractive activity... This consists of substantial opencast workings associated with the recently closed Tower Colliery (much of which has recently been reclaimed and converted into improved pasture), the extensive complex of buildings at Tower No... 4 Colliery and Tower Drift Mine and numerous other relict industrial features (e...g... disused levels, ironstone workings, spoil tips, trackway formations, water management features)... This landscape pattern is well defined and extremely coherent in visual terms, largely obliterating the pre-existing landscape of enclosed upland common with evidence of Bronze Age funerary activity shown on the OS 1st-3rd edition maps... The remaining area of intact upland moor lying to the W of the Nant Gwrangon was heavily afforested in the 1950s, resulting in the destruction of the Cefn yr Esgyn cairnfield...)
Evaluation Criteria: Potential	High (This area has not been subject to a detailed historic landscape characterisation and consequently there is significant potential (and indeed, an urgent requirement) for further survey work in terms of recording the surviving industrial features within this landscape (especially regarding the complex of buildings at Tower No... 4 Colliery) before they are destroyed in the process of site clearance and demolition prior to re-development...)
Evaluation Criteria: Rarity	High (This area forms one of several areas of former enclosed upland common heavily exploited for industrial extractive purposes in the 19th-20th century (Cynon HL648; Cynon HL995)... However, the engine house, fan house and colliery headgear at Tower No... 4 Colliery all remain in an exceptionally well-preserved condition and constitute rare surviving examples of their type...)
Evaluation Criteria: Survival	N/A (The extensive modern opencast mining activity within this landscape has destroyed much of the evidence for earlier patterns of settlement and funerary activity, most notably for the Bronze Age period, represented by a series of finds and features distributed across the landscape associated with occupation, possible burial or farming activity... The extensive remains of the Cefn yr Esgyrn cairnfield were also ploughed up and largely destroyed to make way for a forestry plantation established in the 1950s (RCAHMW, 1976, 118)... The earlier pre-industrial pattern of enclosure and settlement characterised by isolated farmsteads such as Blaengrwangon Farm (GGAT PRN 04266m) shown on the OS 1st -3rd edition maps has also been obliterated by modern opencast mining and afforestation... Across this aspect area, extensive remains survive of 19th-20th century industrial extractive activity, most significantly the recently closed Tower No... 4 Colliery, the site of which is in the process of being redeveloped, although the well-preserved engine house, fanhouse, colliery headframe and pit head of the early 1940s have been granted scheduled monument status (GGAT PRN 02382m-02384m)... Substantial remains of 19th-20th century disused shafts, spoil tips, water management features and ironstone workings (eg... at Hughes Patch - GGAT PRN 01795m) are broadly distributed across the aspect area and survive in variable condition...)
Evaluation Criteria: Condition	Moderate

Monitoring

Date of monitoring?	2012-03-21
Monitoring undertaken by	Govannon
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Fieldwork
What has changed?	

Historic Landscape

Aspect Area Name	**Rhondda Uplands**	
Aspect Area Classification	**Rural environment/Non agricultural/Marginal Land (Level 3)**	
Aspect Area Code	**CYNONHL687**	
Date Of Survey : 27/10/2003		

Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Woodland Reclaimed land Water & Wetland Extractive Marginal Land Other Settlement

Monitoring

Has the information ever been verified in the field?	Yes (Level 3; 1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	Yes (Upland grazing (now largely superceeded by forestry) associated with enclosed land and farmsteads within Rhondda Fawr Enclosed Valley Side CynonHL805, Rhondda Fach Enclosed Valley Side CynonHL870, Cynon Enclosed Valley Side CynonHL515, and Llanwonno and Cwm Clydach CynonHL833.........)

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Dry Stone Walls Post & Wire Fence Cut Drainage Earth/Turf Bank Cloddiau Variants/Stone & Earth Banks
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Relict-Earthworks Relict-Stone Monuments Industrial Archaeology Buried-dry
Which chronological period is dominant in the area?	Prehistoric Industrial Medieval (to 1536)
Has a Historic Landscape Characterisation been undertaken here?	Yes (Roberts, R, 2001 Historic Landscape Characterisation: Y Rhondda/The Rhondda Part 1: landscape characterisation March 2001 GGAT report no......... 2001/019)
Are there SMR sites here?	Yes
Are there SAMs here?	Yes
Are there Listed Buildings here?	Yes
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	Yes
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	No

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	An extremely large character area that is dominated by unenclosed upland......... It is bounded on the north by the reclaimed land of CynonHL183, on the east and south by the settlement corridors, ie extent of current urban expansion, and main industrial/public transport links of the 18th-21st centuries of CynonHL378 and CynonHL117 and on the west by the UA boundary with Neath-Port Talbot.........

Bibliography

List the key sources used for this assessment	Evans, EM and Lewis, RL, 2003, Funerary and Ritual Monument Survey of Glamorgan and Gwent: a synthesis......... GGAT Report No......... 2003/068, Swansea......... Evans, EM, 2002, Prehistoric Funerary and Ritual Sites: Bridgend, Merthyr Tydfil and Rhondda Cynon Taff......... GGAT report no......... 2002/015, Swansea......... Ordnance Survey, 1884/5, First Edition 6' Map......... Ordnance Survey, 1900/1, Second Edition 6' Map......... Ordnance Survey, 1921, Third Edition 6' Map......... Ordnance Survey, 1998, Rhondda and Merthyr Tydfil......... 1:25000, Explorer 166......... Southampton......... Pearson, A & Lewis, RL 2003, Prehistoric funerary & ritual sites: Blaenau Gwent, Caerphilly, Cardiff, Monmouthshire, Newport, Torfaen and the Vale of Glamorgan......... GGAT report no......... 2003/027, Swansea......... RCAHMW, 1976a, An inventory of the ancient monuments in Glamorgan......... Vol 1: Pre-Norman, Part I, The Stone and Bronze Ages......... Cardiff (HMSO)......... RCAHMW, 2003, The Archaeology of the Welsh Uplands......... Aberystwyth......... Roberts, R, 2001 Historic Landscape Characterisation: Y Rhondda/The Rhondda Part 1: landscape characterisation March 2001 GGAT report no......... 2001/019.........

Assessment

Additional Assessments	
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Outstanding
Justification of overall evaluation	The outstanding value assigned to this area is based on the fact that it represents a remarkably well preserved multi-period upland landscape, containing evidence of human activity dating back to the Mesolithic era, including sites of national importance such as the extensive settlement site of Hen Dre'r Mynydd, the largest undefended Iron Age settlement in SE Wales...

Evaluation

Condition:	Unassessed
Value:	Outstanding (The outstanding value assigned to this area is based on the fact that it represents a remarkably well preserved multi-period upland landscape, containing evidence of human activity dating back to the Mesolithic era, including sites of national importance such as the extensive settlement site of Hen Dre'r Mynydd, the largest undefended Iron Age settlement in SE Wales...)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	
Principal management recommendations	
Guideline	

Description

Summary Description / Key Patterns and Elements	This aspect area of dramatic escarpments of Pennant Sandstone cliffs, glacial cymoedd or corries, and extensive open upland ridges and mountain is a landscape of some importance recognised by its inclusion within the Rhondda Historic Landscape on the Cadw/ICOMOS Register. It is characterised as a relict upland agricultural landscape, chiefly mountain sheepwalk, though partially forested with post-medieval industrial incursion typically extraction related. The area is a multi-period and multi-functional upland landscape dominated by prehistoric funerary and ritual features, and with prehistoric, Roman, medieval and post-medieval upland settlement, also included are Roman and medieval military structures, prehistoric/early medieval boundaries, the cross dykes (some with administrative significance from at least the early medieval period) are also visible and characteristic features of the area. The area was also established as a ridge-top communication corridor from the prehistoric period. During the medieval period the area encompassed at least one, possibly two medieval hunting parks. Lesser features include relict post-medieval field boundaries and industrial remains now largely reclaimed. The area displays a variety of archaeologically important sites of all periods since, and including the Mesolithic, with numerous finds of prehistoric flint tool assemblages. The area is dominated, literally, by prehistoric funerary monuments, burial cairns of the Bronze Age, which include Bachgen Carreg (SAM Gm 234), Carn Fach, Carn-y-Pigwn (SAM Gm 372), Carn-y-wiwer (SAM Gm 323), Carn-y-Bica, Bedd Eiddil, Carn Fawr, Garnwen, Pebyll, the cairn and cist on Mynydd Penygraig, Mynydd Brith-weunydd and Mynydd Troed-y-rhiw, and the cairn group on Mynydd Ton. Unusual for the uplands, is the ditched barrow, Crug-yr-Afan (SAM Gm 233), similar to the bell barrows of Wessex (c. 2000-1450 BC), excavated in 1902. Prehistoric settlement in the area dates back to the Mesolithic
If Classification is "Other", specify here	

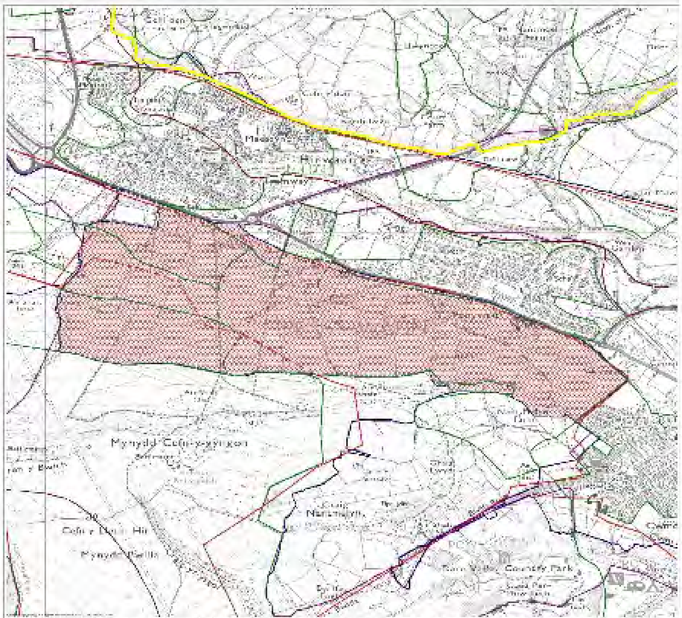
Evaluation Matrix

Evaluation Criteria: Integrity	High (The dominant character of this landscape, consisting of unimproved, common upland sheepwalk with discrete components of relict irregular field enclosure, is well defined and visually coherent... Extensive 19th-20th century industrial extractive activity (mainly quarrying) and modern forestry plantation has impinged upon the coherence of this landscape to a certain extent...)
Evaluation Criteria: Potential	Outstanding (This area has been subject to a detailed historic landscape characterisation, forming HLCA 30 (Rhondda Uplands) within the Rhondda historic landscape (Roberts, 2001); however, there remains considerable potential for further investigation; a comprehensive survey and gazetteer of the numerous prehistoric funerary and settlement sites within this landscape would be particularly valuable... Many of the extant medieval house platform sites have been surveyed by the RCAHMW, however an up to date, comprehensive assessment of these sites and their current condition would be extremely useful... The cross dyke ridge sites within the area have been investigated recently by GGAT (Lewis, 2006)...)
Evaluation Criteria: Rarity	Outstanding (Shares similar characteristics to adjacent HL805 (Rhondda Fawr Enclosed Valley Sides); both areas are distinguished by the remarkable extent and diversity of their archaeological resource, ranging in date from the Mesolithic period through to the present day... One specific site within the aspect area, the extensive settlement site of Hen Dre'r Mynydd, the largest undefended Iron Age settlement in SE Wales, is of national importance...)
Evaluation Criteria: Survival	N/A (This area constitutes an exceptionally rich multi-period landscape, with evidence of human activity dating back to the Mesolithic period... Significant surviving elements of the historic landscape include prehistoric settlement and funerary monuments, the extensive Iron Age undefended settlement site of Hen Dre'r Mynydd (GGAT PRN 00020m-PRN 00021m) a Roman marching camp, several well-preserved early medieval cross ridge dykes guarding the upland ridge way routes into the Rhondda, numerous medieval house platforms and agricultural features of medieval/post-medieval date (i...e... field systems, sheepfolds)... These survive in variable condition, often being damaged by erosion, disturbance by farming practices or quarrying... Extensive, largely relict remains of 19th-20th century industrial extractive activity are visible across much of the aspect area, represented by the extensive workings of the National Colliery, Wattstown, numerous smaller quarries and associated communications features (i...e... tramroads)...)
Evaluation Criteria: Condition	Moderate

Monitoring

Date of monitoring?	2012-03-21
Monitoring undertaken by	Govannon
Has this record been updated following monitoring work?	This record has been updated following monitoring work, there was a real change in the aspect area
Change indicated by	OS Data, Aerial Photographs Fieldwork
What has changed?	

Historic Landscape

Aspect Area Name	**Hirwaun Common, Enclosure**	 Crown Copyright. All rights reserved CCW 100018813 2005
Aspect Area Classification	**Rural environment/Agricultural/Regular Fieldscapes (Level 3)**	
Aspect Area Code	**CYNONHL903**	
Date Of Survey : 23/10/2003		

Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Water & Wetland Recreational

Monitoring

Has the information ever been verified in the field?	Yes (Level 3/1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	No

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Hedgerow Hedgerow With Trees Post & Wire Fence Cut Drainage
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Industrial Archaeology
Which chronological period is dominant in the area?	Post Medieval (1536+) Industrial
Has a Historic Landscape Characterisation been undertaken here?	No
Are there SMR sites here?	Yes
Are there SAMs here?	No
Are there Listed Buildings here?	No
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	No
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	Yes

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	A region dominated by regular fieldscape, but also heavily influenced by extraction... It is bordered on the north by the Cynon valley settlement corridor (Cynon HL117), and on the south by the marginal land of the Rhondda uplands (Cynon HL687)...

Bibliography

List the key sources used for this assessment	Barrie, DSM, 1980, A Regional History of the Railways of Great Britain... Vol... 12: South Wales... Narin... Cadw and ICOMOS, 2000, Register of Landscapes, Parks and Gardens of Special Historical Interest in Wales: Pt2...2: Landscapes of Special Historic Interest Ordnance Survey, 1884/5, First Edition 6' Map... Ordnance Survey, 1900/1, Second Edition 6' Map... Ordnance Survey, 1921, Third Edition 6' Map... Ordnance Survey, 1998, Rhondda and Merthyr Tydfil... 1:25000, Explorer 166... Southampton...

Assessment

Additional Assessments	Bute Colliery and Hirwaun tramway present...
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	High
Justification of overall evaluation	Of high value as a well-preserved example of a late 19th -20th century regular enclosed fieldscape with extensive, broadly distributed relict remains of 18th-19th century industrial extractive activity.

Evaluation

Condition:	Unassessed
Value:	High (Of high value as a well-preserved example of a late 19th -20th century regular enclosed fieldscape with extensive, broadly distributed relict remains of 18th-19th century industrial extractive activity.)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	

Principal management recommendations	
Guideline	

Description

Summary Description / Key Patterns and Elements	This aspect area is characterised by a regular fieldscape, defined by a turf-stone walled boundary, which probably predates industrial activity in the area and may represent the pre-industrial boundary form. These large regular shaped fields enclose what was once the open moorland of Hirwaun Common. The aspect area is bounded to the north and east by the Cynon Valley settlement corridor (CynonHL117); the southern boundary is defined by Cwmdare enclosed valley side (CynonHL836) and the Rhondda Uplands (CynonHL687). Tower Colliery (CynonHL183) bounds the aspect area''s western boundary. The aspect area in the late 18th and 19th centuries was characterised by an extensive network of tramroads servicing the ironworks at Hirwaun, and farther east to those at Merthyr and Ebbw Vale. By 1792 Glover''s Rail Road, from Bryngwyn, entered Hirwaun and joined with the Hirwaun Iron Company''s tramroad from the mountain Levels south of the common. At the river bridge, the tramroads united and entered the Ironworks within the village. The present landscape consists of marginal upland grazing dominated by irrigation ditches; in attempt to remove mountain run off from the common.
If Classification is "Other", specify here	

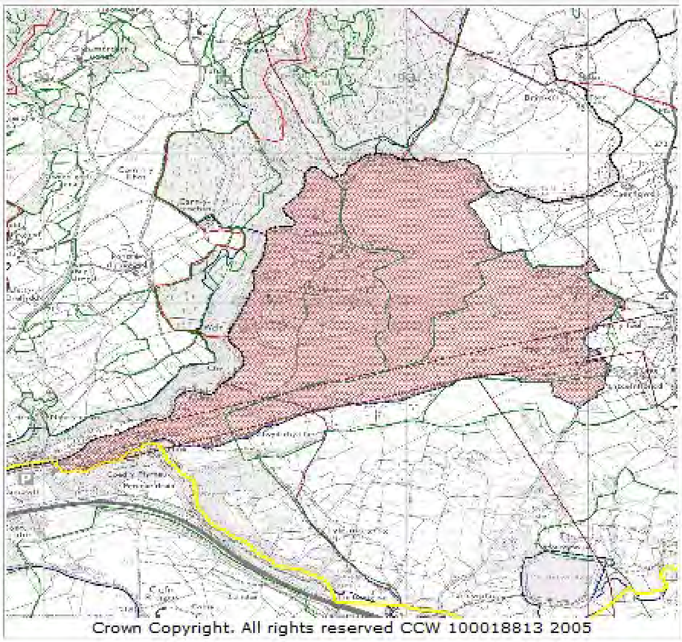
Evaluation Matrix

Evaluation Criteria: Integrity	Outstanding (The existing landscape pattern, characterised by large rectilinear enclosures of 20th century date imposed on what was formerly a large tract of upland moor (Hirwaun Common) extensively mined and quarried in the late 18th and 19th centuries, is well defined.)
Evaluation Criteria: Potential	Outstanding (This area has not yet been subject to a detailed historic landscape characterisation and there is thus potential for further investigation of the extensive relict remains of 18th-19th century industrial activity within this area, both in terms of detailed field survey and documentary study.)
Evaluation Criteria: Rarity	Moderate (Other areas of marginal upland common with evidence of intensive industrial exploitation exist within the RCT historic landscape area.)
Evaluation Criteria: Survival	N/A (The turf stone wall boundary defining the extent of the common area largely survives intact. The archaeological record in this area is dominated by the extensive remains of 18th-19th century industrial activity associated with the several collieries which operated within this area; these remains are broadly distributed across the area and include disused quarry sites, levels, spoil tips and tramroad formations. These industrial extractive remains survive in a variable condition.)
Evaluation Criteria: Condition	Moderate

Monitoring

Date of monitoring?	2013-03-01
Monitoring undertaken by	Trysor at monitoring and implementation stage 3 plus CPAT at stage 2, Govannon and/or Border at stage 1, all in consultation with LPA
Has this record been updated following monitoring work?	

Historic Landscape

Aspect Area Name	**Moel Penderyn**	
Aspect Area Classification	**Rural environment/Non agricultural/Marginal Land (Level 3)**	
Aspect Area Code	**CYNONHL150**	
Date Of Survey : 23/10/2003		

Description

If working at level 3, the classification describes the dominant historic pattern, but which other patterns are important to the historical pattern of this area? (Tick all that apply)	Woodland Marginal Land Extractive

Monitoring

Has the information ever been verified in the field?	Yes (Level 3/1:10,000 and 1:25,000)
Does this area have a special or functional link with an adjacent area?	Yes (The aspect has an agricultural relationship with the enclosed fieldscape of CYNONHL176...)

Description

Which traditional boundary types prevail in the area? (Tick all that apply)	Boulder Wall Earth/Turf Bank Post & Wire Fence
What is the nature of any significant archaeological interest in the area? (Tick all that apply)	Industrial Archaeology
Which chronological period is dominant in the area?	Industrial
Has a Historic Landscape Characterisation been undertaken here?	No
Are there SMR sites here?	Yes
Are there SAMs here?	Yes
Are there Listed Buildings here?	No
Are there Registered Historic Parks and Gardens here?	No
Are there Conservation Areas here?	Yes
Are there World Heritage Sites here?	No
Is the area within a Registered Landscape of Historic Interest?	Yes

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	OS Landline
If OS Data was used, what was the scale?	1:10,000 and 1:25,000
What is the justification for the Aspect Area boundaries?	The Unitary Authority boundary defines the western and northern limits of the aspect area... The southern boundary is identified as the interface between the unenclosed upland of the aspect and the enclosed fieldscapes of CYNONHL176...

Bibliography

List the key sources used for this assessment	Evans, EM and Lewis, RL, 2003, Funerary and Ritual Monument Survey of Glamorgan and Gwent: a synthesis... GGAT Report No... 2003/068, Swansea... Evans, EM, 2002, Prehistoric Funerary and Ritual Sites: Bridgend, Merthyr Tydfil and Rhondda Cynon Taff... GGAT report no... 2002/015, Swansea... Ordnance Survey, 1884/5, First Edition 6' Map... Ordnance Survey, 1900/1, Second Edition 6' Map... Ordnance Survey, 1921, Third Edition 6' Map... Ordnance Survey, 2002, Brecon Beacon National Park, West and Central Areas... 1:25000, Explorer OL12, Southampton... RCAHMW, 1976a, An inventory of the ancient monuments in Glamorgan... Vol 1: Pre-Norman, Part I, The Stone and Bronze Ages... Cardiff (HMSO)... RCAHMW 1976b, An Inventory of the Ancient Monuments in Glamorgan... Vol I: Pre-Norman, Part II, The Iron Age and Roman Occupation... Cardiff (HMSO)... RCAHMW, 2003, The Archaeology of the Welsh Uplands... Aberystwyth...

Assessment

Additional Assessments	
Additional Comments	

Evaluation Matrix

Evaluation Criteria: Overall Evaluation	Outstanding
Justification of overall evaluation	The outstanding value assigned to this landscape lies primarily in the rich industrial heritage which it contains, in particular the extensive remains of the Glyn Neath Gunpowder works on the western edge of the aspect area, which represent a unique survival within the Caerphilly/RCT historic landscape and further to the E, the 18th - 19th century quarries and associated tramroad network on Moel Penderyn.

Evaluation

Condition:	Unassessed
Value:	Outstanding (The outstanding value assigned to this landscape lies primarily in the rich industrial heritage which it contains, in particular the extensive remains of the Glyn Neath Gunpowder works on the western edge of the aspect area, which represent a unique survival within the Caerphilly/RCT historic landscape and further to the E, the 18th - 19th century quarries and associated tramroad network on Moel

	Penderyn.)
Trend:	Unassessed

Recommendations

Existing management	Unassessed
Existing management remarks:	
Principal management recommendations	
Guideline	

Description

Summary Description / Key Patterns and Elements	An island of exposed carboniferous limestone supporting unenclosed upland pasture surrounded by enclosed fieldscapes and forestry. Our earliest endeavours within the landscape are represented by Craig y Ddinas Iron Age hillfort. The hillfort is situated at the southwestern end of the long narrow limestone promontory of Moel Penderyn at the confluence of Afon Mellte and Afon Sychryd. The occupants took advantage of this natural promontory, with its sheer cliffs to the north and south, to build a domestic and defensive space enclosed by two linear earthworks (RCAHMW 1986, 24/5). More recently the hillfort has had aspects of its western and northern boundary quarried away in the pursuit of silica. A tramroad now dissects the extreme western edge of the forts ramparts, a testament to its recent industrial history. It is this period of activity, which so defines the appearance, and nature of the present landscape. To the north of Craig y Ddinas fort, stretching along the valley bottom of
If Classification is "Other", specify here	

Evaluation Matrix

Evaluation Criteria: Integrity	Outstanding (The dominant landscape pattern, characterised by unenclosed upland common on Moel Penderyn bordered by extensive tracts of forestry and enclosed fields, has largely remained unchanged from that shown on the OS 1st edition map, with significant relict remains of 18th-20th century industrial extractive activity including limestone quarrying and, along the banks of the Afon Mellte, silica mining associated with the extensive remains of the Glyn Neath Gunpowder Works.)
Evaluation Criteria: Potential	Outstanding (This area has not been subject to a detailed historic landscape characterisation and consequently there is considerable potential for further investigation, both in terms of field survey and documentary study, of the extensive remains of the Glyn Neath Gunpowder Works and associated silica mines on the E bank of the Afon Mellte, as well as the Penderyn Quarries and associated tramroad network. The Brecon Beacons National Park Authority has undertaken considerable work to conserve the remains of the Gunpowder Works and provide excellent visitor access and information relating to the extant buildings.)
Evaluation Criteria: Rarity	High (Although this area shares many characteristics with neighbouring areas (e.g. Cynon HL 176), as an area of extensive upland common exploited for industrial extractive purposes during the 18th-20th centuries, it is of exceptional importance due to the extensive surviving remains of the Glyn Neath Gunpowder Works and associated silica mines along the E bank of the Afon Mellte, which represent a unique survival not only within the RCT historic landscape but within South Wales as a whole.)
Evaluation Criteria: Survival	N/A (The archaeological record in this area is reasonably diverse, the earliest evidence of human activity represented by the remains of the Iron Age promontory fort of Craig-y-ddinas (GGAT PRN 1107m) which however has been significantly damaged by silica quarrying activity. The ruined remains of a number of isolated farmsteads of medieval or early post-medieval date also survive within the area (e.g. Cil-hepste Fach - GGAT PRN 02586m). The dominant period in the record is undoubtedly industrial, represented by extensive evidence of 18th-20th century industrial extractive activity, including limestone quarrying and associated tramroad features on Moel Penderyn (NPRN 88073; NPRN 308305-308306) and, along the banks of the Afon Mellte, silica mining, associated with the substantial, though ruined remains of the Glyn Neath Gunpowder Works (GGAT PRN 02606m) which are designated as a scheduled ancient monument.)
Evaluation Criteria: Condition	High

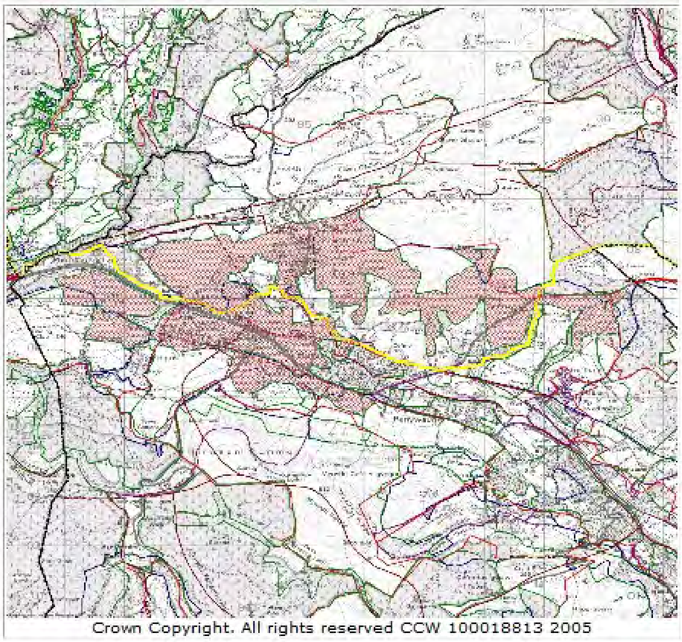
Monitoring

Date of monitoring?	2013-03-01
Monitoring undertaken by	Trysor at monitoring and implementation stage 3 plus CPAT at stage 2, Govannon and/or Border at stage 1, all in consultation with LPA
Has this record been updated following monitoring work?	

Landscape Habitats

Aspect Area Name	
Aspect Area Classification	**Dry (Relatively) Terrestrial Habitats/Grassland & Marsh/Mosaic (Level 3)**
Aspect Area Code	**CYNONLH051**

Date Of Survey : 05/07/2000



Monitoring

Does this area have a special or functional link with an adjacent area?	No
What is the total land area within the boundary (in hectares)?	1400 Hectares

Description

What are the dominant soil types? (specify up to 3 types)	Peat soils
What Phase 1 habitat types are present? Only select the five most dominant types and, for each of these, specify below what percentage of the Aspect Area is made up of these.	Semi-natural Broadleaved Woodland (7%) Semi-improved Neutral Grassland (12%) Improved Grassland (27%) Marshy Grassland (38%) Not Accessed Land (6%)
Does the area contain habitats of international importance?	Yes
Does the area contain BAP habitats?	Yes
Does the area contain protected sites?	Yes
If yes, which ones?	SSSI (Cor Bryn-Y-Gaer, Woodland Park & Pontpren, Bryncarnau grasslands) pSNCI (Sinc ref is 2,3,4,5,7,8,9,10,12,13,18) SAC (Blaen Cynon)
Approximately what proportion of the Aspect Area is within the protected site?	11-20%
Does the area support important species?	Yes
Are there any significant threat species present in abundance? (Field visit required)	Not known
Are any of these features in a very good condition? (Field visit required)	
Are any of these features in a poor condition? (Field visit required)	
What are the main land management activities taking place in the area? (Field visit required)	Stock grazing
Do any of the above appear to have an appreciable positive impact on biodiversity? (Field visit required)	None
Do any of the above appear to have an appreciable negative impact on biodiversity? (Field visit required)	Some (Stock grazing will prevent the grassland from reaching higher levels of ecological value...........................)
Is the biodiversity in the area in any way threatened?	Not known
Are there clear opportunities to improve the biodiversity aspect of this area?	Yes (Introduce Glastir scheme...........................)
Summarise the key features that define this area's biodiversity character	Lowland marshy grassland with transition to upland marshy grassland including the largest area of peat based valley mire in Mid Glamorgan...........................Hirwaun ponds supports a rich dragonfly fauna...........................

Evaluation

Value	Outstanding (Large areas of Purple moor grass priority habitat which is a much declined and threatened habitat........................... SAC and SSSI designations are present...........................)
Condition	Good
Trend	Constant

Description

If yes, which habitats of international importance?	Purple moor-grass meadows
If yes, which BAP habitats?	Purple Moor Grass & Rush Pastures Fens

Recommendations

Existing management	Unassessed
Principal management recommendations	
Guideline	Long Term (Long Term - Ensure grazing levels do not degrade habitat......... - Long Term - preserve Marsh Fritillary habitats......... - Medium Term - Introduce Glastir scheme) Long Term (preserve Marsh Fritillary habitats...........................) Medium Term (Introduce Tir Gofal scheme)

Monitoring

Has the information ever been verified in the field?	Yes

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10 000, how much of the Aspect Area boundary is precise?	All

At 1:10,000, how much of the Aspect Area boundary is precise?	All
What baseline information source was used for Aspect Area boundary mapping?	Other (OS raster, OS landline, Phase 1 habitat..........................)
If OS Data was used, what was the scale?	1:10,000
What is the justification for the Aspect Area boundaries?	They encompass a large area of grassland within which areas of marshy are frequent..........................

Bibliography

List the key sources used for this assessment	Relevant LBAP

Assessment

Additional Assessments	Sinc ref is 2,3,4,5,7,8,9,10,12,13,18
Additional Comments	N/A

Evaluation Matrix

Evaluation Criteria: Priority Habitats	High (Numerous areas of Purple moor grass priority habitat are present..........................)
Evaluation Criteria: Significance	High (Areas of such habitats covering such extensive areas are rare..........................)
Evaluation Criteria: Opportunity	Moderate (Area could be further enhanced by alterations to grazing pressure..........................)
Evaluation Criteria: Expansion rates	Low (Purple moor grass marshy grassland has greatly declined)
Evaluation Criteria: Sensitivity	High (Areas of habitat could be easily lost due to intensification of grazing..........................)
Evaluation Criteria: Connectivity/Cohesion	High (Areas of semi-improved and marshy grassland are fragmented within the wider improved grassland landscape, particularly in lowland areas..........................)
Evaluation Criteria: Habitat Evaluation	Outstanding (Such large areas of valuable grassland are rare..........................)
Evaluation Criteria: Importance for key species	High (Marsh Fritillary are present..........................)
Evaluation Criteria: Overall Evaluation Habitat and Species	Outstanding

Description

If yes, which species? (for each of the species, also note the source of information)	(Eurodryas aurinia) Marsh Fritillary, (Euphydryas aurinia) Marsh Fritillary, (Cirsium dissectum) Meadow Thistle, (Sanguisorba officinalis) Great Burnet, (Hipparchia semele) Grayling, (Pyrrhosoma nymphula) Large Red Damselfly, (Campylopus introflexus) Heath Star Moss, (Dactylorhiza fuchsii) Common Spotted Orchid, (Boloria selene) Small Pearl-bordered Fritillary, (Carum verticillatum) Whorled Caraway, (Rhinanthus minor) Yellow-rattle, (Ulex gallii) Western Gorse, (Hyacinthoides non-scripta) Bluebell, (Cladopodiella fluitans) Bog Notchwort, (Carum verticillatum) Whorled Caraway, (Boloria selene) Small Pearl-bordered Fritillary, (Alchemilla glabra) Smooth Lady's-mantle, (Boloria selene) Small Pearl-bordered Fritillary, (Scutellaria minor) Lesser Skullcap, (Inachis io) Peacock butterfly, (Lasiommata megera) Wall Brown, (Orthetrum coerulescens) Keeled Skimmer, (Sphagnum compactum) Compact Bog-moss, (Coenonympha pamphilus) Small Heath, (Sphagnum tenellum) Soft Bog-moss, (Coenonympha pamphilus) Small Heath, (Polyommatus icarus) Common Blue, (Polygonia c-album) Comma, (Libellula quadrimaculata) Four-spotted Chaser, (Sympetrum danae) Black Darter, (Pyrrhosoma nymphula) Large Red Damselfly, (Tyria jacobaeae) Cinnabar, (Pinguicula vulgaris) Common Butterwort, (Rana temporaria) Common Frog, (Euphrasia anglica) Eyebright, (Eleocharis quinqueflora) Few-flowered Spike-rush, (Euphrasia anglica) Eyebright, (Bufo bufo) Common Toad, (Cordulegaster boltonii) Golden-Ringed Dragonfly, (Platanthera chlorantha) Greater Butterfly-orchid, (Menyanthes trifoliata) Bogbean, (Splachnum ampullaceum) Cruet Collar-moss, (Dactylorhiza maculata) Heath Spotted Orchid, (Cordulegaster boltonii) Golden-ringed Dragonfly, (Pedicularis palustris) Marsh Lousewort, (Buteo buteo) Buzzard, (Callophrys rubi) Green Hairstreak, (Euphrasia rostkoviana) Eyebright, (Genista tinctoria) Dyer's Greenweed, (Vanellus vanellus) Lapwing, (Vicia orobus) Wood Bitter-vetch, (Vicia orobus) Wood Bitter-vetch, (Turdus philomelos)

Evaluation Matrix

Justification of overall evaluation	A large area of amuch declined, threatened Priority habitat as well as valuable asreas of semi-improved grassland.......................... area has both SSSI and SAC designations within it which show its great value.......................... An important area for Marsh Fritillary

Recommendations

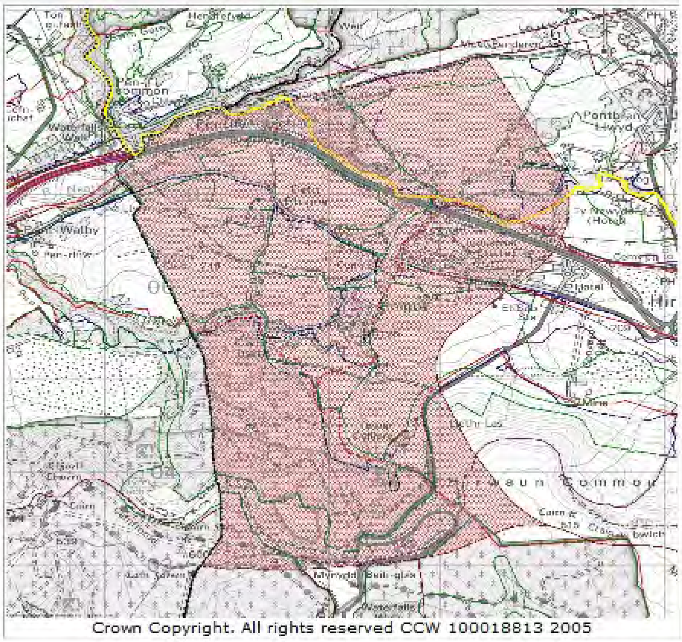
Existing management remarks:	Ensure protection of/appropriate management of habitat

Monitoring

Date of monitoring?	2012-07-01
Monitoring undertaken by	Environment Systems Limited
Has this record been updated following monitoring work?	This record has been updated following monitoring work as more up to date information is available
Change indicated by	Phase 1 Habitat Survey & Seasonal Change Maps
What has changed?	

Geological Landscape

Aspect Area Name	**Rhigos**
Aspect Area Classification	**Mountain and upland valley/Glaciated mountain terrain/Glacial mountain valley (Level 3)**
Aspect Area Code	**CYNONGL028**
Date Of Survey : 24/04/2000	



Description

What is the geographical and topographical character of this area?	S margin of the NE-SW Upper Neath valley, S of the Neath fault zone (including part of SSSI Dyffrynoedd Nedd a Mellte, a Moel Penderyn SSSI)... Steep scarp slope in gently S-dipping Pennant sandstones (Upper Carboniferous), eroded into prominent cirque with landslips in Craig y Llyn SSSI... Lower gentle slopes in Productive Coal Fm (Upper Carboniferous), covered with extensive boulder clay & patches of peat, which fills a glacial lake at Hirwaun Ponds... NW-SE Hirwaun fault zone... Coal Measures worked in Tower colliery & reclaimed opencast sites... Adits in Pennant measures...
What is the characteristic Level 3 component of the area?	Glacial mountain valley
Which of the following is a significant contributor to the geological character of the area?	Stratigraphic formation(s) (Productive Coal Fm, South Wales Pennant Fm (Upper Carboniferous)) Superficial deposits (Boulder clay, alluvium, peat) Structural features (NW-SE Hirwaun Fault Zone, E-W thrust zone) Active processes (Fluvial) Past processes (Glacial, periglacial)
What additional subsidiary Level 3 components are notable?	Active upland river or stream channel system Ancient upland river / stream systems Mass movement Mineral workings Other (Tectonically controlled topography)
What Level 4 components are notable in this area?	Scarp slope Landslip (ancient) Opencast mine, gravel or sand pit Reclaimed land Lagoon/lake/pool (natural) Lake / reservoir (artificial) Slope Hill top Former lake (e.g. silted up) Cwm/corrie Coal / mineral spoil tips
What active geological and geomorphological processes are significant in this area?	Fluvial
Are there components of significant hydrological importance?	Yes (Neath valley, reservoirs, streams...)
Are there any pedological processes that are significant in the area or have had a landscape forming effect?	Yes (High - low permeability soils...)
Is there current mineral extraction?	Yes (Coal)
Has there been mineral extraction in the past?	Yes (Coal)
Are there SSSI/GCR sites here?	Yes (Includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs - interests include Westphalian stratigraphy (Upper Carboniferous)...)
Are there geological SINC, 2nd tier, or RIGS sites in the area?	Yes (Cefn Rhigos Drumlins Site (RIGSID 784): Geomorphological; Dinas Silica Mines (RIGSID 563, part): Carboniferous / Industrial.)

Evaluation

Value	Outstanding (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Condition	Good (Southern area includes edge of plateau with well developed cirques - lower ground to north with some development, but not threatening former...)
Trend	Constant (Southern area includes edge of plateau with well developed cirques - lower ground to north with some development, but not threatening former...)

Recommendations

Existing management	Generally Appropriate
Principal management recommendations	Maintain natural system and maintain SSSI in favourable condition by implementation of management plans and ensure that RIGS are safeguarded using Local Plan policies and constraint mapping and that other features of particular geological or geomorphological significance in the area are not lost/damaged due to development, etc.
Guideline	Long Term (Maintain SSI in favourable condition by implementation of management plans and ensure that RIGS are safeguarded using Local Plan policies and constraint mapping.) Long Term (Ensure that no significant features of geological or geomorphological significance, including glacial cirques in south of AA and lake sediments at Hirwaun Ponds, are lost/damagedt due to development/forestry, etc.)

Tolerance To Change

Are there any significant threats to the current integrity and condition of the Earth Heritage features of the area?	Yes (Ensure that no significant features of geological or geomorphological significance, including glacial cirques in south of AA and lake sediments at Hirwaun Ponds, are lost/damagedt due to development/forestry and that SSSI is maintained in favourable condition by implementation of management plan...: No net loss of key geological/geomorphological features should be considered acceptable.)

Aspect Area Boundary

To what level was this information site-surveyed?	Level 3
At 1:10,000, how much of the Aspect Area boundary is precise?	None (Aspect Area boundaries plotted at 1:25,000...)
What baseline information source was used for Aspect Area boundary mapping?	Other (1:50 000 BGS Geological map sheet; 1:25 000 OS Explorer map sheet; Digital Terrain Model compiled from OS panorama digital terrain data (50m resolution))
If OS Data was used, what was the scale?	1:25,000
What is the justification for the Aspect Area boundaries?	AA corresponds to Pennant sandstone outcrop of the upper Neath valley...

Evaluation Matrix

Evaluation Criteria: Research Value	Outstanding (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Evaluation Criteria: Educational Value	High (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Evaluation Criteria: Historical Value	High (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Evaluation Criteria: Rarity / Uniqueness	Outstanding (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Evaluation Criteria: Classic Example	High (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Evaluation Criteria: Overall Evaluation	Outstanding (Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.)
Justification of overall evaluation	Southern area includes edge of plateau with well developed cirques - includes Dyffrynoedd Nedd a Mellte, a Moel Penderyn and Craig y Llyn SSSIs with interests including Westphalian stratigraphy (Upper Carboniferous) and RIGS for glacial geomorphology and Carboniferous stratigraphy.

Bibliography

List the key sources used for this assessment	1:50 000 BGS Geological Map sheet 231 Merthyr, S&D, 1979; 1:25 000 Explorer Map OL12 Brecon Beacons National Park, Western and Central Regions ; 1:25 000 Explorer Map 166 Rhondda and Merthyr Tydfil; Digital Terrain Model compiled from OS panorama digital terrain data (50m resolution); 1:100 000 Groundwater Vulnerability Map, Environment Agency... Sheet 36, Gwent, South and Mid Glamorgan, 1996; 1:625 000 Geological Map of the UK: Quaternary Geology, S sheet, 1977; Barclay, W...J..., Taylor, K... and Thomas, L...P... 1988... Geology of the South Wales coalfield... Part 5, The country around Merthyr Tydfil : Memoir of the British Geological Survey, Sheet 231 (England and Wales)... 3rd ed..., H...M...S...O..., London, x+52p...

Assessment

Additional Assessments	South Wales RIGS survey (2013); LANDMAP monitoring project (2012-2013).
Additional Comments	Additional Level 4 features include: Stream; Disused quarry; Natural crags and inland outcrops...

Monitoring

Has the information ever been verified in the field?	No
Does this area have a special or functional link with an adjacent area?	No

Description

If Classification is "Other", specify here	N/A

Recommendations

Existing management remarks:	Southern area includes edge of plateau with well developed cirques - lower ground to north with some development, but not threatening former...

Description

Where bedrock dominated, what is the dominant bedrock type?	Sedimentary
Where bedrock dominated, what is the age that characterises the aspect area?	Carboniferous
Where bedrock dominated, what is the major rock lithogy (-ies)?	Sandstone
Where drift dominated, what is the dominant drift deposit?	Glacial
Where drift dominated, what is the major sediment that characterises the area?	Boulder clay/till

Monitoring

Date of monitoring?	2012-03-01
Monitoring undertaken by	K.N. Page (Geodiversity and Landscape Specialist) in conjunction with L.Cherns (University of Cardiff) at the change detection stage of the monitoring process and with input from the local planning authority (2012-2013).
Has this record been updated following monitoring work?	This record has been updated following monitoring work as more up to date information is available
Change indicated by	Policies, plans & information resources (South Wales RIGS survey (2013).)
What has changed?	

8.2 The tables below identify the Aspect Areas that fall within the ZTV and Study Area.

8.3 Further scoping for assessment identifies areas (shaded grey) for detailed assessment i.e. all host areas and areas with a High or Outstanding evaluation that have the theoretical potential to experience Significant indirect effects as a result of the proposed development.

Visual and Sensory

Unique ID	Area Name	Published classification and (Evaluation)	Potential Landscape Character Effects (and Representative Viewpoints)
CYNONVS833	Penderyn	Hillside & Scarp Slopes Mosaic (Moderate)	Host Area and surrounding landscape – Direct and Indirect intervisibility from close to long range (VPs A, B, C , D, G, H, I & L)
CYNONVS522	Abedare	Urban (Low)	Indirect. Largely outwith the ZTV – occasional close range theoretical intervisibility largely of stack and building ridge (VP E & F)
CYNONVS001	Tower Colliery	Excavation (Low)	Indirect. Theoretical medium to long range intervisibility – largely of stack and building ridge (VP K)
CYNONVS340	Hirwaun Common	Upland Grazing (High)	Indirect. Theoretical long range intervisibility from elevated land in context of opencast workings (VP J)
CYNONVS580	St Gwynno	Wooded Upland & Plateau (Moderate)	Indirect. Theoretical long range intervisibility from ridge and upper slopes of Mynydd Beili-glas (VP N)
CYNONVS890	Craing Nantmelyn	Hillside & Scarp Slopes Grazing (Moderate)	Indirect. Theoretical long range intervisibility of stack and building ridge south of Hirwaun and Penywaun
CYNONVS735	Cadair Fawr	Upland Grazing (High)	Indirect long range intervisibility from elevated land east of Penderyn (VP M)

Cultural

Unique ID	Area Name	Published classification and (Evaluation)	Potential Landscape Character Effects (and Representative Viewpoints)
CYNONCL056	Designated Landscape Areas	Other Institutions (High)	Host Area (south eastern part of Site) and land to the east where ZTV indicates ridge and stack close range intervisibility. Also long range intervisibility from land to south of Hirwaun and Penywaun.
CYNONCL044	Brecon Beacons National Park	Land Divisions (Outstanding)	Host area (northwestern part of Site within BBNP) and land to the north and northeast. Frequent close to long range intervisibilty (VPs A. B, C, D, G, H & M).
CYNONCL042	Hirwaun	Heavy Industry (High)	Indirect effects. South of Site with ZTV indicating limited close range intervisibility (VPs E & F).
CYNONCL041	The Rhigos	Sense of Place (High)	Indirect effects. South and east of Site including Rhigos and environs and Hirwaun Common ZTV indicates frequent medium to long range intervisibility (VPs I, J, K, L & N).

Historic

Unique ID	Area Name	Published classification and (Evaluation)	Potential Landscape Character Effects (and Representative Viewpoints)
CYNONHL117	Cynon Valley Corridor	Nucleated Settlement (Outstanding)	Host Area and land in the valley including the A465 corridor, Hirwaun and Rhigos. Close range intervisibility and restricted further afield (VPs A, B, C, E, F & I).
CYNONHL176	Penderyn	Other Fieldscapes (Outstanding)	Indirect effects. Medium to long range intervisibility from elevated land around Pontbren Llywd and Penderyn (VPs D, G, H & M)
CYNONHL183	Tower Colliery	Reclaimed land (High)	Indirect effects. Medium to long range intervisibility south of Hirwaun (VPs J & K)
CYNONHL722	Cwm Wyrfa	Regular Fieldscapes (Moderate)	Indirect Effects. Long range intervisibility south of Cefn Rhigos (VP L)
CYNONHL687	Rhondda Uplands	Marginal Land (Outstanding)	Indirect Effects. Long range intervisibility at Hirwaun Common (VPs J & N)
CYNONHL903	Hirwaun Common, Enclosure	Regular Fieldscapes (High)	Indirect Effects. Long range intervisibility south of Penywaun – building ridge and stack only
CYNONHL150	Moel Penderyn	Marginal Land (Outstanding)	Indirect effects only. Long range intervisbility from elevated land (VP H)

Landscape Habitats

Note – Host Area only covered. Other Landscape Habitat Aspect Areas within the Study Area are not covered as there is no potential for significant indirect effects.

Unique ID	Area Name	Published classification and (Evaluation)	Potential Landscape Character Effects
CYNONLH051	Not given	Mosaic (Outstanding)	Host Area and immediately adjoining land. Direct landscape impacts focusses on additions to the landscape structure on the site and the relationship to adjoining vegetation/habitats.

Geological Landscape

Note – Host Area only covered. Other Geological Aspect Areas within the Study Area are not covered as there is no potential for significant indirect effects.

Unique ID	Area Name	Published classification and (Evaluation)	Potential Landscape Character Effects
CYNONGL028	Rhigos	Glacial Mountain Valley (Outstanding)	Host Area and immediately adjoining land. Limited potential for significant effects as existing ground levels would remain largely unchanged.

8.4 All host areas have been included for the five LANDMAP layers. Other aspect areas have been scoped for inclusion where the published Evaluation is High or Outstanding i.e. where there is the potential for Significant indirect effects on Landscape Character.

8.5 The assessment below focuses on the worst case scenario i.e. Operational at Year 1 winter, with any Significant effects shaded grey. Construction effects are covered in the main chapter text together with Year 15 effects (where Significant Year 1 effects only have been identified).

8.6 Cross reference to Viewpoints has been included; however the assessment of effects on the key characteristics of the landscape as recorded in the LANDMAP is different to an assessment of the impact of the Proposed Development on the visual amenity as experienced by human receptors. In theory there can be indirect effects from a Proposed Development on aspect areas within the wider study area without intervisibility, however in reality for developments of this nature most indirect effects do not occur unless there is some level of intervisibility.

Area Name (Unique ID)	Value	Susceptibility to Change	Sensitivity	Magnitude	Landscape Character Effect (Year 1 winter)
Visual and Sensory					
Penderyn (CYNONVS833)	Medium	Direct and Indirect Effects: Medium	Medium	Very Large to Medium at close to medium range (e.g. VPs A, B, C, D & H)	Major to Moderate/Major **(Significant)**
				Medium to Very Small at medium to long range (e.g. VPs G, I & L)	Moderate/Minor (Not Significant)
Hirwaun Common (CYNONVS340)	High	Indirect Effects: Low	Medium	Medium at long range (e.g. VP J)	Moderate (Not Significant)
Cadair fawr (CYNONVS735)	High	Indirect Effects: Low	Medium	Small to Medium at long range (e.g. VP M)	Minor/Moderate (Not Significant)
Cultural Landscape					
Designated Landscape Areas (CYNONCL056)	High	Direct and Indirect effects: Low	Medium	No direct or indirect effects upon prehistoric monuments, redundant industrial workings or forestry	Neutral (No effect)
BBNP (CYNONCL044)	Very High	Direct and Indirect effects: Medium	High	Close range: Proposed Development within infrastructure of established industrial estate within the BBNP (VPs A, B, C & D): Large	Major **(Significant)**
				At medium to long range as above (VPs G, H and M): Very Small to Medium	Moderate/Major **(Significant)** to Minor/Moderate (Not Significant)
Hirwaun (CYNONCL042)	High	Indirect Effects: Low	Medium	Generally limited at close to medium range	Moderate (Not Significant)

				intervisibility and within context of industrial estate: Medium to Large (VPs E & F).	
The Rhigos (CYNONCL041)	High	Indirect Effects: Low	Medium	Generally limited intervisibility and within context of industrial estate: Small to Medium (VPs I, J, K, L & N).	Moderate/Minor (Not Significant)
Historic Landscape					
Cynon Valley Corridor (CYNONHL117)	Very High	Direct and Indirect effects: Low	Medium to High	Close to long range: No effect on the key characteristics of the urban and industrial transport and communication corridor (VPs A, B, C, E, F & I)	Neutral (Not Significant)
Penderyn (CYNONHL176)	Very High	Indirect Effects: Very Low	Medium	Medium to long range: No effect on the key characteristics of prehistoric funerary activity & medieval/post medieval fieldscape (VPs D, G, H & M)	Neutral (Not Significant)
Tower Colliery (CYNONHL183)	High	Indirect Effects: Very Low	Low to Medium	Medium to long range: No effect on the key characteristics of 19th to 20th century extractive activity (VPs J & K)	Neutral (Not Significant)
Rhondda Uplands (CYNONHL687)	Very High	Indirect Effects: Very Low	Medium	Long range: No effect on the key characteristics of prehistoric and funerary monuments (VPs J & N)	Neutral (Not Significant)
Hirwaun Common, Enclosure (CYNONHL903)	High	Indirect Effects: Very Low	Medium	Long range: No effect on the key characteristics of regular fieldscape and turf-stone wall field boundaries	Neutral (Not Significant)
Moel Penderyn (CYNONHL150)	Very High	Indirect Effects: Very Low	Medium	Long range: No effect on the key characteristics of the historic tramway on the eastern side of the hill (outwith ZTV)	Neutral (Not Significant)
Landscape Habitats					
CYNONLH051	Very High	Low	Medium	Small (beneficial) from addition of native perimeter tree and shrub planting	Minor/Moderate beneficial (Not Significant)
Geological Landscape					
CYNONGL028	Very High	Low (at a Site level)	Medium	Very Small from minor changes to ground levels within Site	Minor (Not Significant)

enviroparks

APPENDIX 8.3

Viewpoint assessment

Chapter Eight
APPENDIX 8.3

VIEWPOINT ASSESSMENT

Viewpoint A

8.1 This viewpoint is representative of views potentially gained by public footpath users within the National Park, although the definitive route along the lower slope of the nearby reservoir has limited accessibility due to fencing. However, it appears that the track could be used by footpath users as it connects directly to the route near Tai-cwpau to the west and a section of fence near the northeastern corner of the Site has been cut to allow access to the overgrown route that passes through woodland to the east of the reservoir. A belt of trees exists between the definitive route and the Site and therefore the actual visibility would be less than illustrated in this view.

8.2 The existing view (see **Visualisation Aa**) takes in the northern boundary of the Site that is enclosed by a security fence, beyond which scrub within rough grassland filters views of the existing building on the Site. The remainder of the Site is visible, partly filtered in places by scrub. The backdrop of the view consists of planting within the Hirwaun Industrial Estate, pylons and rising land at Hirwaun Common on the horizon.

8.3 The sensitivity of the footpath users views has been assessed as follows:

- The views are restricted by surrounding tree planting within the reservoir and adjacent industrial estate (i.e. within the Site) and are filtered by the security fencing that encloses the Site. The value of the view is Medium.

- The Susceptibility to change assuming a baseline of no development on the Site is Medium due to the adjacent industrial uses and context within the Hirwaun Industrial Estate.

- The overall sensitivity is assessed as Medium.

8.4 The changes to the view as a result of the Proposed Development would comprise the introduction of the High Energy Use building that is located between 15m and 30m from the security fence. The planting along the northern boundary would be reinforced, such that by Year 15 visibility of the proposals would be very limited, although the view would be replaced by a dense thicket of native tree and shrub planting with heavily filtered glimpses of the building beyond in winter.

8.5 The magnitude of visual effect at Year 1 would be Very Large with views of the new buildings, filtered by existing retained tree planting and more apparent in winter.

8.6 The overall effects for walkers (diverted from the definitive footpath route) would be a Major effect that is Significant (Year 1), reducing to a Moderate level that is Not Significant as planting matures (Year 15).

8.7 The magnitude relative to the consented scheme is unchanged as whilst more of the taller stack would be seen above the High Energy Use building than the permitted stack, the proposed stack is set back further into the Site. The permitted High Energy building façade and associated planting would continue to be the dominant elements in the view. Consequently due to perspective, the relatively modest apparent increase in the stack height would not be sufficient to change the magnitude and overall effect compared with the permitted scheme.

Viewpoint B

8.8 This viewpoint is representative of views potentially gained by anglers within the National Park, at the top of the southern reservoir embankment. There is no promoted public access to this location noting the nearby definitive footpath route is along the lower slope of the reservoir embankment and has limited accessibility due to fencing (the alternative footpath route is represented by Viewpoint A).

8.9 South facing views in winter are always difficult to photograph as the arc of the sun is restricted and the clear conditions needed for landscape photography typically means that the sun will be within the 90 degree viewing angle, regardless of the time of day photography is taken.

8.10 The existing view (see **Visualisation Ba**) is approximately 50m from the Site boundary and takes in the northern boundary of the Site that is enclosed by woodland. The remainder of the Site is visible, including clear views of the existing phase 1 building. The backdrop of the view consists of planting within the Hirwaun Industrial Estate, a line of pylons and rising land beyond at Hirwaun Common on the horizon.

8.11 The sensitivity of the anglers using the reservoir has been assessed as follows:

- The main focus of angler's views would be in the opposite direction across the water. The Site is set within the context of other industrial buildings. The value of the view presented is Low to Medium.

- The Susceptibility to change assuming a baseline of no development on the Site is Medium due to the adjacent industrial uses and context within the Hirwaun Industrial Estate.

- The overall sensitivity is assessed as Medium.

8.12 The changes to the view as a result of the Proposed Development would comprise the introduction of the taller stack that is located further into the Site. The planting along the northern boundary would be reinforced, such that by Year 15 visibility of the permitted buildings would be further restricted, although the stack (as in the permitted scheme) would remain clearly visible.

8.13 The magnitude of visual effect at Year 1 would be Very Large with views of the new buildings, filtered by existing retained tree planting and more apparent in winter (see **Visualisation Bb**). The magnitude at Year 15 (see **Visualisation Bc**) would remain at a Very Large level as whilst ground level activity and the lower levels of the buildings would be screened by the growth of new tree and shrub planting along the northern boundary (see **2008 ES Figure 12.5**), the stack would remain the dominant element in the view

8.14 The overall effects for anglers would be a Major effect that is Significant (Year 1), and whilst some reduction in visibility of the permitted buildings would occur due to growth of planting the effect would remain Major and Significant at Year 15.

8.15 The magnitude as a result of the proposed revised stack relative to the consented scheme is clearly greater, however it is already at the maximum assessment level of Very Large and this magnitude would remain at Year 15, noting that both the permitted and proposed development would have a long term significant adverse visual impact from this location

Viewpoint C

8.16 This viewpoint is representative of views potentially gained by anglers within the National Park on the northern shore of the reservoir near a memorial bench (to fishermen). There is no promoted public access to this location.

8.17 South facing views in winter are always difficult to photograph as the arc of the sun is restricted and the clear conditions needed for landscape photography typically means that the sun will be within the 90 degree viewing angle, regardless of the time of day photography is taken.

8.18 The existing view (see **Visualisation Ca**) is approximately 330m from the Site boundary and takes in the northern boundary of the Site that is enclosed by woodland. The open water of the reservoir dominates the view and the backdrop consists of planting and roofscape of buildings within the Hirwaun Industrial Estate, a line of pylons and the rising land at Hirwaun Common on the horizon. The existing phase 1 building is largely screened from view by the reservoir embankment with only the upper parts of the roof visible.

8.19 The sensitivity of the anglers using the reservoir has been assessed as follows:

- The main focus of angler’s views would be across the water towards the Site set within an industrial context and with the pylons forming prominent vertical features across the panorama. The value of the view presented is High.

- The Susceptibility to change assuming a baseline of no development on the Site is Medium due to the adjacent industrial uses and context within the Hirwaun Industrial Estate.

- The overall sensitivity is assessed as High to Medium.

8.20 The main changes to the view as a result of the Proposed Development would comprise views of the upper levels and roof of the proposed Gasification Hall and Turbine Hall and Fuel Storage Hall set behind. The proposed High Energy Use Building would not be visible apart from a glimpse of the ridgeline (see **Visualisation Ca**). Planting along the northern boundary would be reinforced, however it is unlikely that by Year 15 growth of the tree planting at a lower level would be sufficient to screen views of the buildings (see **Visualisation Cb**).

8.21 The magnitude of visual effect at Year 1 and Year 15 would be Large to Very Large.

8.22 The overall effects for anglers would be a Major effect that is Significant (Year 1 and Year 15).

8.23 The differences relative to the consented scheme would be a noticeable increase in stack height, noting that the visual impact would be Significant for both the permitted scheme and the Proposed Development.

Viewpoint D

8.24 This viewpoint is representative of views potentially gained by public footpath users within the National Park on the track near Tai-cwpau farmstead. In reality the path appears to have restricted use as a route through the farmstead is prevented by aggressive farm dogs. Furthermore, approaching the location in a westwards direction and passing Viewpoint A is unlikely as further west the route passes through near impenetrable woodland east of the reservoir.

8.25 South facing views in winter are always difficult to photograph as the arc of the sun is restricted and the clear conditions needed for landscape photography typically means that the sun will be within the 90 degree viewing angle, regardless of the time of day photography is taken.

8.26 The existing view (see **Visualisation Da**) is approximately 130m from the Site boundary and takes in rising landform as sheep grazed pasture to the southeast of the farmstead of Tai-cwpau . The landform and tree planting beyond restricts visibility of the Site with a glimpse of the Phase 1 building visible. Distant rising landform is barely perceptible on the horizon.

8.27 The sensitivity of footpath users along the route has been assessed as follows:

- As described above the route does not appear well used and the glimpse of the existing Phase 1 building is a fleeting oblique glimpses that is not available from other locations along the footpath route. The value of the view presented is Medium.

- The Susceptibility to change assuming a baseline of no development on the Site is High as the view is predominantly rural in character with no discernible visibility of the existing Hirwaun Industrial Estate.

- The overall sensitivity is assessed as Medium to High.

8.28 The changes to the view as a result of the Proposed Development would comprise partly filtered views of the revised stack set behind intervening tree cover. The top half of the stack would be clearly visible against the sky. The majority of the permitted buildings would be screened by a combination of landform and intervening tree cover (see **Visualisation Db**). Planting along the western boundary would be reinforced, such that by Year 15 visibility of the roofscape and upper levels of the proposed buildings would be predominantly fully screened, however the upper parts of the stack would still be clearly visible.

8.29 The magnitude of visual effect at Year 1 would be Large. The overall magnitude at Year 15 would reduce slightly due to the growth of new tree planting along the eastern boundary of the Site.

8.30 The overall effects for footpath users would be a Moderate/Major effect that is Significant (Year 1), reducing to a Moderate level that is Not Significant as new planting matures (Year 15).

8.31 The differences relative to the consented scheme would be noticeable and whilst the proposed stack is clearly higher the set back into the Site and tree cover that filters views of the lower parts would assist in reducing the relative impact. The changes in the view from the revised stack would not be sufficiently different to alter the magnitude and overall effect when compared with the consented scheme.

Viewpoint E

8.32 This viewpoint is representative of oblique views potentially gained by road users in vehicles on the layby off the eastbound A465 Dual carriageway. Fleeting views towards the Site would also be available to passengers of vehicles travelling in both directions on the A465 although given the woodland screening it is unlikely that the proposed development would be perceived by motorists passing at speed.

8.33 The existing view (see **Visualisation Ea**) is approximately 190m from the Site boundary and takes in buildings and outside storage within the Hirwaun Business Park, set behind a belt of woodland planting. The existing phase 1 building on the Site is partly visible and the embankment of the reservoir and nearby woodland planting can also be perceived. The overhead lines of the electricity pylons cross the length of the panorama.

8.34 The sensitivity of road users has been assessed as follows:

- The industrial foreground of the existing business park and restricted oblique visibility, heavily filtered by intervening woodland are only likely to be perceived by drivers who stop in the layby and result in a Low value.

- The Susceptibility to change assuming a baseline of no development on the Site is

Low as the Site is set within the context of the existing Hirwaun Industrial Estate and is heavily filtered by intervening woodland.

- The overall sensitivity is assessed as Low.

8.35 The changes to the view as a result of the Proposed Development would comprise the introduction of the revised stack that whilst much taller than the stack of the permitted scheme would be heavily filtered by tree cover in winter and likely fully screened by trees when they are in leaf.

8.36 The magnitude of visual effect at Year 1 would be Medium to Large taking into account no visibility in summer and restricted visibility in winter (see **Visualisation Eb**). The magnitude at Year 15 would slightly reduce to a Medium level overall, because ground level activity and the lower levels of the buildings would be screened by the growth of new tree planting along the southern boundary.

8.37 The overall effects for road users would be a Moderate effect that is Not Significant (Year 1), reducing to a Minor/Moderate effect that is Not Significant as new planting matures (Year 15).

8.38 The magnitude and resulting effects relative to the consented scheme is increased, although the impact upon visual amenity would remain Not Significant.

Viewpoint F

8.39 This viewpoint is representative of oblique views potentially gained by road users entering the access drive to the nearby restaurant and Buckley's Bungalow. The view is also representative of direct views that may also be available to road users of Fifth Avenue, within the Hirwaun Industrial Estate.

8.40 The existing view (see **Visualisation Fa**) is approximately 390m from the Site boundary and is dominated by the Fifth Avenue corridor on the edge of the Hirwaun Business Park. The Sewage treatment works are set behind tree planting in the right of the view, with pylons punctuating the skyline. Part of the existing phase 1 building on the Site is partly visible in the background of the view, although the majority of the Site is screened by intervening landform, reinforced by tree cover.

8.41 The sensitivity of road users has been assessed as follows:

- The industrial fringe character of the existing business park with glimpses of reclaimed land and pylons, combined with rural elements including woodland, pasture and trees result in a Low to Medium value.

- The Susceptibility to change assuming a baseline of no development on the Site is Low to Medium as the Site is set within the context of the existing Hirwaun Industrial Estate although other built development does not dominate this viewpoint.

- The overall sensitivity is assessed as Low to Medium.

8.42 The changes to the view as a result of the Proposed Development would comprise the visibility of the stack that was previously screened as part of the permitted development. The upper parts of the stack would be seen against the sky with intervening tree cover filtering views of the lower levels.

8.43 The magnitude of visual effect at Year 1 would be Medium (see **Visualisation Fb**). The magnitude at Year 15 would slightly reduce because ground level activity and the lower levels of the buildings would be screened by the growth of new tree planting along the southern boundary, although as the stack visibility as the main component of built development would remain unchanged the magnitude is assessed to remain at Medium.

8.44 The overall effects for road users would be a Moderate effect that is Not Significant (Years 1 and 15).

8.45 The magnitude and level of effect relative to the consented scheme is increased as a result of the revised stack, although the overall effect upon visual amenity would remain Not Significant.

Viewpoint G

8.46 This viewpoint is representative of oblique views potentially gained by road users of the private track to the holiday cottage of Tyle-morgrug in the National Park. The view does not represent a route promoted to the public, but is likely to be experienced by groups interested in the outdoors and staying at the cottage. Views towards the Site from the dwelling itself are predicted to be filtered by closer intervening tree cover.

8.47 The existing view (see **Visualisation Ga**) is approximately 1.03km from the Site boundary and is dominated by undulating upland sheep pasture, with much of the track flanked by tree planting. The Hirwaun Business Park buildings are located in the middleground of the valley, set amongst tree planting including belts of coniferous species. The steeply rising land of Hirwaun Common is located on the horizon and some of the wind turbines of Pen y Cymoedd are also visible.

8.48 The sensitivity of road users has been assessed as follows:

- The rural character of the immediate landscape contrasts with the existing infrastructure of the Hirwaun Business Park in the valley and therefore views towards the Site in this context have a High to Medium value.

- The Susceptibility to change assuming a baseline of no development on the Site is High to Medium as the Site is set within the context of the existing Hirwaun Industrial Estate although other built development does not dominate the landscape at this viewpoint.

- The overall sensitivity is assessed as High to Medium.

8.49 The changes to the view as a result of the Proposed Development would comprise the introduction of the upper levels of the proposed stack, with both the existing Phase 1 building and proposed buildings fully screened by intervening landform and dense intervening tree cover. The stack would be largely screened by intervening tree cover, particularly in the summer.

8.50 The magnitude of visual effect at Year 1 would be Small to Very Small with the stack largely screened (see **Visualisation Gb**). The magnitude at Year 15 would likely be reduced further by the growth of intervening existing tree planting.

8.51 The overall effects for road users would be a Minor/Moderate effect that is Not Significant (Year 1), with a Minor effect that is Not Significant at Year 15.

8.52 The magnitude relative to the consented scheme has been assessed and whilst the increase in stack height may be noticeable in winter, it remains a minor element in the view. Given intervening tree screening the change it is assessed not be sufficiently different to alter the magnitude and overall effect when compared with the consented scheme.

Viewpoint H

8.53 This viewpoint is representative of oblique views potentially gained by walkers and horse-riders on the bridleway near Moel Penderyn in the National Park. The views are available for a relatively limited stretch of the route with intervening vegetation and /or landform restricting visibility in either direction along the route. Similar but slightly more elevated views would be available from open access land at the summit and south facing slopes of Moel Penderyn itself, although these would be more distant from the Site than the selected viewpoint.

8.54 The existing panoramic view (see **Visualisation Ha**) is approximately 1.54 km from the Site boundary and is dominated by large-scale open undulating rough grassland, with only limited tree and shrub cover. The pale coloured Hirwaun Business Park buildings are located in the valley in the middleground of the view and typically strongly contrast with darker tree planting. The existing phase 1 buildings and the majority of the Site is visible just above intervening landform. The steeply rising land of Hirwaun Common is located on the horizon and the Pen y Cymoedd wind turbines are also visible.

8.55 The sensitivity of bridleway users has been assessed as follows:

- The rural character of the immediate landscape in the National Park contrasts with the existing infrastructure of the Hirwaun Business Park in the valley and therefore views towards the Site in this context have a High value.

- The Susceptibility to change assuming a baseline of no development on the Site is High as whilst the Site is set within the context of the existing Hirwaun Industrial Estate, other built development whilst present does not dominate the landscape at this viewpoint and additional large scale built development, particularly with vertical and pale coloured elements, has the potential to become detractors in the view.

- The overall sensitivity is assessed as High.

8.56 The changes to the view as a result of the Proposed Development would comprise the upper levels of all the proposed main buildings and the upper levels of the stack, backclothed by existing industrial buildings and tree cover. The growth of proposed tree planting along the northern boundary of the Site would assist in restricting visibility of the High Energy Use Building at Year 15.

8.57 The magnitude of visual effect at Year 1 would be Medium (see **Visualisation Hb**). The magnitude at Year 15 would be reduced to a Medium to Low level by the fact the external facades would have faded, particularly the wood cladding and to a lesser extent by the growth of intervening existing tree planting (see **Visualisation Hc**).

8.58 The overall effects for bridleway users would be a Moderate/Major effect that is Significant (Year 1), with a Moderate effect that is Not Significant at Year 15.

8.59 The magnitude relative to the consented scheme has been assessed and the increase in stack height, whilst noticeable, at this distance would not be sufficient to increase the overall magnitude as the backcloth of industrial development and colouring of upper levels of the stack help to mitigate the impact, noting the stack is also located further from the viewer than the permitted location. It is assessed that the increase in the height of the stack would result in a similar effect i.e. the visual impact of both the permitted development and Proposed Development would be Significant at Year 1 and Not Significant at Year 15.

8.60 The cumulative effect taking into account the consented gas power station to the southwest of the Site, within the Hirwaun Industrial Park is illustrated on a wireline visualisation (see **Visualisation Hd**). Reference has also been made to Viewpoint No. 18 photomontage of the Hirwaun Power Project (HPP) ES which is taken at a similar location to Viewpoint H. No significant effects upon visual amenity from this location were identified in the HPP ES and the cumulative effect, taking into account the consented Enviroparks development was assessed to be of *'negligible magnitude'* and the *'cumulative effect neutral'* (see page 523 of the HPP ES).

8.61 Using the methodology outlined at **Appendix 12.1**, the prior presence of the consented HPP would result in a Very Small overall magnitude and a Minor adverse effect (there would be removal of more visible pale coloured large scale buildings replaced by the HPP structures of a smaller footprint and several vertical stacks backclothed by landscape). The addition of the Proposed Development, significant in its own right, would extend the volume of built development in the view, however given that the consented HPP would only have a Very Small magnitude upon the visual amenity of bridleway users, the cumulative effect of the Hirwaun Enviroparks scheme (both consented and proposed) in combination with the consented HPP would be Minor and Not Significant.

Viewpoint I

8.62 This viewpoint is representative of views potentially gained by users of the open space (a sports pitch) and private views from the rear of nearby properties on Heol Esgyn.

8.63 The existing panoramic view (see **Visualisation Ia**) is approximately 1.61 km from the Site boundary and contains the amenity grassland of the sports pitch in the foreground, enclosed to the southeast by native tree and shrub planting. The middleground of the view consists of sheep grazed pasture and includes a line of pylons, behind which glimpses of buildings located within the Hirwaun Industrial Estate area available, partly screened by tree cover.
The distant horizon is formed by elevated land at Moel Penderyn and more distant views of rising land east of Penderyn.

8.64 The sensitivity of users of the open space and nearby residents has been assessed as follows:

- The rural outlook includes panoramic views of a predominantly rural landscape beyond the sports pitches, including prominent elevated land within the National Park. Pylons and buildings within the Hirwaun Industrial Estate represent detractors in the view. In this context it is assessed that views have a High value for residents and Medium value for users of the sports pitches.

- The susceptibility to change assuming a baseline of no development on the Site is Medium as the Site is set down in the valley within the context of the existing Hirwaun Industrial Estate, noting additional vertical man made features have the potential to add to the detractors already present.

- The overall sensitivity is assessed as High to Medium for residents and Medium for users of the open space.

8.65 The changes to the view as a result of the Proposed Development would comprise the visibility of the revised stack, with both the existing Phase 1 building and proposed buildings fully screened by intervening landform and dense intervening tree cover. The stack would appear at a lower relative height to the closer pylons in the view largely seen against a landform backdrop, with the uppermost extent seen against the sky above the distant horizon (where the stack would be pale grey in colour to minimize apparency).

8.66 The magnitude of visual effect at Year 1 would be Small with distant views of the stack visible in the context of a number of pylons (see **Visualisation Ib**). The magnitude at Year 15 would be reduced further by the growth of intervening existing tree planting.

8.67 The overall effects for residents would be a Minor/Moderate effect that is Not Significant (Year 1), with a Minor effect that is Not Significant at Year 15. Users of the Sport pitch would experience a Minor effect at Year 1 and a Minor/Negligible effect at Year 15 (both Not Significant).

8.68 The magnitude relative to the consented scheme has been assessed and the increase in the stack height, whilst noticeable would not be sufficient at this range to increase the overall magnitude. The backcloth of landform and colouring of the upper levels of the stack would help to mitigate the potential visual impact, noting the stack would appear lower relative to the horizon than the existing pylon towers, although the pylon towers are much closer to the viewer.

Viewpoint J

8.69 This viewpoint is representative of views potentially gained by road users driving northeastwards along the A4061 and users of the nearby public footpath. The public footpath has been blocked off by three lengths of post and wire fencing (barbed wire) that flank the A4061 and the minor road parallel with the A4061. The only stile to the footpath is located adjacent to a private track and with the fencing between this point and the A4061 the route has effectively been stopped up.

8.70 The existing panoramic view (see **Visualisation Ja**) is approximately 1.71 km from the Site boundary and in the foreground is dominated by the A4061 and the parallel private track. The middleground of the view comprises the valley with the roofscape and upper levels of the pale coloured buildings within the Hirwaun Industrial Estate visible and surrounded by tree cover. The existing Phase 1 building is barely discernible and largely screened by intervening tree cover. The Penderyn Reservoir is visible in the mid-ground of the view, set above the Site. The distant horizon is formed by elevated land within the National Park.

8.71 The sensitivity of road users has been assessed as follows, noting that whilst the pubic footpath has been stopped up, the views would be similar to views nearby from rising open access land on Hirwaun Common.

- The predominantly rural outlook includes man-made features including the existing Hirwaun Industrial Estate and transport corridors. The upland landscape of the National Park forms a distinctive backdrop in the views. In this context it is assessed that fleeting views for motorists have a Medium value and users of nearby Open Access land, in the context of the Opencast workings also a Medium value.

- The susceptibility to change assuming a baseline of no development on the Site is Medium as the Site is set down in the valley within the context of the existing Hirwaun Industrial Estate.

- The overall sensitivity is assessed as Medium for both road users and for walkers across the nearby open access land of Hirwaun Common.

8.72 The changes to the view as a result of the Proposed Development would comprise the larger revised stack that would be backclothed by fields and woodland cover with the National Park in the vicinity of the dwelling of Tre-banog-uchaf. The stack would not affect the skyline or the open, more elevated parts of the National Park landscape The growth of existing tree planting within the industrial estate would assist in restricting visibility of the proposed buildings at Year 15.

8.73 The magnitude of visual effect at Year 1 would be Medium (see **Visualisation Jb**). The magnitude at Year 15 would be further reduced by the growth of intervening existing tree planting, although the majority of the proposed stack would be visible and consequently the assessed magnitude level would not change (see **Visualisation Jc**).

8.74 The overall effect upon the visual amenity of road users and walkers would be a Moderate effect that is Not Significant (Year 1 and Year 15).

8.75 The magnitude relative to the consented scheme has been assessed and the revised stack would result in an increase in magnitude and overall effect, however the effect would remain Not Significant at Year 1 and 15.

8.76 The cumulative effect taking into account the consented gas power station to the southwest of the Site, within the Hirwaun Industrial Park is illustrated on a wireline visualisation (see **Visualisation Jd**). Reference has also been made to the photomontages prepared from Viewpoint Nos. 4 and 15 for the Hirwaun Power Project (HPP) ES, noting that Viewpoint J was taken inbetween these two locations along the A4061. Moderate effects upon visual amenity (Not Significant) from Viewpoints Nos. 4 and 15 were identified in the HPP ES and the cumulative effect, taking into account the consented Enviroparks development was assessed to be of 'Low magnitude' and the 'cumulative effect Slight' (see page 522 and 523 of the HPP ES).

8.77 Using the methodology outlined at **Appendix 8.1**, the prior presence of the consented HPP from Viewpoint J would result in a Medium overall magnitude and a Moderate adverse effect (there would be removal of more visible pale coloured large scale buildings replaced by the HPP structures of a smaller footprint but taller height and overall volume). The addition of the Proposed Development, not significant in its own right, would be partially set behind the HPP and the roofline of the proposed buildings would extend beyond, but would be largely screened by existing intervening tree cover, apart from the revised stack that would be clearly visible extending above the gas power station. The cumulative effect from the addition of the Hirwaun Enviroparks scheme (both consented and proposed) in combination with the consented HPP would be Moderate and Not Significant.

Viewpoint K

8.78 This viewpoint is representative of views gained by public footpath users southeast of Rhigos. The public footpath is signposted and starts at the edge of Rhigos but upon reaching the A4061 further progress is prevented by three lengths of post and barbed wire fencing (See Viewpoint J description above).

8.79 The existing panoramic view (see **Visualisation Ka**) is approximately 1.83 km from the Site boundary and in the foreground is dominated by medium to large scale fields of sheep grazed pasture enclosed by hedgerows. The coniferous planting belts and pylons in the valley below are visible in the middle-ground of the view, with most of the buildings within the Hirwaun Industrial Estate screened from view. The water of the reservoir above the Site is discernible and the rising land of the National Park extends across the horizon of the view.

8.80 The sensitivity of footpath users has been assessed as follows:

- The predominantly rural outlook includes some man-made features including the pylons and occasional buildings; however these are subservient in the overall view. The upland landscape of the National Park forms a distinctive backdrop in the views. In this context it is assessed that oblique views for footpath users have a High value.
- The susceptibility to change assuming a baseline of no development on the Site is Medium as the Site is set down in the valley and partially screened.
- The overall sensitivity is assessed as High to Medium.

8.81 The changes to the view as a result of the Proposed Development would comprise the introduction of the upper parts of the proposed stack, with both the existing Phase 1 building and proposed buildings fully screened by intervening landform and dense intervening tree cover. The stack would be seen in close proximity to an existing closer pylon tower and would be set well below the horizon.

8.82 The magnitude of visual effect at Year 1 would be Small to Medium (see **Visualisation Kb**). The magnitude at Year 15 would be reduced further by the growth of intervening existing tree planting that would slightly reduce the visibility of the proposed stack, but not enough the change the level of assessed magnitude.

8.83 The overall effects for footpath users would be a Minor/Moderate effect that is Not Significant (at Year 1 and 15).

8.84 The magnitude relative to the consented scheme has been assessed and the revised stack would result in an increase in magnitude and overall effect, however the effect would remain Not Significant.

Viewpoint L

8.85 This viewpoint is representative of views gained by public footpath users south of Cefn Rhigos. The public footpath is signposted from the minor road but the stile is rotten and difficult to negotiate and there is no worn route on the ground, suggesting infrequent use.

8.86 The existing panoramic view (see **Visualisation La**) is approximately 2.14 km from the Site boundary and in the foreground is dominated by medium to large scale fields rough pasture enclosed by hedgerows, with remnant hedgerow lines also present. Pylons cross the field nearby and extend into the middle-grounds of the view where glimpses of the buildings within the Hirwaun Industrial Estate are visible, filtered by intervening tree cover. The rising land of the National Park, south and east of Penderyn extends across the horizon of the view.

8.87 The sensitivity of footpath users has been assessed as follows:

- The predominantly rural outlook includes frequent man-made features including the nearby pylons and frequent buildings in the valley partially filtered by tree cover. The upland landscape of the National Park forms a distinctive backdrop in the views. In this context it is assessed that oblique views for footpath users have a Medium value.
- The susceptibility to change assuming a baseline of no development on the Site is Medium as the Site is set down in the valley and partially screened.
- The overall sensitivity is assessed as Medium.

8.88 The changes to the view as a result of the Proposed Development would comprise the introduction of the upper levels of the proposed stack, with small parts of the roof of the tallest proposed buildings also visible.

8.89 The magnitude of visual effect at Year 1 would be Small to Medium with only a part of the roofscape and upper parts of the stack visible above intervening tree cover and in the context of pylon towers (see **Visualisation Lb**). The visibility of the proposed building at Year 15 would be reduced further by the growth of intervening existing tree planting although the proportion of the stack visible would remain largely unchanged.

8.90 The overall effects for footpath users would be a Minor/Moderate effect that is Not Significant (Year 1 and Year 15).

8.91 The magnitude relative to the consented scheme has been assessed and whilst the revised stack would have a greater visual impact than the permitted scheme it would be seen in the context of nearby pylon towers of similar height that also break the horizon. It is assessed that the change is not sufficient to change the assessed magnitude level and overall effect at Year 1 when compared with the permitted scheme, however there would be no reduction in magnitude and overall effect at Year 15 with the revised stack.

Viewpoint M

8.92 This viewpoint is representative of views gained by walkers across open access land within the National Park, east of the farmstead of Bodwigiad.

8.93 The existing panoramic view (see **Visualisation Ma**) is approximately 2.35 km from the Site boundary and in the foreground is dominated by open moorland with patches of heather amongst rough grassland. The Hirwaun Industrial Estate is clearly visible in the valley below with buildings appearing contained by surrounding tree cover, noting the glimpses of the roof of the existing Phase 1 building above a belt of conifer planting. The upland landscape including Hirwaun Common forms a distinctive backdrop in the views, with the route of the A4061 visible and the Pen y Cymoedd turbines on the skyline.

8.94 The sensitivity of walkers using the open access land has been assessed as follows:

- The rural landscape is punctuated by frequent man-made features in the valley below including the settlement of Pontbren Llywd, the edge of Hirwaun and the roofscape and upper levels of buildings in the Hirwaun Industrial Estate partially screened by surrounding tree cover. In this context it is assessed that views for walkers have a High value.

- The susceptibility to change assuming a baseline of no development on the Site is Medium as the Site is set down in the valley within the context of the Industrial Park and contained by planting.

- The overall sensitivity is assessed as High to Medium.

8.95 The changes to the view as a result of the Proposed Development would comprise the introduction of the upper parts of the proposed stack, with both the roof and upper parts of the proposed buildings seen above the surrounding tree cover and in the context of existing industrial buildings.

8.96 The magnitude of visual effect at Year 1 would be Small to Medium within the context of surrounding built development with only a part of the roofscape and upper stack visible above intervening tree cover (see **Visualisation Mb**). The visibility of the proposed buildings at Year 15 would be reduced further by the growth of intervening existing tree planting, although this would not be sufficient to reduce the assessed level of effect with the visibility of the revised taller stack remaining largely unchanged.

8.97 The overall effects for footpath users would be Moderate i.e. Not Significant (Years 1 and 15).

8.98 The magnitude relative to the consented scheme has been assessed and whilst noticeably taller, the stack would only result in a modest change in magnitude due to the intervening distance, industrial context and expansive nature of views. The overall effect would remain Not Significant.

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8.99 The cumulative effect taking into account the consented gas power station to the southwest of the Site, within the Hirwaun Industrial Park is illustrated on a wireline visualisation (see **Visualisation Mc**). Reference has also been made to the photomontage prepared from Viewpoint Nos. 21 for the Hirwaun Power Project (HPP) ES at a similar location. *'Slight'* effects upon visual amenity (Not Significant) from Viewpoint No. 21 was identified in the HPP ES at page 515 and the cumulative effect, taking into account the consented Enviroparks development was assessed to be of *'Low magnitude'* and the *'cumulative effect Slight'* (see page 524 of the HPP ES).

8.100 Using the methodology outlined at **Appendix 12.1**, the prior presence of the consented HPP from Viewpoint J would result in a Very Small magnitude and a Minor/Moderate adverse effect (there would be removal of more visible pale coloured large scale buildings replaced by the HPP structures of a smaller footprint but taller height and overall volume). The upper parts of the Proposed Development stack would be visible with the majority of the buildings screened by exisitng woodland cover and tree planting. The cumulative effect from the addition of the Hirwaun Enviroparks scheme (both consented and proposed) in combination with the consented HPP would be Moderate and Not Significant.

Viewpoint N

8.101 This viewpoint is representative of views gained by road users of the A4061 at Mynydd-Beili-glas and walkers of open access land near the layby and promoted viewpoint.

8.102 The existing panoramic view (see **Visualisation Na**) is approximately 3.82km from the Site boundary and is located near a layby. The photography was not taken from the layby and interpretative panel at the promoted viewpoint as at these locations the Site is partly obscured by intervening landform. The landscape is dominated by the steep moorland slopes of Hirwaun Common and in the middle-distance the panoramic views include the Hirwaun Industrial Estate and the village of Rhigos in the valley below. Buildings are typically contained by surrounding tree cover, noting the glimpses of the existing Phase 1 building. The upland landscape of the National Park forms a distinctive backdrop in the views. Behind the viewer close range views of the wind turbines of the Pen y Cymoedd windfarm are available.

8.103 The sensitivity of walkers using the open access land has been assessed as follows:

- The open moorland landscape is punctuated by frequent man-made features in the valley including the roofscape and upper levels of buildings in the Hirwaun Industrial Estate partially screened by surrounding tree cover. Given the extensive panoramic views towards the National Park and promoted viewpoint status it is assessed that views for walkers have a Very High value.

- The susceptibility to change assuming a baseline of no development on the Site is High because whilst the Site is set down in the valley and contained by planting and flanked by existing built development, the elevated location of the viewpoint allows views into the ground level of the Site.

- The overall sensitivity is assessed as High to Very High.

8.104 The changes to the view as a result of the Proposed Development would comprise the upper levels and roofscape of all the main buildings with the ground level in front of the High Energy Use building visible. The stack would be clearly visible and backclothed against the landscape close to the reservoir.

8.105 The magnitude of visual effect at Year 1 would be Small (see **Visualisation Nb**). The magnitude at Year 15 would be reduced by the growth of intervening existing tree planting and also proposed tree planting along the southern and western boundaries of the Site (see **Visualisation Nc**), although visibility of the stack would remain largely unchanged.

8.106 The overall effects for walkers would be a Moderate effect that is Not Significant (Year 1), with a Moderate/Minor effect that is Not Significant at Year 15.

8.107 The magnitude relative to the consented scheme has been assessed and whilst noticeably taller, the stack would only result in a modest change in magnitude due to the intervening distance, industrial context and expansive nature of views. The overall effect would remain Not Significant.

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APPENDIX 8.4

Residential Visual Amenity Assessment

Introduction

The assessment covers three of the closest dwellings to the propsoed stack (Tai-cwplau, Reservoir House and Tre-banog-uchaf), where visibility of the propsoed stack was potentially available and there was the potential for significant effects upon visual amenity. Buckleys Bungalow is located ~400m west of the Site and views from the access drive and parts of the garden would be similar to Viewpoint F from the nearby public road. As no windows face the proposed development, a detailed assessment of Buckley's bungalow was uncessary.

The location, height and density of intervening planting represented in the computer generated images is indicative only and was estimated from aerial photos and field study from nearby roads and public rights of way. Direct access to the properties from residents was not sought, due to the prevailing Covid-19 pandemic. However the approach adopted for the visualisations and assessment is identifical to the approach that would occur in normal circumstances, should residents deny access to private land.

20a The Wharfage, Ironbridge,
Shropshire, TF8 7NH
www.pleydellsmithyman.co.uk

The property is an isolated 2 storey dwelling situated on a platform at ~231m AOD, with gently sloping surrounding land. An outbuilding is situated to the east and an open garden area surrounds the property that is greatest in extent to the south of the dwelling and includes a large hard surfaced turning area where several vehicles are parked and building materials are stored. South of the property and beyond the aforementioned turning area there is a paddock enclosed by mature hedgerow trees to the south and west. Expansive views across the valley would be available, noting that intervening tree cover would partially restrict views of built development within the town of Hirwaun, although the Tower Colliery and the landform of Hirwaun Common on the horizon would be the most apparent features in the backdrop of the view.

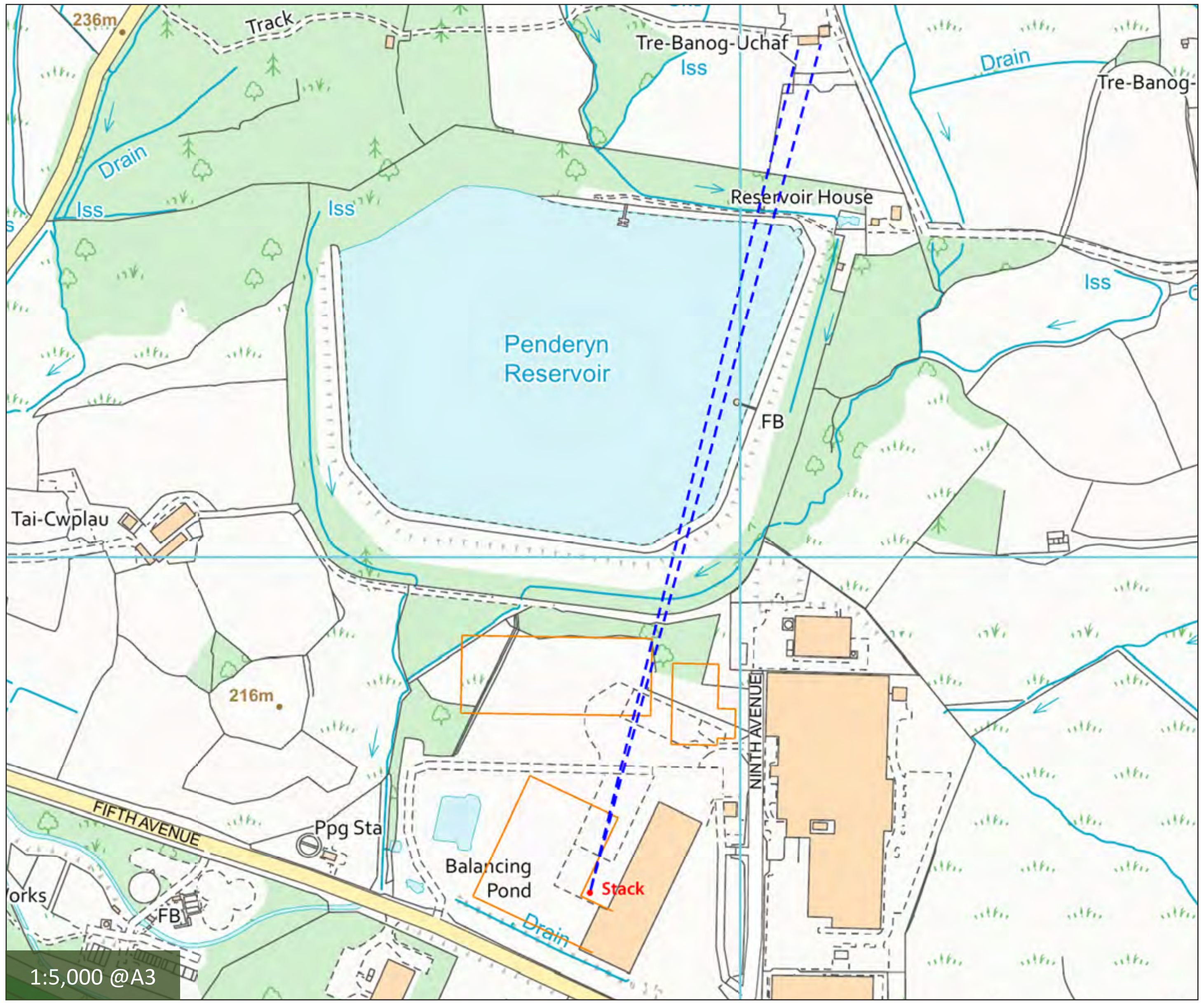
The principal views are likely to be obtained from the dwelling at ground floor level and whilst a number of windows occur on all main elevations, the key views would appear to be focussed to the south, where the main access road and parking are also located (i.e. in the direction of the proposals). West facing views over open countryside with limited man-made elements are also likely to be of higher value. Views from the north and east facing elevations of the house, shaded and partially influenced by the outbuilding are likely to be of lesser value.

A viewpoint for the computer generated visualisation was selected from the southern elevation of the dwelling and would also be representative of views from the south facing garden and main access road. Foreground views would comprise the front garden and turning area/car parking area beyond, set down below an embankment. A paddock flanked by mature, largely deciduous trees encloses the middle-ground with Hirwaun, the tower colliery and the landform of Hirwaun Common set beyond (see Computer Generated Image photomontages Oa, Ob and Oc).

The ground floor views from the front of the proposed property, looking southwest are assessed to have a Medium-High sensitivity. The top of the proposed stack would be located at a height of ~290m AOD and approximately 700m to the southwest of the dwelling. As indicated by Photomontage Oa and Ob upper part of the proposed stack would be clearly visible with a greater proportion seen in winter. The backdrop to the left of the stack in the view would include development on the former tower colliery site. The uppermost part of the stack would appear at a similar height to the highest visible point on Hirwaun Common and the magnitude of effect would be Medium and when combined with the Medium-High sensitivity would result in a Moderate effect upon visual amenity that is Not Significant. Due to the intervening distance and expansive nature of views, it is assessed that the stack would be sufficiently distant not to have the potential to appear overbearing in these views. Photomontage Oc illustrates the difference between the revised stack now proposed and the permitted stack. Whilst the proposed stack would be clearly be perceived as a taller strucutre than the permitted stack. The increase in height is partly mitigated by the stack being located further from the property, having a more slimline design and being paler in colour.

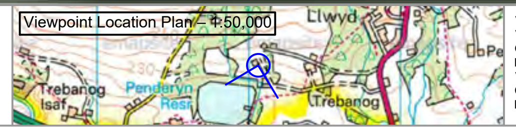
When the impact upon residential visual amenity is assessed in the round, account is taken of the views unaffected by the proposed development (i.e. views from the western elevation of the dwelling) as well as the assumption that views from any upper floor windows are likely to be bedrooms and bathrooms, not normally occupied in daylight hours.

In conclusion it is assessed that there would be no unacceptable effects upon residential visual amenity as a result of the revised stack.



Computer generated view from Tre-banog-uchaf

Viewpoint Location Plan – 1:50,000



View flat at a comfortable arm's length

Viewpoint Grid Reference:	294059,207412
Ground Height AOD (m):	230
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	194.0
Distance to Site (km):	0.71
Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
Image width:	820mm

Consultant:
Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH
T: 01952 433211 F: 01952 433323
E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

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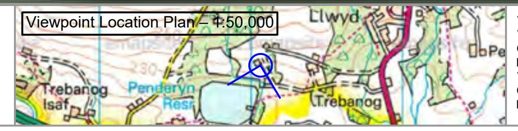
-	-	-	-	-
Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southwestwards from Tre-banog-uchaf**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Oa**

Viewpoint Location Plan – 1:50,000



View flat at a comfortable arm's length	
Viewpoint Grid Reference:	294059,207412
Ground Height AOD (m):	230
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	194.0
Distance to Site (km):	0.71
Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
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Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH
T: 01952 433211 F: 01952 433323
E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

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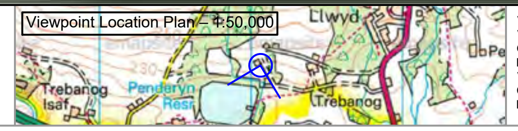
Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southwestwards from Tre-banog-uchaf**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	Visualisation Ob



View flat at a comfortable arm's length	
Viewpoint Grid Reference:	294059,207412
Ground Height AOD (m):	230
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	194.0
Distance to Site (km):	0.71

Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
Image width:	820mm

Consultant:
Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH

T: 01952 433211 F: 01952 433323
E-mail: psl@pleydellsmithyman.co.uk

Client:

-	-	-	-	-
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Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southwestwards from Tre-banog-uchaf**

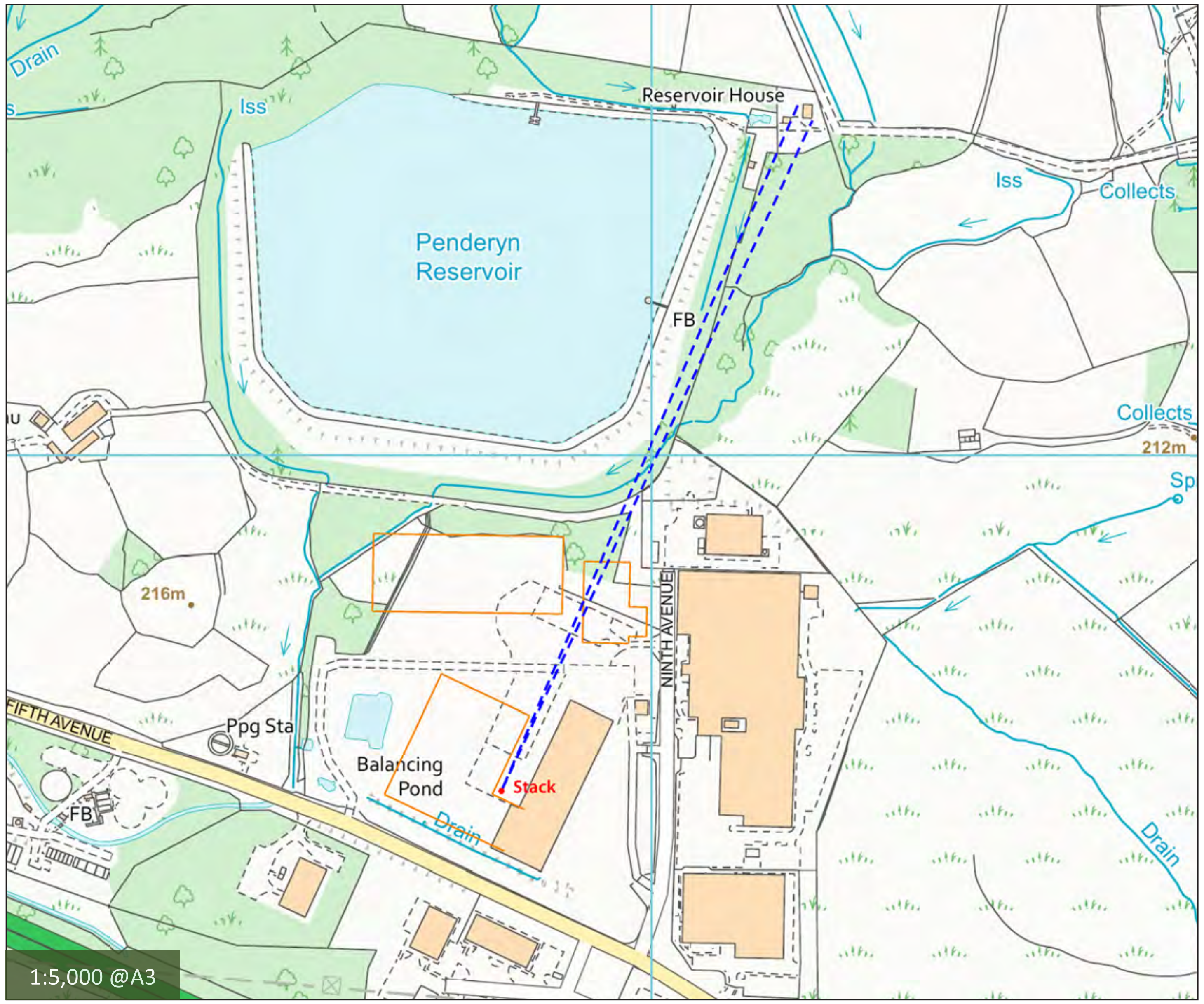
Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Oc**

The property is an isolated 2 storey dwelling with a pitched roof and a large conservatory that adjoins the property on the western elevation. The property is situated on gently rising land at ~218m AOD and is surrounded by mature hedgerows and tree cover along the property curtilage to the north, east and west, resulting in an enclosed private rear garden. A track to Penderyn reservoir passes along the front garden curtilage of the property with gated access only to anglers and the water company – the car park for these users is separated from the property by an additional gate and a tall hedgerow. Immediately south of the property and beyond the aforementioned track there is an additional garden area that includes shrubs and trees set against a mature woodland backdrop.

The principal views are likely to be obtained from the dwelling at ground floor level and may be available on all elevations, however from the external layout, main views would appear to be focussed to the south where parking is also located (in the direction of the proposals) and to the west where the conservatory and main garden area is situated. Views from the north and east elevations are likely to be of lesser importance as they would be over peripheral areas of the garden and are closer to boundary screen planting.
A viewpoint for the computer generated visualisation was selected from the southwestern corner of the dwelling where it would also be representative of views from the main access path and near the southern edge of the conservatory. Foreground views would comprise the front garden and car parking area, with the track beyond. An areas of garden beyond the track includes a low hedge and trees and shrubs in lawn. Mature deciduous woodland forms the backdrop (see Computer Generated Image photomontage Pa and Pb).

The ground floor views from the front of the proposed property, looking southwest are assessed to have a Medium-High sensitivity. The top of the proposed stack would be located at a height of ~290m AOD and approximately 590m to the southwest of the dwelling. As indicated by Photomontage Pa and Pb the intervening woodland would screen the proposed stack from view in summer and the stack is likely to be not visible or very heavily filtered in winter, noting that the viewline would pass through 200m+ depth of woodland and due to the density and maturity of the woodland the upper part of the stack is unlikely to be visible, even in winter.
The magnitude of effect in the overall context would be Very Small to None and when combined with the Medium-High sensitivity would result in a Negligible effect upon visual amenity from ground floor level that is Not Significant. Due to the intervening distance and surrounding woodland screening any heavily filtered winter glimpses of the upper part of the stack would represent a modest addition of a new man-made built structure that would be sufficiently screened and distant not to have any potential to appear overbearing in these views.

When the impact upon residential visual amenity is assessed in the round, account is taken of the views unaffected by the proposed development (i.e. views from the western elevation of the dwelling) as well as the assumption that views from any upper floor windows are likely to be bedrooms and bathrooms, not normally occupied in daylight hours.
In conclusion it is assessed that there would be no unacceptable effects upon residential visual amenity as a result of the revised stack proposals.



20a The Wharfage, Ironbridge,
Shropshire, TF8 7NH
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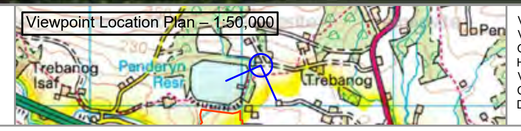
Viewpoint Location Plan – 1:50,000



View flat at a comfortable arm's length

Viewpoint Grid Reference:	294125,207272
Ground Height AOD (m):	216
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	201.0
Distance to Site (km):	0.54
Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
Image width:	820mm

Consultant:

Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH

T: 01952 433211 F: 01952 433323

E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

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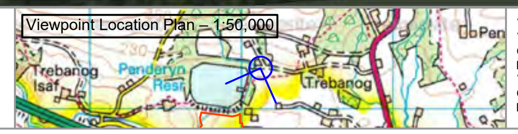
Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southwestwards from Reservoir House**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Pa**

Viewpoint Location Plan – 1:50,000



View flat at a comfortable arm's length	
Viewpoint Grid Reference:	294125,207272
Ground Height AOD (m):	216
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	201.0
Distance to Site (km):	0.54

Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
Image width:	820mm

Consultant:
Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH
T: 01952 433211 F: 01952 433323
E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

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Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southwestwards from Reservoir House**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Pb**

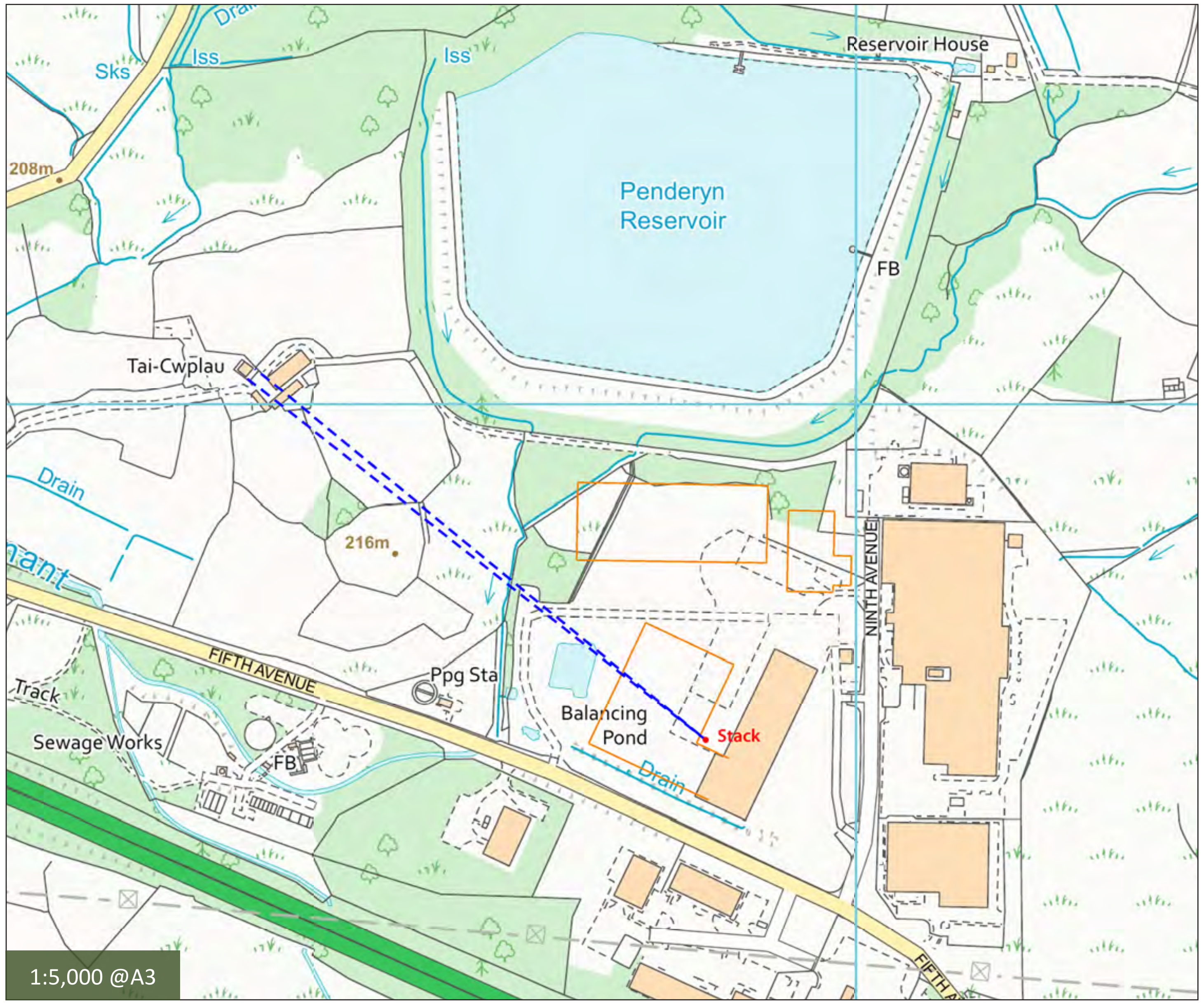
The property is an isolated 2 storey farmhouse with a pitched roof and a large 2 storey rear extension that has a flat roof. The property is situated on locally elevated land at ~212m AOD with farm buildings located to the south and east of the property. A public footpath passes through the farmyard and a range of farm vehicles and storage of materials is located adjacent to the buildings and nearby areas of hardstanding.

The principal views are likely to be obtained from the farmhouse at ground floor level and appear to be from the main facades Views from the main façade at the rear of the property overlook a grassed garden area flanked by mature trees to the west and open countryside in all other directions. These views would be unaffected by the proposed stack.
Views from the other main façade facing southeast towards the proposed development are from the front of the dwelling which includes a small garden area. The immediate context of the farmyard dominates with agricultural buildings enclosing views (see Computer Generated Image photomontage Qa and Qb).

The ground floor views from the front of the proposed property, looking southeast are assessed to have a Medium-High sensitivity. The top of the proposed stack would be located at a height of ~290m AOD and approximately 450m to the southeast of the dwelling. As indicated by Photomontage Qa and Qb the intervening barns would largely screen the proposed stack from view all year around with tree cover playing no role in seasonal screening. The uppermost part of the stack would be visible above the ridge of the central barn, however the magnitude of effect in the context of the surrounding barns would be Very Small and when combined with the Medium-High sensitivity would result in a Minor effect upon visual amenity that is Not Significant. The stack, being largely screened and representing a minor protrusion of built form above the barn would not have the potential to appear overbearing in these views.

When the impact upon residential visual amenity is assessed in the round, account is taken of the views unaffected by the proposed development (i.e. views from the rear of the dwelling to the northwest) as well as the assumption that views from any upper floor windows are likely to be bedrooms/bathrooms, not normally occupied in daylight hours.

In conclusion it is assessed that there would be no unacceptable effects upon residential visual amenity as a result of the revised stack proposals.



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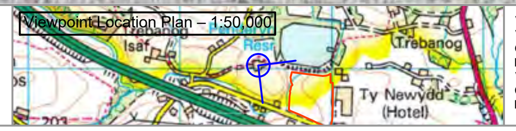
Computer generated view from Tai-cwplau

Viewpoint Location Plan – 1:50,000



View flat at a comfortable arm's length	
Viewpoint Grid Reference:	293512,207026
Ground Height AOD (m):	211
Horizontal Angle of View (°):	53.5
Vertical Angle of View (°):	18
Camera Bearing (°):	128.0
Distance to Site (km):	0.46

Principal Distance (mm):	812.5
Camera:	N/A
Lens:	N/A
Date and time of photograph:	N/A
Paper width:	841mm
Image width:	820mm

Consultant:
Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH

T: 01952 433211 F: 01952 433323
E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

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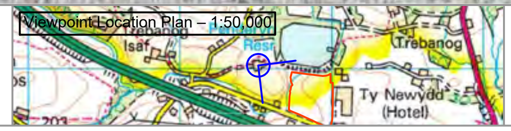
Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southeastwards from Tai-cwplau**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Qa**

Computer generated view from Tai-cwplau



View flat at a comfortable arm's length		Principal Distance (mm):	812.5
Viewpoint Grid Reference:	293512,207026	Camera:	N/A
Ground Height AOD (m):	211	Lens:	N/A
Horizontal Angle of View (°):	53.5	Date and time of photograph:	N/A
Vertical Angle of View (°):	18	Paper width:	841mm
Camera Bearing (°):	128.0	Image width:	820mm
Distance to Site (km):	0.46		

Consultant:

Pleydell Smithyman
20a The Wharfage
Ironbridge
Telford
Shropshire TF8 7NH

T: 01952 433211 F: 01952 433323

E-mail: psl@pleydellsmithyman.co.uk

Client: enviroparks

-	-	-	-	-
-	-	-	-	-
Final Revision:	Date:	Description:	By:	Chk:

Site: **ENVIROPARKS HIRWAUN**

Drawing Title: **View southeastwards from Tai-cwplau**

Date:	Scale:	Paper Size:	Drawn By:	Checked By:	Status:	Final Revision:	CAD Ref:	Drawing No:
20 May 2020	-	841×297 mm	XL	PSL	-	-	M19.144.R.002	**Visualisation Qb**

APPENDIX 9.1

Habitats Regulations Assessment Stage 1 and 2 Report

ENVIROPARKS HIRWAUN, HIRWAUN, RHONDA CYNON TAFF, SOUTH WALES

SHADOW HABITAT REGULATIONS ASSESSMENT: STAGE 1 SCREENING AND STAGE 2 APPROPRIATE ASSESSMENT REPORT

A Report to: Enviroparks (Wales) Limited

Report No: RT-MME-124755 RevC

Date: June 2020

MIDDLEMARCH ENVIRONMENTAL

Triumph House, Birmingham Road, Allesley, Coventry CV5 9AZ
Tel: 01676 525880 Fax: 01676 521400
E-mail: admin@middlemarch-environmental.com Web: www.middlemarch-environmental.com

REPORT VERIFICATION AND DECLARATION OF COMPLIANCE

Report Version	Date	Completed by:	Checked by:	Approved by:
RevC	02/06/2020	Hannah Train GradCIEEM (Senior Ecological Consultant)	Tom Docker CEcol MCIEEM (Managing Director)	David Smith MCIIEM (Ecology and Landscapes Director)
RevB	18/09/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
RevA Issue 3	04/08/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Issue 2	26/05/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Issue 1	26/05/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Draft 3	11/05/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Draft 2	27/04/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Draft 1	20/04/2017	Dr Katy Read CEnv MCIEEM MCIWEM C.WEM DipSM (Executive Director)	Tom Docker MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)

The information which we have prepared is true, and has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct. We confirm that the opinions expressed are our true and professional bona fide opinions.

DISCLAIMER

The contents of this report are the responsibility of Middlemarch Environmental Ltd. It should be noted that, whilst every effort is made to meet the client's brief, no site investigation can ensure complete assessment or prediction of the natural environment.

Middlemarch Environmental Ltd. accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

NON-TECHNICAL SUMMARY

This report has been produced by Middlemarch Environmental Ltd for Enviroparks (Wales) Limited (EWL) and presents a shadow Habitats Regulations Stage 1 Screening and Stage 2 Appropriate Assessment Report associated with the proposed Enviroparks Hirwaun development at Hirwaun, Rhonda Taff, South Wales.

In 2008 EWL submitted planning applications to Rhondda Cynon Taf County Borough Council (RCTCBC) and Brecon Beacons National Park Authority (BBNPA) for planning permission for development of a sustainable waste recovery and energy production park at the site. Planning applications were made to two planning authorities because the boundary between the two crosses the application site. Planning permission was granted by both authorities on 21 December 2010 (RCTCBC reference 08/1735/10 and BBNPA reference 08/02488/FUL). Permission was granted subsequently for various amendments to the approved proposals.

The 2009 shadow Habitats Regulations Assessment report (RT-MME-104641) which was produced concluded that with the mitigation proposed at the time in place, the Enviroparks scheme would have no Likely Significant Effect on any of the Natura 2000 sites. A Biodiversity Scheme was agreed with Countryside Council for Wales and RCTCBC and BBNPA, and secured through a Section 106 agreement as part of the mitigation package. It is understood that whilst Enviroparks have provided the agreed financial contribution associated with the Biodiversity Scheme, no works have been carried out on the Biodiversity Scheme by Butterfly Conservation.

Since 2010 the planning permissions have been implemented through the construction of the first phase of the development. However, since the original scheme design was prepared in 2008, advances in waste recovery technologies and a much-changed policy and commercial landscape for waste recovery and renewable energy generation necessitated a review of the original master plan for the Enviroparks site.

This shadow Habitats Regulations Assessment: Stage 1 report was originally submitted in 2017 in support of a revised planning application for the site. It provided an updated assessment of the likely significant effects of the proposals on three Special Areas of Conservation (SACs): Blaen Cynon SAC; Coedydd Nedd a Mellte SAC; and, Cwm Cadlan SAC.

Planning permission for the amended phase two development was granted by RCTCBC in February 2019 (reference 17/0249/10) and BBNPA in March 2019 (reference 17/14587/FUL).

A new planning application is to be submitted in 2020 to reflect a further amendment to the scheme design, specifically the relocation and raising in height of an already-consented emissions stack.

The conservation objectives for each of the Natura 2000 sites considered in this report are associated with preserving the favourable conservation status of qualifying habitats and species. In 2008, CCW published Core Management Plans for all of the sites considered in this report, which describe known areas of vulnerability for these sites. These areas of vulnerability are all factors which could reduce the ability of the sites to meet their conservation objectives, therefore this assessment is focused on the ability of the proposed development to contribute to known areas of vulnerability. Since the original sHRA report was completed in 2009, new Natura 2000 – Standard Data Forms have been issued (in 2015) which also identify ‘threats’ to the specific Natura 2000 site. The assessment of the potential impacts of the development proposal have therefore been considered in accordance with these new data. Natural Resources Wales have also provided high-level information regarding the current management arrangements at Blaen Cynon SAC.

With respect to Blaen Cynon SAC, the assessment has shown that there are potentially effects from dust pollution of the SAC (given its proximity to the Enviroparks site) during construction. However, these potential effects can be controlled through development and implementation of a Dust Management Plan.

The 2017 modelling showed that without additional technological mitigation measures, the scheme could result in deposition at the closest point within Blaen Cynon SAC of nutrient nitrogen and acid deposition, which were at a level which could not be considered insignificant. Increased nitrogen deposition is known to result in habitat changes within grassland habitats, where the increased nutrient levels can favour more nitrophilious species which can result in a loss of species-diversity. In accordance with the Habitats Regulations, it is important to recognise that the qualifying features of Blaen Cynon SAC are marsh fritillary *Euphydryas aurinia* as the site is considered to be one of the best areas for this butterfly in the United

Kingdom. Therefore, any effects from changes in air pollution are considered indirect effects as they may impact plant species on which the marsh fritillary in its larval stage inhabit, but there are not considered to be any direct effects on the butterfly individuals. An effect would be considered to affect the favourable conservation status of marsh fritillary butterfly if increased nitrogen and acid deposition resulted in a reduction in the population of the larval food plant for the species (Devil's-bit scabious *Succisa pratensis*), or a significant change in the habitats such that they would no longer provide habitat suitable to support the butterfly species. During the planning process, consultation with Natural Resources Wales took place and additional technological mitigation options were explored by the project team. Modelling completed in September 2017 showed that, with the implementation of these additional technologies the potential process contributions from the Enviroparks scheme would be at a level that they could be screened as insignificant for all pollutants, with the exception of acid deposition, which would be at a low level (1.79% of the critical load), but which cannot be screened out, based on accepted screening criteria.

The April 2018 decision by the Court of Justice of the European Union (CJEU) in the case of *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17) means that measures intended to avoid or reduce the harmful effects of a proposed project on a European site may no longer be taken into account by competent authorities at the Habitat Regulations Assessment 'screening stage' when judging whether a proposed plan or project is likely to have a significant effect on the integrity of a European designated site. This is a reversal of a previously settled principle in English and Welsh law. As such, where a proposed development is proximate to a SAC or SPA and could give rise to significant effects, even if these effects can be mitigated for, an Appropriate Assessment (Stage 2) is required.

This RevC version of the report has been updated to reflect this ruling.

The levels of nitrogen deposition and acid deposition at Blaen Cynon SAC which were presented in the 2009 sHRA are not directly comparable to the data presented in 2017, or in the current version of this report. This is due to the fact that the data in this report is from a grid reference closest to the Enviroparks development (as requested by Natural Resources Wales), rather than a central grid reference within the SAC (as was used in the 2009 assessment). The critical loads and critical levels have also been updated since 2009 by APIS and as such the current data is based on current guidance.

The updated modelling completed in 2020, which accounts for the implementation of the additional technologies as well as the increased stack height, has confirmed that at the closest point within Blaen Cynon SAC, the revised scheme would result in deposition of nutrient nitrogen and acid deposition at less than 1% of the critical loads, levels which can be screened as insignificant. However, when acid deposition was modelled across a wider area, the contributions are widely dispersed from the 90 m stack, and not all locations across the Blaen Cynon SAC would actually remain within 1 % of the critical load. The highest contribution of acid deposition within the wider area would equate to approximately 2.9 % of the critical load, although it should be noted that this level of acid deposition does not occur within the Blaen Cynon SAC and is approximately 235 m away from the nearest point of this receptor. As such, the contributions of acid across the SAC in its entirety will be less than this, but cannot be screened as insignificant.

An assessment of the potential in-combination effects of the proposed Enviroparks scheme in addition to other committed projects and plans was included in the 2017 modelling work, and, where relevant, in the 2020 modelling work. Although there are currently no published screening criteria associated with in-combination effects, due to the elevated background levels of nitrogen deposition and acid deposition within the local area, the 2017 assessment confirmed that in-combination predicted environmental concentrations for these two factors were above 1% of the relevant critical load at Blaen Cynon SAC, although for nitrogen deposition the levels were only just above 1%, at 1.29%.

The updated air quality modelling completed in 2020 confirmed that at the closest point within Blaen Cynon SAC to the Enviroparks development, the in-combination predicted environmental concentration for acid deposition marginally exceed the 1 % insignificance threshold, equating to approximately 1.03 %. At several other points across the wider area the in-combination levels cannot be screened as insignificant.

Potential effects from the following on Blaen Cynon SAC have been screened out based on the modelling works completed in 2017 and 2020 to support this assessment: ammonia; oxides of nitrogen (NOx); sulphur dioxide; metals (cadmium, thalium and heavy metals); volatile organic compounds (VOCs); and Polycyclic Aromatic Hydrocarbons (PAH).

For the 2008 application, a Biodiversity Scheme was agreed with Countryside Council for Wales, RCT and BBNPA, and secured through a Section 106 agreement. This scheme was designed to provide compensatory marshy grassland habitat for marsh fritillary use within a 5km radius of the Enviroparks scheme as mitigation, compensation and enhancement for loss of habitat from the proposed development site and also any adverse effects on marsh fritillary populations within Blaen Cynon.

Guidelines have therefore been provided with respect to altering the Biodiversity Scheme, already agreed and contributed to, although not yet implemented, to ensure that it can be considered to provide improvements to the conservation of the marsh fritillary butterfly, SAC qualifying species by providing additional on-site mitigation in the form of creation of areas of marsh fritillary habitat within the Enviroparks site.

For Coedydd Nedd a Mellte SAC, potential effects from the Enviroparks development alone and in-combination with other projects and plans, when taking into account the implementation of additional mitigating technologies and the increased stack height, have been screened out for the following: nitrogen deposition, ammonia; oxides of nitrogen (NOx); sulphur dioxide; metals (cadmium, thalium and heavy metals); volatile organic compounds (VOCs); and Polycyclic Aromatic Hydrocarbons (PAH). It can therefore be concluded that if additional technologies are implemented and the stack height is increased, there would be no adverse effects from the proposed development on this SAC site.

At Cwn Cadlan SAC, the modelling has shown that assuming that additional technologies and the increased stack height are implemented as part of the scheme, potential effects, both alone and in-combination with other projects and plans, for the following can be screened out: nitrogen deposition, ammonia; oxides of nitrogen (NOx); sulphur dioxide; metals (cadmium, thalium and heavy metals); volatile organic compounds (VOCs); and Polycyclic Aromatic Hydrocarbons (PAH). It can therefore be concluded that if additional technologies are implemented, there would be no adverse effects from the proposed development on this SAC site.

Consideration has been given in this Screening Report to the potential in-combination effects from the proposed development when considered with identified energy projects within the local area, and from plans set out in the Local Development Plans for Rhondda Cynon Taff County Borough Council and Brecon Beacons National Park Authority which could have an impact on the three SACs discussed in this report.

CONTENTS

1. INTRODUCTION

1.1 PROJECT BACKGROUND

In April 2020, Enviroparks (Wales) Limited commissioned Middlemarch Environmental Ltd to undertake an updated Shadow Habitat Regulations Assessment (sHRA) (Stage 1: Screening) associated with a development at Enviroparks Hirwaun, Rhonda Taff, South Wales. Middlemarch Environmental Ltd carried out a Shadow Appropriate Assessment for a development at the site in 2009 to support planning applications to Rhondda Cynon Taff County Borough Council (RCTCBC) and Brecon Beacons National Park Authority (BBNPA), as the site spans two planning areas, associated with the development of a sustainable waste resource recovery and energy production park. Planning permission was granted by both authorities on 21 December 2010 (RCTCBC reference 08/1735/10 and BBNPA reference 08/02488/FUL) following the completion of a planning obligations agreement under Section 106 of the Town and Country Planning Act 1990. Further to this, planning permission was granted subsequently for various amendments to the approved proposals.

Since then the planning permissions have been implemented through the construction of the first phase of the development. However, since the original scheme design was prepared in 2008, advances in waste recovery technologies and a much-changed policy and commercial landscape for waste recovery and renewable energy generation necessitated a review of the original master plan for the Enviroparks site.

This shadow Habitats Regulations Assessment: Stage 1 report was originally submitted in 2017 in support of a revised planning application for:

> *Amended phase II development and operation of a sustainable waste resource recovery and energy production park, comprising the consolidation of the approved gasification yard and pyrolysis building into a 6,270.43m² gasification hall; an emissions stack measuring 45m in height and 4.5m in diameter; a 2,102.86m² fuel storage hall and a 378m² turbine hall for electricity generation; and a 4,824m² open service yard containing ancillary structures including air-cooled condensers for the gasification plant, ancillary fire water tanks and a fire pumphouse, effluent pumps, gas boosters, transformers and a standby diesel generator and fuel tank, with boundary landscape and planting at land at Fifth Avenue, Hirwaun Industrial Estate, Hirwaun, Aberdare.*

In summary, the main differences between the development approved in 2010 and the amended scheme applied for in 2017 were as follows:

- It was proposed that the gasification yard, pyrolysis building and engine house all shown separately in the 2010 scheme should all be consolidated into a single building. This would be achieved by raising the height of the consented but unbuilt building on the Fifth Avenue frontage of the site by two metres to an eves height of 14.1 metres and a ridge height of 16.1 metres to accommodate a Fuel Storage Hall and Turbine Hall, and building a Gasification Hall to the north of this revised building, extending towards the centre of the site, with an eves height of 16.5 metres. and a ridge height of 18.5 metres.

- Raising the height of the consented but unbuilt emissions stack at the centre of the site from 40 metres to 45 metres to ensure the effective dispersion of atmospheric emissions without interference to air flow from the proposed Gasification Hall beneath. The stack would also be increased in diameter from 2.5 metres to a maximum 3.5 metres, which will enhance both its operational performance and structural integrity.

- Deletion of the consented anaerobic digestion tanks inside the western boundary of the site. This is because a similar facility had opened at Bryn Pica, nearby.

- The replacement of the consented but unbuilt green wall inside the south-western corner of the site with a belt of tree and shrub planting. The green wall had been proposed to conceal the open gasification yard. However, with the gasifiers located in the proposed Gasification Hall, this requirement fell away.

These amendments were a rationalisation of the existing approved development and were intended to afford a range of operational and amenity benefits. Placing all process elements into a single building is operationally efficient. Plant and equipment would be protected from the weather and operational monitoring would be assisted. Working conditions for staff would improve. From an amenity perspective, enclosing the gasifiers in a building greatly assists noise attenuation and odour containment, helps to avoid light pollution and presents a less industrial and more visually coordinated feature in views from outside the site, including from the elevated terrain in the Brecon Beacons National Park to the north. The new and amended buildings would use the same elevational treatment and building materials approved for the development that was granted planning permission in 2010. For the avoidance of doubt, the revised proposals involve no change to the overall volume of materials processed at the site.

Consultation with Natural Resources Wales early in 2017 confirmed that a shadow Habitat Regulations Assessment would be required to inform the determination of the application, due to the proposed development site's proximity to a number of nature conservation sites. Reference to mapped data and as outlined by Natural Resources Wales, the following European statutory nature conservation sites are within a 5 km radius of the scheme: Blaen Cynon Special Area of Conservation (SAC), Coedydd Nedd a Mellte SAC and Cwm Cadlan SAC. These sites form part of the Natura 2000 network of European statutory nature conservation sites.

As such, a Stage 1 (Evidence Gathering and Screening) of a shadow Habitat Regulations Assessment was undertaken for the scheme. The need for projects with the potential to impact upon Natura 2000 sites to be assessed is stated in Article 6 of the European Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (hereafter 'the Habitats Directive'). Articles 6 (3) and 6 (4) of this Directive state that an Appropriate Assessment is required for any plan or project that is considered likely to have a significant effect on a Natura 2000 site, either individually or in-combination with other plans or projects. Natura 2000 sites are those sites designated under the Habitats Directive to ensure the protection of European important habitats, and include SACs, SPAs, Offshore Marine Sites (OMS) and Ramsar sites. The Habitats Directive is transposed into UK legislation through the Habitat Regulations. Regulation 61 of the Habitat Regulations incorporates the requirements of Articles 6 (3) and 6 (4) of the Habitats Directive.

The competent authority can only agree to the proposed development after having ascertained that it will not adversely affect the integrity of any Natura 2000 sites. Where adverse impacts are anticipated, projects or plans may still be agreed provided that there are no alternative solutions and the plan is considered to be of overriding public interest. In such instances appropriate compensatory measures are required to ensure that the overall coherence of the Natura 2000 site network is protected.

Following further consultation with Natural Resources Wales during 2017, the EWL team worked to identify additional technologies which would reduce the original modelled emissions from the Enviroparks scheme. The RevB version of the report, issued in September 2017, provided updated modelled data (provided by Environmental Visage Ltd, see Envisage 2017d report) which was understood to include the implementation of additional technologies, and which were deliverable as part of the scheme.

The April 2018 decision by the Court of Justice of the European Union (CJEU) in the case of *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17) means that measures intended to avoid or reduce the harmful effects of a proposed project on a European site may no longer be taken into account by competent authorities at the Habitat Regulations Assessment 'screening stage' when judging whether a proposed plan or project is likely to have a significant effect on the integrity of a European designated site. This is a reversal of a previously settled principle in English and Welsh law. As such, where a proposed development is proximate to a SAC or SPA and could give rise to significant effects, even if these effects can be mitigated for, an Appropriate Assessment (Stage 2) is required. This RevC version of the report has been updated to reflect this ruling.

Planning permission for the amended phase two development was granted by RCTCBC in February 2019 (reference 17/0249/10) and BBNPA in March 2019 (reference 17/14587/FUL).

A new planning application is to be submitted in 2020 to reflect a further amendment to the scheme design, specifically the relocation and raising in height of the already-consented stack. Updated air quality modelling has been undertaken by Environmental Visage Ltd to inform an updated version (RevC) of this report. New and revised text compared with previous versions of this report is shown in purple.

1.2 CONSULTATION

Natural Resources Wales responded to a pre-application enquiry associated with the revised planning application on 20th February 2017. They provided the following comments in their response:

> *A HRA, to be undertaken by the Local Authority, will be required to inform the determination of this application. A HRA was undertaken for the previous application at Enviroparks and that should now be updated to consider the new proposals. The new proposals result in different emissions (such as Ammonia, Benzene, Heavy Metals, Cadmium and Poly Aromatic Hydrocarbons (PAH), and different rates of acid and nitrogen deposition. In addition, since the original HRA, new developments have been proposed / constructed in the local area and these will need to be considered in the context of the HRA.*

A meeting was held at Natural Resources Wales offices on 9th May 2017 to discuss the project and the initial results of the air quality modelling. During this meeting NRW provided further information regarding the SAC sites considered in this Stage 1 report, and requested that a draft version of the report be circulated to NRW for their comments. A draft version of the report was provided to NRW and subsequently a final version was also provided to RCT and BBNPA as part of the planning application process.

Comments on the Draft version of the report were received from NRW on 27th June 2017. The consultation concluded the following:

> ***"Requirement*** *- Further information is required to demonstrate that emissions can be controlled to an acceptable level to demonstrate that there is no adverse effect on the integrity of the relevant Special Areas of Conservation (SAC).*
>
> ***Atmospheric Dispersion Modelling***
> *<u>Summary</u> – Worst Case IED Limits Emissions Data should be used, with a 70% conversion ratio of NO2:NOx.*
>
> ***Habitats Regulations Assessment***
> *<u>Summary</u> – With the information currently available, the project is likely to have a significant effect on the European Sites / SACs identified. In the determination of this application, your Authority must make an Appropriate Assessment of the implications for those sites in view of their conservation objectives.*
>
> ***Mitigation***
> *<u>Summary</u> – the measures proposed by the Applicant by way of mitigation are not considered to be acceptable. To ensure that the proposals will not give rise to adverse effects on the SACs, further information should be submitted to demonstrate that technical solutions are available and will be utilised within the design to control emissions to an acceptable level."*

On receipt of the above consultation response from NRW, the Enviroparks team engaged with an experienced technology provider to further consider the technological mitigation measures which could be included within the proposed system, as a way of ensuring that the emissions from the development were reduced to levels which were considered insignificant. The Envisage (2017c) report from August 2017 provides the following clarification of the approach taken:

> *"Emissions of NO_x, SO_2, NH_3, and HCl have been reduced or removed by the use of comprehensive abatement measures, in order to ensure that the resultant impact on the local environment is not only acceptable from a human health perspective, but can also be screened as insignificant at the very local sensitive ecological receptors.*
>
> *Details of the technologies to be applied are not detailed within this report, but will be included as part of a wider submission to the Local Planning Authority in due course. However, the ability of the abatement systems to meet the specified pollutant discharge concentrations is assured."*

A further meeting was held with Natural Resources Wales and Welsh Government on 19th July 2017 to discuss progress made by the applicant, EWL, in relation to the identification and assessment of alternative technologies which could be implemented as part of the scheme to provide the 'mitigation' measures requested above in relation to air pollution / air quality changes.

During the process of ongoing liaison with Natural Resources Wales they provided additional mapped information regarding the habitat distribution at Blaen Cynon SAC, Coedydd Nedd a Mellte SAC and Cwm Cadlan SAC, in addition to information regarding the current management arrangements within Blaen Cynon SAC.

On 23rd August 2017 a telcon was held between EWL, Savills (planning consultants), Environmental Visages Ltd (air quality consultants), Middlemarch Environmental Ltd (ecologists) and NRW. During this telcon EWL provided an update of the additional research works that were being undertaken to identify additional technologies which were deliverable as part of the scheme, which would act to minimise the nitrogen and acid deposition from the plant at the SACs considered in this report. Mitigation options within the Enviroparks site, and also potentially at an off-site location were also discussed.

Further to this telcon a site visit was held on 6th September 2017 between EWL and NRW to consider the areas within the Enviroparks application site that could be suitable for the provision of land suitable for creation of marsh fritillary habitat.

2. METHODOLOGY

The current assessment is based on the best practice for Habitat Regulations Assessment as outlined in The Habitat Regulations Handbook (DTA Publications, 2013 and subsequent updates). This document expands upon previous guidance published by the Impacts Assessment Unit at Oxford Brookes University (2001) and the Department for Communities and Local Government (2006).

Best practice guidance identifies that the Habitat Regulations Assessment process is broadly divisible into four stages, with the need to complete each stage determined by the results of the previous stage. In summary, these stages are:

- **Stage 1: Evidence Gathering and Screening**
  This stage is associated with collecting evidence regarding those parts of the Natura 2000 network that have the potential to be impacted by the strategic land-use plan, either alone or in-combination with other projects or plans. Where no significant effects are perceived, sites may be screened out of the need for further assessment during Stage 2.

- **Stage 2: Appropriate Assessment of Significant Impacts**
  Where it is considered a Natura 2000 site may experience significant effects from a project or strategic land-use plan, either alone or in-combination, a detailed assessment of likelihood and severity of the perceived impact on the integrity of the Natura 2000 network is undertaken. This assessment is based on a detailed review of the project or plan in conjunction with the structure, function and conservation objectives of the Natura 2000 site. This stage may also include a preliminary assessment regarding the potential for the identified impacts to be mitigated.

- **Stage 3: Assessment of Alternative Solutions**
  Where impacts on the integrity of the Natura 2000 network are perceived, this stage examines alternative ways of achieving the objectives of the project or strategic land-use plan in order to avoid these impacts.

- **Stage 4: Imperative Reasons of Overriding Public Interest and Compensation Measures**
  Where the potential for adverse impacts remains, and where it is deemed that a project or land-use plan should proceed for Imperative Reasons of Overriding Public Interest (IROPI), an investigation of appropriate compensatory measures is undertaken.

This report focuses on Stage 1 and Stage 2 of the Habitat Regulations Assessment process. Evidence gathering and screening is undertaken for those Natura 2000 Sites identified as being of relevance to the current project, and then an Appropriate Assessment of Significant Impacts is undertaken. The following Natura 2000 sites are considered in this screening report: Blaen Cynon SAC, Coedydd Nedd a Mellte SAC and Cwm Cadlan SAC. These sites form part of the Natura 2000 network of European statutory nature conservation sites. The location of the site is shown on Drawing C124755-01 in Chapter 11.

Implicit in the Habitats Directive is the application of the **precautionary principle**, which requires that the conservation objectives of Natura 2000 should prevail where there is uncertainty whether there will be an impact or not (Oxford Brookes, 2001). The European Commission's Final Communication from the Commission on the Precautionary Principle (European Commission, 2000a) states that the use of the precautionary principle presupposes:

- Identification of potentially negative effects resulting from a phenomenon, product or procedure; and,
- A scientific evaluation of the risks which because of the insufficiency of the data, their inconclusive or imprecise nature, makes it impossible to determine with sufficient certainty the risk in question (CEC, 2000).

According to best practice guidance, this means that the emphasis for assessment should be on objectively demonstrating, with supporting evidence, that there will be no significant effects on a Natura 2000 site. The publication 'Managing Natura 2000 Sites: The Provision of Article 6 of the 'Habitats' Directive 92/43/EEC' (European Commission, 2000b) provides explanatory guidance regarding this point, which is paraphrased below.

> *It is clear from the context and from the purpose of the directive that the 'integrity of the site' relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect*

the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for the purposes of Article 6(3), provided that the coherence of the network is not affected.

The expression 'integrity of the site' shows that focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.

As regards the connotation or meaning of 'integrity', this can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation. The 'integrity of the site' has been usefully defined as 'the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or levels of populations of the species for which it was classified' (IEEM, 2006).

The integrity of the site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives.

Conservation objectives for the Natura 2000 sites considered in this assessment are presented in Chapters 6 to 8.

3. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

3.1 CURRENT LAND USE

The Application Site is located on Fifth Avenue in Hirwaun Industrial Estate (central National Grid Reference SN 938 068). The site is situated at the northern edge of the industrial estate, with industrial buildings located to the south and east. Penderyn Reservoir forms the northern site boundary, with early-mature sessile oak lining the boundary and over-shading much of the track. A pumping station and an area of pasture with scattered trees forms the western site boundary. Fifth Avenue forms the southern site boundary and Ninth Avenue forms the majority of the eastern site boundary, with the remainder marked by a water treatment works.

The 2009 sHRA report states that the site was dominated by an area of flat, made ground, with incorporated drainage channels. It was understood that the area was previously built upon (within the last 100 years). The central area of the site was dominated by marshy grassland, however occasional gorse and planted scattered trees were present towards the edges of this habitat. The area was grazed by horses and thus subjected to a high level of poaching. Fenced off areas were present along the eastern and western site boundaries, with protected areas of young broad-leaved plantation woodland and scattered trees in marshy grassland.

A grassy track ran along the northern site boundary, bound between lines of trees (northern side of track) and broad-leaved woodland (southern side of track). A small stream extended along the western edge of the site, with a second shallower brook flowing into this stream forming a triangular area of willow carr, scattered trees and marshy grassland separate from the main area of the site (the third side was formed by a dry ditch which separated this area from the grassy track).

In 2017 an Environmental Statement Addendum was prepared by Savills. Chapter 13 of this ES Addendum, states that "*The habitats present within the Application Site remain broadly unchanged since the 2008 ES chapter*". The ES Addendum however, does identify the following changes to the ecological baseline of the site since 2008:

- Since the submission of the 2008 ES, construction works for Phase 1 are largely completed with the exception of the Phase 1 car park. The Phase 1 area now includes a large building, known as the Fuel Preparation Hall, in the south-east part of the site, a gatehouse, an access road running across the site between Ninth Avenue and Fifth Avenue, temporary construction laydown and parking areas and foul and surface water drainage works.
- A reduced temporary SUDS attenuation swale was constructed as part of Phase 1, which will be replaced by the full scale attenuation and landscape area along the southern boundary which was identified in the original consented site plan. This will be constructed as part of the Phase 2 works and will provide the required mitigation for the loss of reptile and amphibian habitat elsewhere on the site.
- During Phase 1, mitigation was provided for reptiles and amphibians through good quality habitat being retained within the Temporary Wildlife Protection Area (TWPA).
- Additional works during 2015/16 impacted part of the TWPA, resulting in the need to modify the TWPA perimeter.
- Additional mitigation works were undertaken during August and September 2016 to ensure that habitat for reptiles and amphibians was, and continues to be adequately protected.

Chapter 3 of the 2020 ES Addendum (Savills, 2020) reiterates that the Fuel Preparation Hall *"formed a part of the proposals approved in 2010 and has been built, occupying land in the south-eastern part of the site. It measures 14 metres to ridge in height and 132 x 36 metres in plan with a short return on the Fifth Avenue frontage, giving a gross internal floorspace of 4,752 m^2".*

Regarding access, circulation and parking, the 2020 ES Addendum states that *"Vehicular access to the Enviroparks site would be from Fifth and Ninth Avenues. These entrances, along with a connecting internal access road across the centre of the Enviroparks site, have been constructed, along with areas of hardstanding to the north and west of the existing Fuel Preparation Building."*

Other buildings and structures have yet to be constructed.

3.2 Scope of the Proposed Development

The Environmental Statement Addendums (Savills, 2017 and Savills, 2020) provide a detailed description of EWL's proposals which are covered by the planning application. A short summary of the processes that would take place on the site, and the individual buildings within which these processes would be accommodated is given below.

Processes will include:

- Waste management;
- Water reception;
- Fuel preparation; and,
- Gasification.

The buildings which have been built and are proposed for the site include:

- Fuel preparation hall (already built);
- Fuel storage hall;
- Gasification hall;
- Stack;
- Turbine hall;
- Service yard;
- On site high-energy user building;
- Biomax building;
- Visitor centre and administration building; and,
- Areas for site access, circulation and parking.

Extensive landscape and planting is proposed around the periphery of the site and within the car park. Plant species would be selected to reflect the aims of integrating new planting with that which already exists on the site boundaries, providing a suitable visual foil for the buildings and some ecological benefit.

The proposed layout of the site is shown on EPT Partnership drawing 'Proposed Overall Site Plan' (Ref: ENV_EPT_GEN_DR_A_6011 RevP9).

The 2020 planning application is concerned solely with the relocation and raising in height of the already-consented stack. There are no other changes to the permitted scheme.

4. CUMULATIVE SCHEMES

4.1 INTRODUCTION

As part of the updated air quality assessment work completed in support of the 2017 planning application, consideration was given to the in-combination effects on air quality as a result of projects and plans within the local area. Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017) identifies the projects and plans which were considered.

4.2 IN-COMBINATION PROJECTS (2017 ASSESSMENT)

Chapter 9 Air Quality provided the following discussion regarding projects which are considered 'in-combination' as part of the air quality modelling works:

> *"Located on an industrial estate, the Enviroparks development is in close proximity to operations that might have an impact on air quality. Eden UK, across Ninth Avenue from the site, holds a Local Authority Environmental Permit for its coating processes, from which the main regulated pollutant is PM_{10}. Other Local Authority Environmental Permits registered in or around Hirwaun include a coal handling Permit for Tower Regeneration Ltd, a coatings manufacturing Permit for Eftec Limited, which produces engineered materials and application systems for bonding, coating, sealing and damping in vehicles, and a wood product Permit application for the Celtic Communities Wood Fuel Limited. None of these installations and processes are expected to have a significant impact upon local air quality, due to their type, size and distance from existing Air Quality Management Areas or other vulnerable areas.*
>
> *Since the 2008 ES, a number of energy plants have been constructed or proposed on the Hirwaun Industrial Estate. These include the Green Frog Short Term Operating Reserve (STOR) located off Main Avenue, and operational since 2012. Additionally, a Nationally Significant Infrastructure Project, Hirwaun Power was awarded a Development Consent Order in July 2015, for the development of an open-cycle gas turbine peaking plant to generate up to 299 MW_e, and Premier Green Energy Ltd has been awarded a change of use planning permission to develop a renewable energy generation facility comprising a pyrolysis plant for the conversion of non-hazardous mixed waste wood materials into 8 MW_e energy.*
>
> *Several other new, proposed or committed developments have been identified in the area, including the Abergorki Wind Farm, situated on land to the North East of Forch-Orky; land remediation and reclamation of old tips, derelict land and buildings, surface coal extraction and associated ancillary development at the Tower Colliery site; potential development of the former Ferrari's Bakery site in Hirwaun, for which the site was sold at auction in July 2016 although there are no further details on whether or not the proposed development will progress at the site at this time.*
>
> *When considering the potential cumulative effects of proposed or committed developments in the Hirwaun area, the air quality assessment prepared for the ES Addendum has taken the following schemes* [see Table 4.1] *into account:*

Development Name	Scheme	Consideration
Abergorki Wind Farm	Three wind turbines	Construction traffic impacts
Hirwaun Power	Gas fired 'peaking' power generating plant providing up to 299mwe	Construction traffic and operational emissions
Hirwaun Energy Centre	Wood pyrolysis energy plant	Operational emissions
Green Frog Connect Ltd,	STOR generator farm	Operational emissions

Table 4.1: Cumulative Effects Considered in 2017 Air Quality Assessment

Chapter 9 Air Quality states that with respect to other identified schemes with limited additional or a reduced impact on current background air quality levels:

> *"Other identified schemes have been assessed as having limited additional, or as having a reduced impact on current background air quality levels, e.g. reduced traffic movements at Tower Colliery, or are considered to have insufficient information available for consideration e.g. the likely proposals for the Ferrari's Bakery site."*

4.3 IN-COMBINATION PLANS (2017 ASSESSMENT)

In addition to considering in-combination schemes, Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017) provides the following assessment of plans which have been considered as part of the air quality assessment modelling. Chapter 9 states that:

> *"Allocated land within the Rhondda Cynon Taf Local Development Plan includes:*
>
> *Policy NSA 8 - Land South of Hirwaun*
> *Land is allocated South of Hirwaun for the construction of 400 dwellings, 36 hectares of employment, a new primary school, a retail store of 2000m^2 net floor space, medical /community centre and informal recreation contained in a landscape setting. Development on the Strategic Site will be subject to a large-scale reclamation scheme.*
>
> *Policy NSA 9 - Housing Allocations*
> *Land is also allocated in the Northern Strategy Area of Rhondda Cynon Taf for residential development on non-Strategic Sites in the following locations:*
> *Land South of Rhigos Road, Hirwaun, a 0.57 hectare flat field situated on the edge of Hirwaun, located behind a low density residential street has been identified for 15 Dwellings.*
>
> *Policy NSA 21 - Park and Ride / Park and Share Provision*
> *Provision for park and ride / park and share facilities will be provided on land to the South of Hirwaun.*
>
> *Although allocated for development, these schemes are not yet in the planning system. The Local Authority applies a consistent and proportionate approach to their consideration of development applications which could either have the potential to adversely affect local air quality or introduce a relevant population to an existing area of potentially poor local air quality. Should a development meet the relevant criteria and it is proportionate to do so, the Local Authority will require an Air Quality Assessment to be produced in order to objectively examine the air quality implications of the proposed development, and to provide sufficient information to allow the Local Planning Authority to evaluate the material planning consideration. In this way, the Local Authority attempts to ensure that future developments will negate or mitigate any impacts on local air quality whilst continuing to treat each application for planning consent on its individual merits."*

As such, whilst these plans have been identified, their air quality impacts have not been considered in this assessment as they are not yet 'committed developments' and as such there is no air quality data available to base an assessment on.

The one scheme which this does not necessarily apply for is Ferrari's Bakery site. This site has the potential to increase traffic movements and result in associated air quality impacts, and the planning consent expires on 28/10/2019. A search for air quality data associated with this site for inclusion in this assessment was carried out by Environmental Visage Ltd, however available data was limited and it is understood that the site was sold at auction in 2016, having not been developed. As such, there is currently no data associated with the development proposals on which an assessment can be made. It is understood that the site initially failed to sell at auction, but a deal was done subsequently. Bearing in mind the location of this site (in Hirwaun itself rather than on the Industrial Estate) and the uncertainty over its future as well as a lack of detailed information on the only possible 'in-combination' effect from traffic changes, Environmental Visage Limited screened this project out of the detailed assessments.

Consideration has also been given to any in-combination effects which might be outlined in the following documents:

- 'Habitat Regulations Assessment (Appropriate Assessment) Report. Rhondda Cynon Taf County Borough Council. Draft Deposit Local Development Plan' (Enfusion, 2009).
- 'Brecon Beacons National Park Local Development Plan - Final Sustainability Appraisal Report (incorporating Strategic Environmental Assessment)' (TRA, 2013).

In-combination effects from these plans are discussed further below.

<u>Rhondda Cynon Taf County Borough Council. Draft Deposit Local Development Plan</u>
The Appropriate Assessment (Enfusion, 2009) provides the following conclusions with respect to air quality impacts on Blaen Cynon SAC:

"The LDP has the potential to increase levels of traffic along the A465 and A4059 through the development of Strategic Site 5: Land South of Hirwaun and Employment allocation 9 (North of Fifth Avenue, Hirwaun Ind Estate, Hirwaun). Increased traffic could lead to an increase in airborne pollutants at Blaen Cynon SAC as the A465 and A4059 are within 200m. The plans and programs that have the potential for in-combination effects in relation to increased traffic along the A465 and A4059 are:

- *The Trunk Road Forward Programme 2002 proposes the dualling of the A465 from Abergavenny to Hirwaun. Section 7 (A465:A470 to Hirwaun) is in close proximity to the SAC. This in-combination with the development proposed in the LDP has the potential to increase levels of airborne pollutants through increased traffic.*
- *The Brecon Beacons National Park (BBNP) Local Development Plan Preferred Strategy identifies the potential for a small amount of growth in Peneryn, the precise location and size of development is as yet not unknown, however allocations outside the main settlement of Brecon are likely to be small in number. There is a small likelihood that development in this area may increase levels of traffic along the A4059 which is within 200m of Blaen Cynon SAC. The BBNP Preferred Strategy contains strong policies in regard to environmental protection and climate change (minimise greenhouse emissions).*

RCT's Deposit Draft Plan contains a number of policies that will assist in mitigating any potential increase in traffic and therefore airborne pollutants, such as ensuring improvements to and encouraging the use of public transport, walking and cycling routes. The proposed level of employment development will also help to reduce daily out-commuting to work from RCT by private car. The Core Management Plan for the Blaen Cynon SAC (CMP) does not identify air pollution as being a significant issue at this site. "There are no known off-site factors, such as pollution, that are affecting the marsh fritillary to any significant extent, although there is still much industry in the locality". The CMP also states that as management of the SAC habitat improves, off-site factors could become more apparent. Based on information provided in the CMP and from the JNCC; site level management issues (grazing and scrub management) are currently the most important factor in terms of maintaining and improving the marsh fritillary habitat. Taking these factors into account it is assessed that the LDP will not have significant effects on Blaen Cynon SAC either alone or in-combination in regards to airborne pollution."

Consultation with NRW during a meeting on 9th May 2017, clarified that whilst air quality was not considered to be a threat in the 2008 Core Management Plan for Blaen Cynon SAC (as suggested above), it is now considered to be a threat to the SAC.

The Transport Statement which forms part of the Environmental Statement Addendum provides the following with respect to the proposed A465 dualling works:

"…significant works have been undertaken on the Heads of the Valleys Road (A465), which provides strategic road access to Hirwaun Industrial Estate. Upgrades to sections of the A465 between Dowlais and Brynmawr to the east of Hirwaun are complete, and improvements between Dowlais and Hirwaun are programmed to commence in 2018."

Consultation with Welsh Government (Meredith, *Pers. Comm.*) confirmed that an Environmental Impact Assessment associated with the stretch of the A465 between Hirwaun and Dowlais is currently being completed, and should be publicly available in July 2017. However, this means that there is currently no data which can be used to carry out further modelling work on the potential 'in-combination' effect of this section of the strategic project.

With respect to air quality (concentrations in air at ground level), the transport assessment works (Chapter 8, Environmental Statement Addendum, Savills, 2017) for works completed to date, on which the conclusions presented in Sections 6.5.2.10, 7.5.1.9 and 8.5.1.9 are based, use a Tempro assessment methodology which includes an expected increase in traffic levels in line with local development proposals. The Tempro assessment uses national data applied at a local level into which the local authority would have provided their input from strategic traffic improvement proposals.

Whilst no data is currently available on which a more detailed assessment of this scheme can be competed, it should be recognised that whilst the A465 dualling works could result in an increase in traffic levels, one of the key reasons for the dualling works is to is to improve the flow of traffic and potentially this could reduce contributions to air pollution from traffic due to improved traffic flows in proximity to the SAC.

Enfusion (2009) do not identify any potential adverse effects from the Local Development Plan on Ceodydd Nedd a Mellte SAC or Cwm Cadlan SAC and as such, it can be concluded that there would be no in-combination effects from the proposed development and the Local Development Plan on these sites.

Brecon Beacons National Park Local Development Plan
The TRA (2013) SER report provides a summary of the Appropriate Assessment works that were completed for the Local Development Plan. The following summary is provided:

> *"A HRA for the LDP has been undertaken as a separate process to the SA/SEA. A summary of the process, results and recommendations are provided below…*
>
> *The second stage of the screening undertaken at Deposit stage (including proposed site allocations) identified that there was potential for likely significant effects at five European sites (Blaen Cynon SAC, Llangorse Lake SAC, River Usk SAC, River Wye SAC and Usk Bat Sites SAC) both alone (as a result of the location of certain candidate sites) and combined with other plans and programmes.*
>
> *The screening recommended a number of policy safeguards that seek to address issues identified through the assessment. These recommendations were subsequently incorporated into the LDP. Monitoring measures and a joint Water Cycle Study (after adoption of the LDP) were also recommended as a result of data limitations and the uncertainty surrounding the implementation of development.*
>
> *The screening concluded that with the recommended policy safeguards and monitoring measures incorporated into the Plan, the Deposit LDP would not have likely significant effects on European sites either alone or in-combination with other plans or projects."*

Assuming that the proposed Enviroparks is policy compliant, it may therefore be possible to conclude that the proposed Enviroparks scheme will not have any adverse in-combination effects from other schemes outlined in the plan. A copy of the Appropriate Assessment report has been requested from BBNPA and will be reviewed in greater detail once this document has been provided.

TRA (2013) do not identify any potential adverse effects from the Local Development Plan on Ceodydd Nedd a Mellte SAC or Cwm Cadlan SAC and as such, it can be concluded that there would be no in-combination effects from the proposed development and the Local Development Plan on these sites.

4.4 2020 In-Combination Assessment

The updated air quality modelling completed in 2020 has demonstrated that the development would result in process contributions for the majority of pollutants of less than 1% of the lower critical loads when considered 'alone'. These process contributions can be screened as 'insignificant' and therefore no assessment of in-combination effects is required.

With respect to cumulative effects associated with nutrient nitrogen and acid deposition, Owen, (2020, *Pers. Comm.*) states that:

> *When considering the contributions of nutrient Nitrogen and acid deposition to the three local SACs in combination with the cumulative effects of other local third-party emissions… the contributions of nutrient Nitrogen remain within 1 % of the Critical Load, as do contributions of acid deposition at Cwm Cadlan and Coedydd Nedd a Mellte. Acid deposition does marginally exceed the 1 % insignificance threshold at Blaen Cynon however, equating to approximately 1.03 % at the modelled receptor point.*

5. RELEVANT NATURA 2000 SITES

This report presents evidence to allow potential impacts on relevant Natura 2000 sites to be assessed and the need for a full Habitat Regulations Assessment to be screened.

Chapter 9 Air Quality from the Environmental Statement Addendum (Savills, 2017) sets out the methodology used to assess air quality impacts on ecological receptors (as identified by Natural Resources Wales in their pre-application responses, see Section 1.2). The assessment included designated sites located within 10 km of the Enviroparks facility. This assessment identified that there were three Natura 2000 sites within this radius: Blaen Cynon SAC, Coedydd Nedd a Mellte SAC and Cwm Cadlan SAC.

The qualifying criteria and relative distances of the sites from the 2017 application site boundary (which remains unchanged in 2020) are summarised in Table 5.1. It should be noted that the site boundary for the 2017 (and current application) is smaller than that from the original planning application.

NATURA 2000 SITE	QUALIFYING FEATURES	DISTANCE FROM APPLICATION SITE
Blaen Cynon SAC [UK 0030092]	The site contains an extensive complex of damp pastures and heaths supporting the largest metapopulation of marsh fritillary butterfly *Euphydryas aurinia*, an Annex II species, on the southern edge of the Brecon Beacons National Park.	125 m east
Coedydd Nedd a Mellte SAC [UK 0030141]	The site is a very large and diverse example in South Wales of the Annex I habitat 'Old sessile oak woods with *Ilex* and *Blechnum*'. The woods extend along a series of deeply incised valleys and ravines, and contain complex mosaics of sessile oak *Quercus petraea* woodland, ash *Fraxinus excelsior* woodland (some of which is referable to the qualifying Annex I habitat type 9180 *Tilio-Acerion* forests of slopes, screes and ravines), and transitions to lowland woodland types.	1.24 km west north-west
Cwm Cadlan SAC [UK 0013585]	The site has the largest recorded example of Annex 1 habitat 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils' in Wales and also supports the Annex 1 habitat 'Alkaline fens'.	2.48 km north-east

Table 5.1: Summary of Natura 2000 Qualifying Criteria and Distance from Application Site Boundary

The location of these sites in relation to the proposed development site is shown on Drawing C124755-01 in Chapter 11.

The designation criteria, conservation objectives, known areas of vulnerability and consideration of the development impacts for each of the Natura 2000 sites listed in Table 5.1 are detailed in Chapters 6 to 8.

6. BLAEN CYNON SAC

6.1 QUALIFYING CRITERIA

The following information is taken from the Joint Nature Conservation Committee (JNCC) site description and accompanying Natura 2000 data sheet, both of which are available at: https://sac.jncc.gov.uk/site/UK0030092.

Information has also been obtained from the Countryside Council for Wales (CCW, 2008a) Core Management Plan for the site.

Country: Wales
Unitary Authority: East Wales
Centroid: SN946066
Latitude: 51.74833333
Longitude: -3.528055556
Site Code: UK0030092
Status: Designated Special Area of Conservation (SAC)
Area (ha): 66.52

Blaen Cynon contains an extensive complex of damp pastures and heaths supporting the largest metapopulation of marsh fritillary *Euphydryas aurinia* on the southern edge of the Brecon Beacons National Park. The marsh fritillary butterfly *Euphydryas aurinia* is found in a range of habitats in which its larval food plant, devil's-bit scabious *Succisa pratensis*, occurs. Marsh fritillaries are essentially grassland butterflies in the UK, and although populations may occur occasionally on wet heath, bog margins and woodland clearings, most colonies are found in damp acidic or dry calcareous grasslands. Populations of marsh fritillary vary greatly in size from year to year, and, at least in part, this is related to cycles of attack from parasitic wasps. Adults tend to be sedentary and remain in a series of linked metapopulations, forming numerous temporary sub-populations, which frequently die out and recolonise.

Blaen Cynon also supports a range of habitats. Marshy grassland, and flush and spring are of particular importance as they provide habitat for the marsh fritillary. Also present are areas of raised bog, species-rich neutral grassland, acid grassland and semi-natural broadleaved woodland.

6.1.1 SAC Qualifying Criteria

6.1.1.1 Qualifying Habitats
The site does not contain any Annex I habitats (Habitats Directive: 92/43/EEC) that are listed as primary reasons for selection.

6.1.1.2 Qualifying Species
This site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance listed on Annex II of the Directive. The SAC citation states that with respect to *Euphydryas (Eurodryas, Hypodryas) aurinia* this is considered to be one of the best areas in the United Kingdom.

6.2 CONSERVATION OBJECTIVES

The CCW (2008a) Core Management Plan for Blaen Cynon SAC includes the conservation objectives for designated features. Each conservation objective consists of the following two elements: vision for the feature; and, performance indicators. During a meeting on 9th May 2017 with Natural Resources Wales, it was confirmed that whilst an updated management plan for Blaen Cynon SAC is currently being produced, this has not yet been published and therefore the 2008 plan is considered to represent the most up to date management plan for the site. At the time of writing this RevC version of the report, an updated management plan did not appear to have been produced.

6.2.1 SAC Feature: Marsh Fritillary Butterfly
The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- The site will contribute towards supporting a sustainable metapopulation of the marsh fritillary in the Penderyn/ Hirwaun area. This will require a minimum of 50ha of suitable habitat, of which at least

10 ha must be in good condition, although not all is expected to be found within the SAC. Some will be on nearby land within a radius of about 2km.

- The population will be viable in the long term, acknowledging the extreme population fluctuations of the species.
- A minimum of 30% of the total site area will be grassland suitable for supporting marsh fritillary (as the total area of the SAC is 66.62 ha, 30% represents approximately 20 ha.)
- At least 40% of the suitable habitat (approximately 8 ha) must be in optimal condition for breeding marsh fritillary.
- Suitable marsh fritillary habitat is defined as stands of grassland where *Succisa pratensis* is present and where scrub more than 1 metre tall covers no more than 10% of the stands.
- Optimal marsh fritillary breeding habitat will be characterised by grassland where the vegetation height is 10-20 cm, with abundant purple moor-grass *Molinia caerulea*, frequent "large-leaved" devil's-bit scabious *Succisa pratensis* suitable for marsh fritillaries to lay their eggs and only occasional scrub. In peak years, a density of 200 larval webs per hectare of optimal habitat will be found across the site.

The performance indicators for the condition of the feature and the factors affecting the feature are provided in Table 6.1 below.

Performance Indicators for Feature Condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Density of larval webs	Larval web density in a 'good' year for marsh fritillary has been identified as a measurable performance indicator of the population. During peaks in the population cycle a density of 200 webs per hectare of suitable habitat is an appropriate target to set as defining favourable condition for strong populations. Wide fluctuations in abundance occur, with dramatic crashes in population size occurring every ten years or so. Recovery from these crashes may take 4 or 5 yrs.	*Upper limit:* not required *Lower limit:* in one year in six the number of larval webs is estimated to be 200 per hectare of Good Condition habitat.
Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Extent and quality of the marshy grassland as habitat for marsh fritillary	The marsh fritillary is a highly localised and sedentary butterfly that inhabits unimproved *Molinia* grassland in the lowlands. It has an annual life-cycle and feeds as a larva on *Succisa pratensis*, especially on large-leaved plants that are growing amongst vegetation that is between 10 and 20 cms tall in late summer/autumn. The larvae over winter communally amongst litter in such situations and the shelter provided by leaf litter and tussocks is considered to be important. Approximately 50 ha of habitat is required to maintain the population in the long-term, with at least 10ha is good condition. Not all is expected to be within the SAC. The operational limits reflect the minimum contribution of the Blaen Cynon SAC towards the favourable conservation status of the species in the Hirwaun/ Penderyn area. **Definition of Good Condition marsh fritillary habitat** Grassland, with *Molinia* abundant where, for at least 80% of sampling points, the vegetation height is within the range of 10 to 20 cm (when measured using a Boorman's disc) and *Succisa pratensis* is present within a 1 m radius. Scrub (>0.5 metres tall) covers no more than 10% of area **Definition of Suitable marshy grassland** Stands of grassland where *Succisa pratensis* is present at lower frequencies but still widely distributed (>5% of sampling points) throughout the habitat patch and in which scrub (>0.5 metre tall) covers no more than 25% of area. Alternatively, *Succisa* may be present at high density in close-cropped swards. [note: Available habitat is the total of Good Condition and Suitable habitat]	20 hectares of Available marshy grassland, including: 8 hectares of Good Condition marsh fritillary habitat Within Areas 1, 2, 3 and 4 50% of the vegetation meets the following criteria: Within a 50cm radius: *Molinia* is present *AND* The cover of *Succisa* is 10% or greater *AND* The vegetation height is between 10-20cm when measured using a Boorman's disc. **AND** The cover of *Juncus* spp. does not exceed 50%

Table 6.1: Performance Indicators for Blaen Cynon SAC Feature – Marsh Fritillary Butterfly

Natural Resources Wales provided a plan of Blaen Cynon SAC that shows the marsh fritillary butterfly habitat within the SAC boundaries. A copy of this map is provided in Appendix 1. This map shows that the SAC includes 6 different areas of land, which all include some pockets of marsh fritillary habitat. The SAC unit which is in closest proximity to the Enviroparks scheme is the largest of the six, and contains the largest concentration of marsh fritillary habitat. Marshy fritillary habitat is shown to be present along the western side of this SAC unit, in close proximity to the Enviroparks development area.

Other Factors to Consider
Owner/occupier objectives - the owners/occupiers of the land typically have an interest in securing some financial/agricultural benefit from the land. This return could be optimised by the agricultural improvement of the land, e.g. by installing new drainage, fertiliser application, or re-seeding; however these operations would cause significant long-term damage to the marsh fritillary habitat, namely the marshy grassland. Additionally unimproved marshy grasslands that are waterlogged for much of the year are difficult to manage for many landowners, possibly resulting in a mixture of over- and undergrazing, with a tendency for scrub to spread. Because of the wet nature of some of the ground, some landowners may be reluctant to graze large stock. This factor will be controlled through management agreements and the SSSI legislation. An operational limit is not required.

Weather conditions **-** Weather conditions have an effect on the breeding success of the marsh fritillary. In particular, poor weather conditions during the adult flight period will reduce opportunities for mating, egg-laying and dispersal from core areas. Weather conditions during early spring influence the rate of larval development of the marsh fritillary and the effects of the parasitic wasp (see below). This site is situated in an area of relatively high rainfall, which has a large influence on the population dynamics of the marsh fritillary. This factor is outside the influence of the site manager and an operational limit is not required.

Parasites **-** The larvae of marsh fritillaries can be parasitised by species of braconid wasp of the *Cotesia* genus. The parasites can have good years and infect a large number of larval webs, causing a crash in the subsequent adult population of marsh fritillary. This factor is outside the influence of the site manager; and an operational limit is not required.

6.2.2 Additional SSSI Features

Blaen Cynon SAC consists of two Sites of Special Scientific Interest (SSSIs): Cors Bryn y Gaer SSSI and Woodland Park and Pontpren SSSI. These sites are included in the Natura 2000 series for their population of marsh fritillary butterfly. The sites also host the following six SSSI features, for which conservation objectives are provided in the Core Management Plan for Blaen Cynon SAC:

- Marshy grassland;
- Flush and spring;
- Raised bog;
- Species-rich neutral grassland;
- Acid grassland; and,
- Semi-natural broadleaved woodland.

The vision for each of these SSSI features and performance indicators for the factors affecting the features have not yet been defined. Furthermore, with the exception of marshy grassland, limited detail is provided with respect to performance indicators for the condition of each feature.

Table 6.2 presents the performance indicators for Blaen Cynon SAC features – SSSI Features.

Feature			
Marshy grassland	**Performance Indicators for Feature Condition**		
	Attribute	***Attribute rationale and other comments***	***Specified limits***
	A1. Extent of marshy grassland	Monitoring will be a map-based exercise. The area of marshy grassland will be mapped as a baseline extent and the total area measured. Repeat monitoring will either re-map the site or review the baseline map in the field. Extent of marshy grassland is defined by the amount of habitat required for marsh fritillaries SSSI feature – Core Management Plan report states that section is to be completed.	Upper Limit: not needed Lower limit: 20 hectares of Available marshy grassland
	A2. Condition of the marshy grassland	The definition of good condition marshy grassland follows that given for the marsh fritillary habitat, as follows: **Definition of Good Condition marsh fritillary habitat** Grassland, with *Molinia* abundant where, for at least 80% of sampling points, the vegetation height is within the range of 10 to 20 cm (when measured using a Borman's disc) and *Succisa pratensis* is present within a 1 m radius. Scrub (>0.5 metres tall) covers no more than 10% of area **Definition of Suitable marshy grassland** Stands of grassland where *Succisa pratensis* is present at lower frequencies but still widely distributed (>5% of sampling points) throughout the habitat patch and in which scrub (>0.5 metre tall) covers no more than 25% of area. Alternatively, *Succisa* may be present at high density in close-cropped swards. [note: Available habitat is the total of Good Condition and Suitable habitat]	This section follows the operational limits for the marsh fritillary feature above: 8 hectares of Good Condition marsh fritillary habitat Within Areas 1, 2, 3 and 4 50% of the vegetation meets the following criteria: Within a 50cm radius: *Molinia* is present *AND* The cover of *Succisa* is 10% or greater *AND* The vegetation height is between 10-20cm when measured using a Boorman's disc. **AND** The cover of *Juncus* spp. does not exceed 50%
	Performance Indicators for Factors Affecting the Feature		
	Factor	***Factor rationale and other comments***	***Operational Limits***
	SSSI feature - Core Management Plan report states that section to be completed.		
Remaining features (Flush and spring, raised bog, species-rich neutral grassland, acid grassland, semi-natural broadleaved woodland)	**Performance Indicators for Feature Condition**		
	Attribute	***Attribute rationale and other comments***	***Specified limits***
	A1. Extent of feature	Monitoring is likely to be a map-based exercise. The area of the feature will be mapped as a baseline extent and the total area measured. Repeat monitoring will either re-map the site or review the baseline map in the field.	SSSI feature - Core Management Plan report states that section to be completed.
	A2. Condition of the feature	SSSI feature - Core Management Plan report states that section to be completed.	SSSI feature - Core Management Plan report states that section to be completed.

Table 6.2: Performance Indicators for Blaen Cynon SAC Features – SSSI Features

6.3 VULNERABILITY OF THE SAC

The CCW Core Management Plan (2008a) includes an assessment of the conservation status of qualifying features and management requirements to maintain or restore each feature.

6.3.1 SAC Feature: Marsh Fritillary Butterfly

In 2008, the conservation status of the marsh fritillary butterfly was **unfavourable**. This was due to the following principal issues:

- Inappropriate grazing;
- Scrub invasion; and,

- Inappropriate tree planting and past agricultural improvements in the management units.

Further details are provided in Table 6.3.

Issue contributing to Unfavourable Status of Feature	Explanation and Management Required
Inappropriate grazing	Without an appropriate grazing regime, the grassland will become rank and eventually turn to scrub and woodland. Conversely, overgrazing, or grazing by inappropriate stock (particularly sheep) will also lead to unwanted changes in species composition, through selective grazing, increased nutrient inputs and poaching. Balancing grazing is the single most important issue in the management of this site. There is now considerable experience in managing sites for marsh fritillaries in Wales, and the needs of the species are now reasonably well understood.
Scrub invasion	Scrub encroachment is an issue, particularly on some wet grassland areas. A programme of scrub control is currently (2008) being undertaken, but it is likely that even with the ideal grazing management, a more or less continuous programme of scrub control will be required at this site. It is clear from aerial photographs and from discussions with landowners, that many areas that are currently covered in alder and willow woodland were formerly wet pasture. Therefore a long-term aim would be to investigate returning some of this to wet pasture that would likely increase the availability of marsh fritillary habitat.
Inappropriate tree planting and past agricultural improvements in the management units	Parts of Woodland Park and Pontpren, notably units 3 and 4 have been subject to improvement in preparation for tree planting, including draining, planting with trees and use of fertiliser. These areas have a programme of scrub removal and cattle grazing in place, to restore the grassland to a condition where it can be used by marsh fritillaries. Some drains have been blocked, to restore the hydrology of the site.

Table 6.3: Summary of Issues Contributing to Unfavourable Status of Feature and Management Required

6.3.2 Additional SSSI Features

The conservation statuses of all SSSI features (marshy grassland, flush and spring, raised bog, species-rich neutral grassland, acid grassland and semi-natural broadleaved woodland) were **unfavourable** in 2008. Management requirements for these features were not provided.

6.3.4 Current Threats to SAC

The Natura 2000 – Standard Data Form (2015a) states that the main threats to this SAC are:

High-rank threats:

- Changes in abiotic conditions – both inside and outside of the SAC; and,
- Air pollution, airborne pollutants – both inside and outside of the SAC.

Medium-rank threats:

- Other ecosystem modifications – both inside and outside of the SAC.

Low-rank threats:

- Biocenotic evolution, succession – both inside and outside the SAC;
- Grazing – inside the SAC;
- Human induced changes in hydraulic conditions – both inside and outside the SAC;
- Invasive non-native species – both inside and outside the SAC; and,
- Pollution to groundwater (point sources and diffusion sources) – inside the SAC.

6.4 Potential Effects on Blaen Cynon SAC – Stage 1: Screening

This section of the report provides an assessment of the potential effects of the proposed development on the Blaen Cynon SAC. The section has been structured to provide consideration of each of the likely pathways for impacts and the site's vulnerabilities as identified in Sections 6.2 and 6.3. Some of the identified 'risks' are identified from the 2008 Core Management Plan for the site (CCW, 2008a), and some are from the 2015 Natura 2000 Standard Data Form. Where there are overlaps between the 'risks' outlined in the two documents, these have been discussed together.

The proposed development has the potential to result in direct impacts on the SAC through changes in local conditions which might affect the SAC, and also indirect effects which may include loss of supporting habitat outside of the SAC which is used by qualifying species.

DIRECT IMPACTS

Direct impacts on the qualifying feature of the SAC, ie marsh fritillary butterflies, as a result of the proposed development would include disturbance of individuals of marsh fritillary within the SAC boundary.

6.4.1 Disturbance

This section assesses whether the proposed development at the site will cause a direct disturbance to marsh fritillary individuals during either the construction or operational stage.

Populations of marsh fritillaries vary greatly in size and form from year to year, related at least in part to cycles from attack by parasitic wasps (JNCCa, no date). Adults tend to be sedimentary, rarely flying more than 50 – 100 m (Butterfly Conservation, 2008), and therefore form a series of linked metapopulations, with numerous temporary sub-populations which frequently die out and recolonise (JNCCa, no date). Where the habitat is very fragmented, populations do not appear to be able to persist and therefore the conservation of clusters of sites in close proximity is important for the species.

In terms of the reaction of marsh fritillary to disturbance, consultations with the Senior Invertebrate Ecologist from CCW (Fowles, 2009) identified that CCW have not carried out any research on the potential impacts of disturbance on butterflies. Fowles (2009) concluded that the major concern from developments close to a known marsh fritillary site (accepting that habitat fragmentation and metapopulation connectivity has been accounted for) would be from the potential impact on hydrology, as groundwater changes may impact on the marshy grassland that supports the marsh fritillaries. He went on to state that *'Whilst some…other threats might affect marsh fritillaries there is no indication to suggest that they are likely to be significant, at least in the scenarios we deal with here in Wales.'*

Therefore, as there is no evidence to suggest that marsh fritillary butterflies are affected by construction or operational disturbance, it can be concluded that disturbance will not result in a direct adverse impact on the integrity of this qualifying feature of Blaen Cynon SAC, and is screened out of further assessment.

INDIRECT IMPACTS

Indirect impacts include those pathways which may result in changes to the habitats within the SAC upon which the marsh fritillary butterfly depends. As part of the assessment works for the 2009 sHRA report (RT-MME-104641), the Environment Agency Wales provided a copy of the Air Pollution Assessment for Blaen Cynon SAC (EAW, no date) which stated that:

> *A reduction in the occurrence of Devil's-bit scabious would put pressure on the marsh fritillary populations, and if the plant is completely lost then the marsh fritillary will disappear from the site.*

Thus, indirect effects on the marshy fritillary butterfly are considered to include pathways through which the habitats which support Devil's-bit scabious could be affected to such an extent that they are no longer able to support this larval foodplant species.

In addition, loss of habitat outside of the SAC, but which could form part of the marshy fritillary's range would also be considered to be an indirect effect.

These potential effects are discussed in further detail in Sections 6.4.2 to 6.4.7 below.

6.4.2 Changes in Abiotic Conditions

Changes in abiotic conditions are considered to be a high-ranking threat to the SAC. Abiotic factors are non-living conditions which can influence where plants or animals live such as: temperature, light intensity; moisture content of soil; and pH of the environment.

6.4.2.1 Dust

Abiotic factors which have the potential to affect Blaen Cynon SAC include dust pollution of the SAC as a result of construction activities within the proposed development site which is located c.100 m west of the SAC at its closest point. Chapter 7 Air Quality of the 2020 ES Addendum states that with respect to dust emissions during the construction phase of the development:

> *"Dust emissions from the consented development as a whole will occur predominantly during construction of buildings, plant, landscape features and hard-standings and the proposed increase in the stack height will make an insignificant contribution to construction-phase dust arisings. The main sources of dust include that generated from land stripping and excavation, piling and foundation works, aggregate and materials handling and preparation, and traffic movements across the site which will, periodically at least involve movement across open ground...*
>
> *The earthworks required at the site will be classed as medium scale, due to the size of the site and the operations required. Construction and track-out impacts will be large scale due, in part to the size of the buildings, and the number of construction vehicle movements required during the peak of the development phase.*
>
> *…the potential impact on ecological receptors can be considered. However, as the sensitive ecological sites are all located more than 50 m from the development site, the overall sensitivity is considered to be low. With a low sensitivity class calculated for all potential effects, the combined sensitivity of the area is low."*

Taking into account the sensitivity of the potential receptors, the Chapter 7 Air Quality of the 2020 ES Addendum concludes that with respect to the magnitude of the impact from dust during construction:

> *"The overall risk of dust impacts from the construction activities for the consented development as a whole is therefore considered to be low..."*

In their pre-application response, Natural Resources Wales (Griffiths, 2017, *Pers. Comm*.) stated the following with respect to dust impacts:

> ***Dust impacts upon designated sites***
> *If dust mitigation can avoid dust depositions of 200mg/m^2/day at the nearest designated site then that should be sufficient to reduce the potential risk of damage to the features. It is generally accepted that dust depositions of 200mg/m^2/day are considered nuisance deposition at residential receptors. Therefore, we will ask that a condition be imposed on any permission granted that a Dust Management Plan (covering both the construction and operational phases) be submitted and agreed with the LPA's prior to any development commencing.*

Subject to the implementation of a Dust Management Plan, dust deposition on Blaen Cynon SAC can be avoided, and no likely significant effects are anticipated.

It should be noted that, as detailed in Section 1.1, the April 2018 decision by the Court of Justice of the European Union (CJEU) in the case of *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17) means that measures intended to avoid or reduce the harmful effects of a proposed project on a European site may no longer be taken into account by competent authorities at the Habitat Regulations Assessment 'screening stage' when judging whether a proposed plan or project is likely to have a significant effect on the integrity of a European designated site (Freeths, 2018). This is a reversal of a previously settled principle in English and Welsh law. As such, where a proposed development is proximate to a SAC or SPA and could give rise to significant effects, even if these effects can be mitigated for, an Appropriate Assessment (Stage 2) is required. Further detail is provided in Section 6.5.

6.4.2.2 Changes in pH
Changes in the pH of the SAC as a result of air pollution are considered in Section 6.4.3 below.

6.4.3 Air Pollution, Airborne Pollutants

Air pollution and airbourne pollutants are considered to be a high-ranking threat to the SAC.

As part of the assessment works for the 2009 sHRA report (RT-MME-104641), the Environment Agency Wales provided a copy of the Air Pollution Assessment for Blaen Cynon SAC (EAW, no date). This document states that the habitats within Blaen Cynon are comprised of acid, neutral and calcareous grassland types, all of which may be supporting the marsh fritillary butterfly. Table 6.4 presents a summary of the potential pollutants and the Environment Agency's assessment of their effect on the marsh fritillary qualifying feature of Blaen Cynon SAC.

Pollutant	Effect on Marsh Fritillary in Acid Grasslands	Effect on Marsh Fritillary in Calcareous Grasslands
Nitrogen oxide (NO_x)	No threat is perceived where the butterfly inhabits acid grassland.	If the grassland is calcareous potential changes to community composition and increased susceptibility to secondary stresses such as drought and frost may lead to an overall adverse effect on the grasslands that the butterfly inhabits. A reduction in the occurrence of Devil's-bit scabious would put pressure on the marsh fritillary populations, and if the plant is completely lost then the marsh fritillary will disappear from the site.
Sulphur dioxide (SO_2)	The butterfly is not considered to be sensitive to exposure of high levels of SO_2 if it inhabits acid grasslands.	Calcareous grasslands are considered to be sensitive to exposure of high levels of SO_2. The key concerns are visible decline symptoms such as leaf discolouration and stimulated growth at low concentrations of S potentially changing community composition.
Ammonia (NH_3)	High concentrations of ammonia can cause stresses on plants and changes to plant morphology. Plants that are less sensitive to the effects of ammonia will become dominant, replacing more sensitive species. The larvae of the butterfly relies on the presence of Devil's bit scabious, if concentrations of ammonia exceed the critical level then there is the possibility that this plant will decrease in numbers or become lost from the site.	
Ozone	The butterfly is not considered to be sensitive to exposure of high levels of ozone if it inhabits acid grasslands.	Calcareous grasslands are considered to be sensitive to exposure to high levels of ozone. The key issues are: visible injury to foliage, reduction in growth rate, selection against ozone sensitive genotypes and a changed reaction to water stress.
Nutrient nitrogen deposition	The butterfly species relies on the presence of Devil's-bit scabious, on which the larvae feed. An increase in nutrient nitrogen (N) will potentially change the species matrix of both calcareous and acid grasslands, with grasses becoming more dominant. If Devil's–bit scabious is lost from the site then so too will the marsh fritillary butterfly.	
Acidification	Whilst in the larval stage the marsh fritillary feeds only on Devils-bit scabious, which is a grassland species. Thus although the larvae and the adults are not directly affected by acidification they may be indirectly affected by damage to, or loss of Devils-bit scabious. The threat to acid grasslands from acid deposition is thought to be small, however there is very little information available on this.	In areas of calcareous grassland it is generally agreed that acid deposition has no effect due to the buffering capacity.

6.4 (continued): Summary of Air Quality Effects on Grassland at Blaen Cynon SAC (after EAW, no date)

The Core Management Plan (CCW, 2008a) for the site, identifies that management Units 1, 2, 3 and 4 are in closest proximity to the proposed development site. Appendix 1 includes a plan showing the management units for Blaen Cynon SAC. The key habitats within these units are marshy grassland (Units 1, 2 and 3) and flushes and springs (Unit 4), with flushes and springs, raised bog, species-rich neutral grassland habitats and acid grassland all noted as being other habitats that are important to the management unit, but not the main focus of management and monitoring. Thus it is clear that the potential pollutants outlined in Table 6.4 which might affect 'calcareous grassland' include nitrogen oxide, sulphur dioxide, ammonia, ozone and nutrient nitrogen.

Due to the nature of the proposed development, from an early stage in the planning process it was considered that potential effects on the SAC as a result of air pollution and airbourne pollutants could not be screened out, and the 2009 sHRA Report (RT-MME-104641) provided an in-depth discussion of the potential air quality impacts of the proposed development on the habitats and qualifying features within Blaen Cynon SAC. This data has been reviewed and Section 6.5 of this RevC version of the report provides an updated assessment of the potential impacts of the proposed development based on the updated modelling completed as part of the 2017 Environmental Statement Addendum (Savills, 2017) and the 2020 Environmental Statement Addendum (Savills, 2020).

As detailed in Chapter 2, where it is considered a Natura 2000 site may experience significant effects from a project or strategic land-use plan, either alone or in-combination, a detailed assessment of likelihood and severity of the perceived impact on the integrity of the Natura 2000 network is undertaken (Stage 2: Appropriate Assessment of Significant Impacts). The detailed assessment work that has been undertaken in relation to potential air pollution impacts on the SAC is considered to provide enough information to allow the competent authority to undertake an Appropriate Assessment, and is presented in Section 6.5.

6.4.4 Inappropriate Tree Planting and Past Agricultural Improvements in the Management Units / Other Ecosystem Modifications

Other ecosystem modifications are considered to be a medium-rank threat to the SAC according to the 2015 Natura 2000 Standard Data Form. The proposed development will have no impact on tree planting, other agricultural management practices, or any ecosystem modifications not considered elsewhere in this chapter. As a result it can be concluded that there would be no likely significant effect on Blaen Cynon SAC as a result of this pathway, either alone or in-combination with other projects or plans. No further assessment is required.

6.4.5 Scrub Invasion / Biocenotic Evolution / Succession / Invasive Non-Native Species

These are considered to be low-rank threats where they are included on the 2015 Natura 2000 Standard Data Form. Other than via potential changes to air quality (which are discussed in Sections 6.4.3 and 6.5.2), given the fact that there is a separation of c.100 m between the proposed development site and the closest Blaen Cynon SAC unit, it is not considered that the proposed development would result in any adverse effects on the SAC via this pathway, either alone or in-combination with other plans or projects. No further assessment is required.

6.4.6 Grazing

This threat is considered to be a low-rank threat on the 2015 Natura 2000 Standard Data Form. Inappropriate grazing regimes by horses, sheep and cattle have been identified in the Core Management Plan as being an issue for Blaen Cynon SAC. The Core Management Plan identifies that action was needed to ensure that management agreements with the landowners of the different SAC land parcels were in place.

The development site is currently fenced off and there are no opportunities for horse-grazing at the site. As such, loss of the land within the development site will not result in any changes to grazing regimes within the SAC and the proposals are therefore not considered to have any adverse effects on the grazing regimes within the SAC, either alone or in-combination with other plans or projects. No further assessment is required.

6.4.7 Human Induced Changes in Hydraulic Conditions / Pollution to Groundwater (Point Sources and Diffusion Sources)

This threat is considered to be a low-rank threat on the 2015 Natura 2000 Standard Data Form. The 2009 sHRA report (RT-MME-104641) stated that:

> *"The proposed development site is not hydrologically connected to Blaen Cynon SAC through surface water systems, as those surface water features within and adjacent to the site flow in a southerly direction and do not outfall into Blaen Cynon SAC;*
>
> *The hydrological studies completed prior to the 2009 assessment showed that the groundwater moves in a south-west direction and therefore any changes to the groundwater levels as a result of a change in the drainage system within the site will not impact on groundwater beneath Blaen Cynon SAC as this is located up gradient of the proposed development site"*

The 2009 sHRA report concluded that there would be no significant adverse impacts on the integrity of the Blaen Cynon SAC as a result of human induced changes to hydraulic conditions and as there are no changes to the drainage proposals from the current application, this conclusion is maintained.

With respect to pollution to groundwater, as it has been shown that the application site does not have any hydrological groundwater connection to the SAC, it can be concluded that there would be no impacts from this pathway as a result of the proposed development, either alone or in-combination with other projects and plans. No further assessment is required.

6.4.8 Loss of Marsh Fritillary Habitat Outside of SAC

The proposed development will not require any landtake from the European Site nor will they affect the boundary of the site. However, given the proximity of Blaen Cynon SAC to the proposed development site (125 m away) the effects of habitat loss at the proposed development site are discussed below.

As part of the 2009 sHRA report (RT-MME-104641) consideration was given to the potential for use of habitats within the Enviroparks site by marsh fritillary. Marsh fritillary surveys were undertaken within the proposed development site in 2008 in three stages to determine the presence of marsh fritillary:

Stage 1: Habitat and Food Plant Assessment
The first stage involved an initial habitat and food plant survey of the site and the surrounding area to provide an assessment of the breeding potential within the site itself and whether there is any potential for dispersal into surrounding habitats. The marsh fritillary is associated with two main habitat types: damp neutral or acidic grasslands (Rhos pastures); and, dry chalk and limestone grasslands. The main larval foodplant is Devil's-bit scabious, with field scabious and small scabious occasionally used.

The majority of the proposed development site is covered in rush-dominated marshy grassland. The site was subject to heavy grazing and therefore the sward was short in-between rush patches (generally less than 5 cm) with occasional sparse tussocks of tufted hair-grass *Deschampsia caespitosa*. An area of semi-improved neutral grassland was present along the southern and eastern site boundaries and was unmown with an average sward length of approximately 40 cm. The sward height of the grassland was deemed to be too high to provide ideal habitat for marsh fritillary as the species prefer intermediate to shorter sward lengths.

A search for Devil's-bit scabious (the larval food plant) revealed only a single patch of five individual plants within the south-eastern corner of the site within the semi-improved neutral grassland habitat. No field scabious *Knautia arvensis* or small scabious *Scabiosa columbaria* were identified within the survey site.

Penderyn Reservoir is located to the north of the site and the grassy slopes of the reservoir were regularly mown, and no devil's-bit scabious was recorded on the slopes. It was not possible to gain access to land within the water treatment works (to the north-east of the site), however when viewed through the fence, the grassland within this habitat appeared to comprise regularly mown amenity grassland with few forb species present. Industrial units and hard standing formed the remainder of the eastern boundary. The land to the south of the site was occupied by further industrial units, surrounded by regularly maintained amenity planting. These habitats surrounding the site are therefore considered to provide unsuitable habitat for marsh fritillary.

Stage 2: Marsh Fritillary Adult Survey
The second stage involved using the Butterfly Monitoring Scheme methodology, to complete a series of counts along a fixed route across the site during given weather conditions. Adult marsh fritillary butterflies seen within 5 m of each side of the transect route were be recorded. Butterfly surveys were completed on 30th May 2008, 30th June 2008 and 16th July 2008. No marsh fritillary butterflies were recorded during any of the butterfly survey visits, or during any of the other visits to the site.

Stage 3: Larval Foodplant Survey
The final stage of the survey identified the quantity of larval food plant across the proposed development site, and included survey using quadrats or by examination of the individual plants for the larval form and eggs of the marsh fritillary. The five Devil's-bit scabious plants in the south-eastern corner of the site were searched for the presence of eggs on 16th June 2008 and 27th August 2008. No marsh fritillary eggs were found during these surveys.

No marsh fritillaries (adults, larvae or eggs) were recorded during any of the surveys. The site provided sub-optimal habitat for marsh fritillary, with only a single small patch of devil's bit scabious (the larval food plant) noted. Adult marsh fritillary rarely fly more than 50-100 m thus reducing the likelihood of the adults utilising the Application Site which is 100 m away at its closest point.

Since 2008, development works at the site have been completed which involved the construction of the Phase 1 area of the site, and reptile mitigation works which involved trapping and translocation and ground works (see Chapter 13 Ecology, of the Environmental Statement Addendum, 2017). It is therefore considered that marsh fritillary butterflies are highly unlikely to be now using the site and as such there would be no indirect effects on the species from the loss of habitat within the application site. No further assessment is required.

6.4.9 Conclusions Following Stage 1: Screening

The Stage 1: Screening exercise has identified that the proposed development will have no 'Likely Significant Effect' on Blaen Cynon SAC as a result of the following threats/pressures:

- Disturbance;
- Inappropriate tree planting and past agricultural improvements in the management units / other ecosystem modifications;
- Scrub invasion / biocenotic evolution / succession / invasive non-native species;
- Grazing;
- Human induced changes in hydraulic conditions / pollution to groundwater (point sources and diffusion sources); or,
- Loss of marsh fritillary habitat outside of SAC.

These threats/pressures are not considered further.

6.5 Blaen Cynon SAC – Stage 2: Appropriate Assessment

The Stage 1: Screening exercise has identified that, in the absence of mitigation, the following threats/pressures have the potential to result in a 'Likely Significant Effect' on Blaen Cynon SAC, and therefore require further assessment:

- Changes in abiotic conditions (dust pollution); and,
- Air pollution, airborne pollutants.

These issues are discussed in more detail below.

6.5.1 Changes in Abiotic Conditions

6.5.1.1 Dust

As detailed in Section 6.4.2.1, it is considered that potential significant effects on Blaen Cynon SAC as a result of dust pollution can be screened out, subject to the implementation of mitigation. As outlined previously, following the April 2018 decision by the Court of Justice of the European Union (CJEU) in the case of *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17), mitigation measures intended to avoid or reduce the harmful effects of a proposed project on a European site must now be considered by competent authorities at the 'Appropriate Assessment' stage.

Subject to the implementation of a Dust Management Plan (as detailed in Chapter 9 of this report), it is clear that dust pollution can be controlled and as such there would be no significant adverse effect on Blaen Cynon SAC as a result of the proposed development, either alone or in-combination with other plans or projects.

6.5.2 Air Pollution, Airborne Pollutants

A description of the model used by the air quality consultants to provide the data discussed in this section of the report is given in Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017) and Chapter 7 Air Quality of the Environmental Statement 2020 Addendum (Savills, 2020), Envisage (2017d) report entitled 'Atmospheric Dispersion Modelling Assessment of Proposed Emissions from Enviroparks Wales Ltd, Hirwaun Industrial Estate, Aberdare' and Envisage (2020) report entitled 'Atmospheric Dispersion Modelling Assessment of Proposed Emissions from Enviroparks Wales Ltd Hirwaun Industrial Estate'. The 2020 modelling report supersedes the 2017 modelling report.

As detailed in Section 1.1, planning permission for the amended phase two development was granted by RCTCBC in February 2019 (reference 17/0249/10) and BBNPA in March 2019 (reference 17/14587/FUL).

Further modelling works were completed in 2020 to inform a new planning application associated with the relocation and raising in height of the already consented stack. These recent results are presented in this report.

When considering air pollution effects, critical levels and critical loads are used to set thresholds against which changes in the levels of air pollutants as a result of a process can be assessed as being 'insignificant' or, if they cannot be considered 'insignificant' may be 'significant' based on further assessment.

APIS (see http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788050) provides the following definitions of critical levels and critical loads:

- Critical Loads are defined as: " *a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*"

- Critical levels are defined as "*concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge*".

APIS state that it is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of pollutant deposited from air to the ground, whereas the critical level is the gaseous concentration of a pollutant in the air.

The EAW (no date) report provided information with respect to the critical levels for a number of air pollutants related to Blaen Cynon SAC, detailed in Table 6.5.

Pollutant	Current Level
Nitrogen dioxide (NO_2)	A critical level of NO_2 has not been set.
Nitrogen oxide (NO_x)	The marsh fritillary butterfly is considered to be sensitive to concentrations of NOx above 30 μg/m^3. All of the EAW estimated levels lie below the critical level. It can be concluded that current NOx concentrations are not high enough at Blaen Cynon to be having an adverse effect on the integrity of the site.
Sulphur dioxide (SO_2)	The marsh fritillary butterfly has a critical level of 20 μg/m^3. All of the EAW estimated levels lie below the critical level. The current levels, both estimated and measured show there is no current threat from SO_2 concentrations to the SAC features.
Ammonia (NH_3)	The marsh fritillary butterfly has a critical level of 1 μg/m^3. It can be concluded that NH3 levels are not currently having a negative effect on the Blaen Cynon SAC feature.
Ozone	The marsh fritillary butterfly is sensitive to ozone concentrations above a critical level of AOT 40 3000 ppb.h. The APIS estimated level of ozone AOT 40 3537 ppb.h is higher than the AOT 40 3000 ppb.h limit for the natural vegetation features.

Table 6.5: Summary of Air Pollution Critical Levels at Blaen Cynon SAC (from EAW, no date)

In addition to the information provided in Table 6.5, the Air Pollution Information System (APIS) website (see http://www.apis.ac.uk/srcl/select-a-feature?site=UK0030092&SiteType=SAC&submit=Next) provides a range of critical levels and critical loads for Blaen Cynon SAC associated with the habitat types which are found within the site. These have been used to inform the air quality assessment modelling works.

In response to comments from Natural Resources Wales as part of the pre-application process in 2017, air quality modelling was carried out specifically to inform the original sHRA Stage 1 report. The assessment methodology included using a grid reference to the closest possible point within the ecological receptor (ie the Natura 2000 site) from the source, as this was considered to give a maximum value for the deposition rates within the SACs. For Blaen Cynon SAC, the modelling is based on the closest point of the SAC to the development site, located at grid reference 294099, 206960.

Air Quality and Air Pollution Screening Criteria
When considering the potential effect of air quality and air pollution on sensitive ecological receptors, a series of screening criteria are used to identify whether a project will result in changes to air quality or air pollution which are below a threshold at which they can be considered 'insignificant'.

The values for critical loads and critical levels give levels above which a habitat may experience adverse effects from the air quality criteria or air pollution levels. Where the scheme is considered to provide a contribution towards air quality or air pollution, but the critical load or critical level in not exceeded, it can be concluded that the scheme would not have a significant adverse impact on the ecological receptor from the relevant air pollutant. If the scheme does result in the critical load or critical level being exceeded, the an additional set of screening criteria apply.
The Institute of Air Quality Management (IAQM, 2016) 'IAQM Position Statement - Effect of Air Quality Impacts on Sensitive Habitats' states that:

> *"The EA recognised early in its process of developing guidance that there would always be a level of emission from an installation such that its impact would be so small as to constitute an 'inconsequential effect', when considered in isolation or in-combination with the background or other*

sources. It chose to set this level at 1% of the relevant criterion, which is typically the critical level for vegetation or the critical load for the habitat being considered…

it is the position of the IAQM that the use of a criterion of 1% of an assessment level in the context of habitats should be used only to screen out impacts that will have an insignificant effect. It should not be used as a threshold above which damage is implied and is therefore used to conclude that a significant effect is likely. It is instead an indication that there may be potential for a significant effect, but this requires evaluation by a qualified ecologist and with full consideration of the habitat's circumstances. The criterion also is intended to apply to an individual source and is not intended to be applied to multiple sources 'in-combination'."

The IAQM Position Statement (IAQM, 2016) provides the following clarification with respect to the use of 1% as a screening threshold:

"it should be recognised that the criterion was set as 1% and not 1.0%. It may be considered by some that it is prudent to explore the likelihood of an adverse effect when the impact is, say 1.2% of a critical load, but the reality is that this was never the original intention of the methodology. The calculation of impacts is always subject to some uncertainty, especially where deposition is concerned. It would be more in the spirit of the original proposal to use 1% as a criterion if impacts that were clearly above 1% were treated as being potentially significant, rather than impacts that are about 1% or slightly greater."

Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017) confirms that the initial screening stage which has been applied to the modelled data was based on the following:

"The Environment Agency sets criteria for considering the impact of process contributions to ambient air, which states that process concentrations equating to less than 1% of the long-term assessment level, or 10% of the short-term level can be screened as insignificant."

If the process contribution (PC) cannot be screened as insignificant based on the criteria above, then a further screening methodology is set out by the Environment Agency (and applied directly by NRW) on their webpage 'Guidance – Air Emissions Risk Assessment for your Environmental Permit'. (see https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit):

"If your long-term PC is greater than 1% and your PEC is less than 70% of the long-term environmental standard, the emissions are insignificant – you don't need to assess them any further."

The consideration of the potential effects from air quality changes and air pollution on Blaen Cynon SAC is therefore discussed below in accordance with these screening criteria.

On 20 March 2017 the High Court handed down its judgment in the case of *Wealden DC v Secretary of State for Communities and Local Government, Lewes DC and the South Downs National Park Authority and Natural England* [2017] EWHC 351 (Admin). The *Wealden* case related to the Habitats Regulations Assessment of a local plan, rather than of a project (as is the case with this assessment), however, since the HRA legal regime is expressed identically for the assessment of plans and projects, this judgement is considered in this assessment.

The case considered the application of the HRA screening criteria outlined above, in light of the legislative requirement that an assessment of a plan or project must be carried out 'alone or in-combination with other plans or projects'. The court did not dismiss use of the screening criteria, but it held that it was not appropriate to apply the screening criteria only to traffic impacts of the subject local plan alone, and on that basis to 'screen it out', when there also existed a neighbouring local plan with predicted traffic impacts on the very same road. Instead, in applying the screening criteria, the court concluded that the *combined* air quality impacts (from traffic) of the subject local plan and the neighbouring local plan on the specific road in question should be considered. For this assessment, the main predicted air quality impacts will not be from traffic, but from emissions from the plant. However, the principal of using screening criteria for considering in-combination effects, rather than effects from the scheme alone would be applicable to this assessment.

It is understood that leave to appeal this judgment is being sought from the Court of Appeal but, at the time of writing, there has been no decision on whether leave will be granted, let alone the outcome of any Court of Appeal decision.

Envisage (2017a) produced an 'Addendum to an Atmospheric Dispersion Modelling Assessment of Proposed Emissions from Enviroparks Wales Ltd Hirwaun Industrial Estate, Aberdare' report which provides technical details associated with the modelling works that have been completed in order to inform this Stage 1 Screening Report. The reader is referred to this for additional technical information regarding the modelling works.

In September 2017, a further report entitled 'Atmospheric Dispersion Modelling Assessment of Proposed Engine Emissions from Enviroparks Wales Ltd Hirwaun Industrial Estate Aberdare' was produced by Envisage (2017d) to provide the results of further atmospheric dispersion modelling using emissions data from alternative applied technologies. EWL now plan to install two gasifier lines which will each treat Refuse Derived Fuel (RDF) to produce gas which will fire up to thirteen Jenbacher engines, and hence the 2017 modelling work considered the normal operational release from up to thirteen engines, discharging through a 45 m high chimney. Additionally, a flare will be required to manage other than normal operating conditions and emergency shut-downs, and the modelling report also considers the potential releases from this point.

The September 2017 modelling assessment (Envisage, 2017d) considered the following process situation:

- Amendments to the proposed technologies have been incorporated into the plant design in order to minimise the process contribution to, and potential impact on the local environment.
- Within the modelling assessment, Nitrogen Dioxide has initially been modelled as total Oxides of Nitrogen. Process contributions of NOx to Critical Levels has been assessed using total (100 %) NOx. As Nitric Oxide does not deposit at a significant rate, contributions from NOx to nutrient Nitrogen and acid deposition calculations for assessment against the Critical Loads are assumed to be 70 % of the total NOx figure, thereby representing the fraction of Nitrogen Dioxide likely to be present in the NOx, which may be available to deposit.
- Emission concentrations provided are levels specified by the technology provider as being achievable and suitable for contractual terms. Important notes on the emissions include:
- Emissions of HF, Volatile Organic Compounds and Dioxins are not detectable.
- Emissions of Total Organic Carbon have been modelled within the study. Of these, should the sum of the limits of detection for Volatile Organic Compounds be applied, 2.12 % might be volatile. The limit of detection for Benzene specifically would suggest that up to 0.274% of the TOC could be Benzene.
- The sum of the limits of detection of Dioxin and Furan species has been included in the study, although Dioxins are not usually detectable in the engine release.

It was also noted that the background concentrations recorded on the APIS website had been updated since the initial modelling work was undertaken (December 2016), and hence the background data applied in the 2017 modelling assessment and in the data presented in the RevB version of this report were amended in line with updated background concentrations obtained in August 2017.

The background deposition and concentration datasets available on the APIS website were updated to a 3-year average for 2016-2018 on 18th March 2020. The most recently available APIS data has been applied for the 2020 modelling assessment.

Chapter 3 of the 2020 ES Addendum (Savills, 2020) states the following in relation to the relocation and raising in height of the consented stack:

> *Emissions from the gasification plant would be expelled via a main stack. In its consented form the stack would be 45 metres high and 3.5 metres in diameter, and would occupy the verge between the northern side of the Gasification Hall and the internal spine road, which is already constructed. This is a confined space, close to the main thoroughfare along which lorries would pass.*
> *The current proposal is for a stack 90 metres high and 3.95 metres in diameter. The increase in stack height follows further studies on the emissions profile of the Enviroparks plant, particularly in relation to acid and nutrient nitrogen deposition on nearby Special Areas of Conservation (SAC)... To facilitate access for emissions monitoring in conjunction with Natural Resource Wales (NRW), a continuous emissions monitoring systems (CEMS) gantry is proposed around the stack at a deck height of 18.5 metres above local ground level. Access to the CEMS gantry would be by means of a permanent steel frame ladder.*

The 2020 modelling work is based on the emissions released from the proposed relocated and taller stack.

6.5.2.1 Nutrient Nitrogen

2017 Assessment

Table 6.6 provides a summary of the modelled deposition rates for nutrient nitrogen at Blaen Cynon SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4.

Details of the gasifier release characteristics to be considered within the modelling were supplied by the Enviroparks design team and have their base in the maximum allowable emission limits which will be imposed on the site operations. These are taken from Annex VI (Technical provisions relating to waste incineration plants and waste co-incineration plants) of the Industrial Emissions Directive (IED) (Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control) (Recast)), and provide the worst-case scenario figures as this modelling adopts the maximum allowable emission limits and assumes that the site will be operational at these maximum allowable emission limits at all times.

For Blaen Cynon SAC, a lower critical load of 10 was used as this is the lowest critical load identified by APIS which would be relevant to some of the habitats found within the SAC. This critical load relates to acid grassland habitats which are recorded as being present within SAC unit 3 (see CCW Drawing in Appendix 1) which is the closest unit to the Enviroparks development site. Table 6.6 also presents the data using the higher critical load for acid grassland at Blaen Cynon SAC.

Nutrient Nitrogen (N)	**Enviroparks Only**	**In-Combination**
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	1.752	2.351
Current Minimum Background (kg N/ha/yr)	21.98	21.98
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.73	24.33
Lower Critical Load:		
Lower end of Critical Load range (kg N/ha/yr)	10	10
Do background levels exceed the lower critical load?	**Yes**	**Yes**
Do PEC levels exceed the lower critical load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**17.5%**	**23.5%**
Long-term PC < 1 % of lower Critical Load?	**No**	**Yes**
Long-term PEC as % of lower Critical Load	**237.3%**	**243.3%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher end of Critical Load range (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	**11.7%**	**15.7%**
Long-term PC < 1 % of higher Critical Load?	**No**	**Yes**
Long-term PEC as % of higher Critical Load	**158.2%**	**162.2%**
Long-term PEC < 70 % of higher Critical Load?	**No**	**No**

Table 6.6: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Blaen Cynon SAC

In the 2009 sHRA assessment, nutrient nitrogen was considered based on two different modelling approaches. The first was the standard modelling approach outlined in Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017). The second modelling was based on an approach used by Laxen and Marner (2005) who concluded that it was usual for the proportion of NO_2 in NO_x from industrial sources to be lower than the proportion of NO, and as such, they included an assumption of 50% NO_2 in NO_x release as being a robust approach. Using these modelling parameters (which were accepted in the 2009 sHRA Report RT-MME-104641), data associated nutrient nitrogen deposition from the new Enviroparks scheme, both alone and in-combination with other projects, are given in Table 6.7.

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	1.430	2.030
Current Minimum Background (kg N/ha/yr)	21.98	21.98
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.41	24.01
Lower Critical Load:		
Lower end of Critical Load range (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**14.3%**	**20.3%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**234.01%**	**240.1%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical Load (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	**9.5%**	**13.5%**
Long-term PC < 1 % of higher Critical Load?	**No**	**No**
Long-term PEC as % of higher Critical Load	**156.1%**	**160.1%**
Long-term PEC < 70 % of higher critical load?	**No**	**No**

Table 6.7: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Blaen Cynon SAC and Laxen and Marner (2005) Assessment Methods

Tables 6.6 and 6.7 present a worst-case scenario based on the emissions being at IED limits. However, in reality, the site is highly unlikely to permanently discharge emissions at the limit concentration, and the gasifier design team estimate much lower emissions generally for the majority of the emissions which will contribute to the nutrient nitrogen and acid deposition rates. As these are long-term assessment values, it is considered appropriate to re-assess the deposition rates resulting from these lower, long-term emission concentrations, whilst recognising that, for short periods during any year, higher releases, up to the emission limit value (and therefore as presented in Tables 6.6 and 6.7) could occur.

Table 6.8 therefore considers the more realistic long-term emission levels from the process (as detailed in the dispersion modelling report submitted with the Environmental Statement Addendum, Savills, 2017), and applies the Laxen and Marner methodology to emissions of NO_x to represent a robust assessment of the levels of NO_2 within the NO_x, to re-consider the levels of nutrient nitrogen and acid deposition to the SACs from the process.

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	1.358	1.958
Current Minimum Background (kg N/ha/yr)	21.98	21.98
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.338	23.938
Lower Critical Load:		
Lower end of Critical Load range (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**13.6%**	**19.6%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**233.4%**	**239.4%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher end of Critical Load range (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	**9.1%**	**13.1%**
Long-term PC < 1 % of higher Critical Load?	**No**	**No**
Long-term PEC as % of higher Critical Load	**155.6%**	**159.6%**
Long-term PEC < 70 % of higher Critical Load?	**No**	**No**

Table 6.8: 2017 Modelled Nutrient Nitrogen Deposition Using Long-Term Realistic Emissions Data at Blaen Cynon SAC and Laxen and Marner (2005) Assessment Methods

The consultation response from Natural Resources Wales stated the following with respect to the use of the Laxen and Marner (2005) Assessment Methods:

"…in calculating the deposition data, a long term NO2:NOx ratio of 50% has been specified with reference to a report assessing air quality impacts on vegetation. This report is not a peer reviewed study and we would therefore expect the submitted risk assessment worst case scenario to use a 70% conversion of NO_x to NO_2, unless a valid site specific justification is given for a lower conversion ratio."

In response to these comments, the additional modelling works (Envisage, 2017c and 2017d) completed in August and September 2017 using additional technological 'mitigation' measures, utilised a 70% conversion of NOx to NO_2 for long-term assessments.

Table 6.9 presents the modelled data taking into account the additional technologies, using IED limits emissions data and a 70% conversion of NOx to NO_2.

Nutrient Nitrogen (N)	**Enviroparks Only**	**In-Combination**
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.0413	0.1295
Current Minimum Background (kg N/ha/yr)	23.8	23.8
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.8413	23.9295
Lower Critical Load:		
Lower end of Critical Load range (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.41%	**1.29%**
Long-term PC < 1 % of lower Critical Load?	Yes	**No**
Long-term PEC as % of lower Critical Load	**238.41%**	**239.29%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher end of Critical Load range (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.28%	0.86%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	158.94%	159.53%
Long-term PEC < 70 % of higher Critical Load?	No	No

Table 6.9: 2017 Modelled Nutrient Nitrogen Deposition Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC and 70% Conversion of NOx to NO_2

Tables 6.6 to 6.9 clearly show that the background concentrations of nutrient nitrogen within Blaen Cynon SAC (21.98 kg N/ha/yr during the original assessments and updated to 23.8 kg N/ha/yr in the August 2017 modelling work) are already significantly above both the lower critical load (10 kg N/ha/yr) and the higher critical load (15 kg N/ha/yr) for acid grassland (the most sensitive of the habitat-types within the SAC to nutrient nitrogen deposition). Acid grassland has been chosen for use in this assessment as it has the lowest critical load identified by APIS of all of the habitat types within the SAC. APIS identifies that the other sensitive habitat types within the SAC include calcareous grassland and fen, marsh and swamp have a critical load range of 15-25 kg N/ha/yr. It is therefore clear that the background nutrient nitrogen levels are exceeded for the lower end of the critical load range for all of the habitats within the SAC Units 1, 2, 3 and 4 (those closest to the Enviroparks development), although the higher critical load for these habitats is not exceeded.

Whilst the lower and higher critical loads for nutrient nitrogen within the SAC acid grassland are already exceeded due to the background levels, further consideration has been given to the potential additional contributions of the proposed development to the levels of nutrient nitrogen likely to be experienced at Blaen Cynon SAC, both on its own and in-combination with other projects.

It is clear from the worst case scenario data presented in Table 6.6, that when the emissions are considered to be at the IED emission limits, the scheme's contribution to nitrogen nutrient will be 17.5% (alone) and 23.5% (in-combination) of the lower critical load for nutrient nitrogen, or 11.7% (alone) and 15.7% (in-combination) of the higher critical load. Table 6.8 is considered to represent the long-term realistic emissions data and this shows that the process contribution will represent 13.6% of the lower critical load and 9.1% of the higher critical load in isolation, and 19.6% of the lower critical load and 13.1% of the higher critical load when considered in-combination with the projects set out in Chapter 4. As such, these levels cannot be screened out as being 'insignificant' and further modelling is required.

Table 6.9 presents the results of the September 2017 modelling which has taken into account additional technologies which can be provided as part of the scheme's design as 'mitigation' measures to reduce the nitrogen deposition from the scheme. This data shows that with these additional technologies employed, other emissions at their IED limits, and using a 70% conversion of NOx to NO_2, would result in a process contribution of 0.41% of the lower critical load and 0.28% of the higher critical load, when considered 'alone'. When the scheme is considered 'in-combination' with other projects and plans, the nitrogen deposition would be 1.29% of the lower critical load and 0.86% of the higher critical load.

It should be noted that the IAQM (2016) statement identifies that the 1% screening criteria is 'not intended to be applied to multiple sources in-combination', although no screening criteria for in-combination schemes are provided by IAQM (2016). Therefore, based on the data presented in Table 6.9, it is possible to conclude that, using the IAQM (2016) screening criteria, the effects on the scheme in relation to nitrogen deposition can be considered 'insignificant' and screened out. However, the judgement in the recent *Wealden* case suggests that 'in-combination' effects should also be considered as part of any screening assessment. The *Wealden* case does not specifically set out what these 'in-combination' screening levels should be, and it is understood that CIEEM and IAQM are currently working on producing additional guidance, although this is not yet available.

As the 'in-combination' effect of the proposal would result in nitrogen deposition which is 1.29% of the lower critical load, consideration is given to the additional screening criteria associated with the PEC. Table 6.9 (considered to provide the worst-case scenario data taking into account application of additional technologies), shows that the PEC is 239.29% of the lower long-term critical when the scheme is considered in-combination with the other projects outlined in Chapter 4. With respect to the higher critical load, the worst-case scenario data taking into account application of additional technologies is 159.53% 'in-combination'. As outlined above, the screening criteria require these levels to be less than 70% to conclude that they are 'insignificant'.

In light of the recent *Wealden* case, a recent paper in The Habitats Regulations Assessment Journal (Issue 8: June 2017) by Chapman (2017) entitled 'The 1% threshold – where did it come from, and can it be justified?' concludes that:

> *"The Wealden decision will prompt some much needed changes in thinking but I firmly believe that a sensible approach will emerge. Bernie Fleming"s article on page 29 refers to guidance currently being drafted by CIEEM and IAQM in this regard and Natural England are also working on associated guidance for their staff to follow. In my professional opinion I suspect that a sensible way forward will need to:*
> *A) Consider the credible evidence for a real risk to site integrity from a given air pollutant and identify the impact mechanism of most concern*
> *B) Recognise the main sources of pollution for the site concerned, without all contributions (however small) becoming guilty by association, and*
> *C) Explore options for strategic approaches to mitigation for air pollution impacts."*

Based on the air quality modelling results obtained in 2017, further detailed consideration of the potential ecological effects of nutrient nitrogen on the habitats within Blaen Cynon was required to assess whether the 'in-combination' effects posed a significant risk to the integrity of the SAC. However, subject to the relocation and raising in height of the emissions stack, a scenario which has been used to inform the 2020 modelled data, the levels of nutrient nitrogen can be screened as 'insignificant', and this further consideration is not required.

2020 Assessment
Table 6.10 presents the 2020 modelled data for nutrient nitrogen deposition at the closest point of Blaen Cynon SAC to the Enviroparks development, which takes into account the raised height of the emissions stack. As Nitric Oxide does not deposit to any significant extent, the deposition of total NOx has been reduced by 30 % to represent deposition from NO_2 only. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.005553068	0.0780
Current Maximum Background (kg N/ha/yr)	21.1	21.1
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	21.10555307	21.1780
Lower End of the Critical Load Range (kg N/ha/yr)	10	10
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.056%	0.78%
Is the Long-Term Percentage Less Than 1 %?	Yes	Yes

Table 6.10: 2020 Modelled Nutrient Nitrogen Deposition at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.10 shows that the background concentration of nutrient nitrogen within Blaen Cynon SAC based on the 2020 modelling work (21.1 kg N/ha/yr) is significantly above the lower critical load (10 kg N/ha/yr) for acid grassland (the most sensitive of the habitat-types within the SAC to nutrient nitrogen deposition). This is broadly consistent with the September 2017 assessment, when the background concentration of nutrient nitrogen within Blaen Cynon SAC was 23.8 kg N/ha/yr.

Whilst the lower critical load for nutrient nitrogen within the SAC acid grassland is already exceeded due to the background levels, further consideration has been given to the potential additional contributions of the proposed development to the levels of nutrient nitrogen likely to be experienced at Blaen Cynon SAC. Table 6.10 shows that the development would result in a long-term process contribution of 0.056% of the lower critical load when considered ‘alone’, and a long-term process contribution of 0.78% of the lower critical load when considered in-combination with other projects and plans. These process contributions can be screened as ‘insignificant’ (less than 1%).

The predicted nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of nutrient nitrogen deposition arising from the Enviroparks development.

6.5.2.2 Acid Deposition

2017 Assessment

Table 6.11 provides a summary of the modelled deposition rates at the IED limits for acid deposition at Blaen Cynon SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4.

The lower critical load has been determined using data from APIS for Blaen Cynon SAC. The lower critical load used for acid deposition (1.018 keq) is comprised of the lowest critical load provided for N plus the lowest critical load provided for S. The higher critical load (1.77 keq) is calculated as the highest critical load provided for N plus the highest critical load provided for S.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.10	2.10
Process Contribution (PC) Acid (keq/ha/yr)	0.3906	0.4402
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.4906	2.5402
Lower Critical Load:		
Lower critical load (keq)	1.018	1.018
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**38.4%**	**43.2%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**244.6%**	**249.5%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher critical load (keq)	4.05	4.05
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	9.6%	10.9%
Long-term PC < 1 % of higher Critical Load?	No	No
Long-term PEC as % of higher Critical Load	61.5%	62.7%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 6.11: 2017 Modelled Acid Deposition Using IED Limits Emissions Data at Blaen Cynon SAC

Table 6.12 presents acid deposition data taking into account the approach adopted by Laxen and Marner (2005).

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.10	2.10
Process Contribution (PC) Acid (keq/ha/yr)	0.3676	0.4172
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.4676	2.5172
Lower Critical Load:		
Lower critical load (keq)	1.018	1.018
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**36.1%**	**41.0%**
Long-term PC < 1 % of lower critical Load?	**No**	**-**
Long-term PEC as % of lower Critical Load	**242%**	**247%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher critical load (keq)	4.05	4.05
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	9.1%	10.3%
Long-term PC < 1 % of higher Critical Load?	No	-
Long-term PEC as % of higher Critical Load	60.9%	62.2%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 6.12: 2017 Modelled Acid Deposition Using IED Limits Emissions Data at Blaen Cynon SAC and Laxen and Marner (2005) Assessment Methods

Table 6.13 presents the modelled acid deposition data using long-term realistic emissions data and applying the Laxen and Marner (2005) assessment methods.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.10	2.10
Process Contribution (PC) Acid (keq/ha/yr)	0.2186	0.2703
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.3186	2.3703
Lower Critical Load:		
Lower critical load (keq)	1.018	1.018
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**21.5%**	**26.6%**
Long-term PC < 1 % of lower critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**227.8%**	**232.8%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher critical load (keq)	4.05	4.05
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	5.4%	6.7%
Long-term PC < 1 % of higher Critical Load?	No	No
Long-term PEC as % of higher Critical Load	57.2%	58.5%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 6.13: 2017 Modelled Acid Deposition Using Long-Term Realistic Emissions Data at Blaen Cynon SAC and Laxen and Marner (2005) Assessment Methods

Based on the additional modelling work competed in September 2017, Table 6.14 presents the modelled acid deposition using IED limits, and a 70% conversion of NOx to NO_2, taking into account the additional technologies which could be incorporated into the scheme.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.19	2.19
Process Contribution (PC) Acid (keq/ha/yr)	0.0178	0.0284
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.2078	2.2184
Lower Critical Load:		
Lower critical load (keq)	1.018	1.018
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**1.74%**	**2.79%**
Long-term PC < 1 % of lower critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**216.87%**	**217.92%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher critical load (keq)	4.05	4.05
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.44%	0.70%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	54.51%	54.78%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 6.14: 2017 Modelled Acid Deposition Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC and 70% Conversion of NOx to NO_2

Tables 6.11 to 6.14 show that the background levels (2.10 keq/ha/yr in the original assessments and updated to 2.19 keq/ha/yr using data from APIS which was accessed in August 2017) already significantly exceed the lower critical load for the habitats within Blaen Cynon. With the process contributions in place, both alone and in-combination with other projects and plans, the lower critical load for the SAC will therefore be exceeded.

With respect to the higher critical load for acid deposition, Tables 6.11 to 6.14 show that the higher critical load will not be exceeded, either alone or in-combination with other projects, based on the worst case acid deposition model (Table 6.11) or based on model using the additional technologies and a 70% conversion of NOx to NO_2 (Table 6.14).

Table 6.11 shows that using the IED emissions limits and without any additional technologies applied to mitigate the effects, Blaen Cynon SAC will experience an increased acid deposition from the process contribution of 38.4% of the lower critical load, when considered in isolation from other projects. The predicted environmental contribution as a percentage of the lower critical loads exceeds the 70% screening threshold in Tables 6.11, 6.12 and 6.13, both in isolation, and in-combination with other projects outlined in Chapter 4.

When the September 2017 model output takes into account the additional technologies proposed and using a 70% conversion of NOx to NO_2, the process contribution would be at 1.74% of the lower critical load, but would not exceed the higher critical load.

However, as set out in Section 6.4.2, consideration is also given in this assessment to the in-combination effects of the project and plans set out in Chapter 4. Using the data presented in Table 6.14, it is apparent that the in-combination effects could not be screened out as insignificant (if a screening criteria of 2.79% is applied) as the contribution would be 4.5% of the lower critical load, and the long-term predicted environmental contribution would be above 70% of the lower critical load.

Based on the air quality modelling results obtained in 2017, the potential effects of acid deposition on Blaen Cynon SAC could not be considered insignificant and further consideration of the potential effects on the integrity of the SAC was required. This information is presented below.

Kros et al (2016) state that abiotic site factors are affected by changes in atmospheric deposition of sulphur (S) and nitrogen (N) compounds, groundwater level changes, changes in management and land use and internal processes such as accumulation of organic matter and vegetation succession. These changes can affect the structure and functioning of semi-natural ecosystems such as grassland and thus the biodiversity. Kros et al (2016) identify two types of effects from enhanced atmospheric deposition of N and S:

(i) soil acidification, leading to enhanced leaching of base cations and increased dissolution of potentially toxic aluminium; and,

(ii) eutrophication due to N enrichment causing an enhanced growth of nitrophilious species outcompeting other species.

Kros et al (2016) suggest that increasing N availability and or nitrate (NO_3) concentration often causes an overall decline in plant species diversity even at long-term low N inputs. However, in some cases, especially under very nutrient-poor conditions, an increase in plant species diversity has been observed due to the expansion of nitrophilious species.

APIS identifies that the following exceedance effects from acid deposition on Blaen Cynon SAC could be experienced: leaching will cause a decrease in soil base saturation, increasing the availability of Al3+ ions, mobilisation of Al3+ may cause toxicity to plants and mycorrhiza and may have direct effect on lower plants (bryophytes and lichens).

Although the grasslands of Blaen Cynon SAC are not the designated feature of the SAC, their protection is important to ensure the survival of the marsh fritillary butterfly at the SAC, although it should be recognised that this sHRA report is focussed on the integrity of the qualifying species, marsh fritillary, and as such it is of key importance to ensure that the habitats maintain devil's-bit scabious *Succisa pratensis* the larval foodplant for this species.

Although the broad habitat of the SAC is listed as acid grassland, the site is in reality, a mixture of calcareous, neutral and acid grasslands, and thus there is the potential for some buffering capacity at the site (Environment Agency, no date). This is particularly important when considering acidification as in areas of calcareous grassland, acid deposition is unlikely to have any significant effect due to the buffering capacity of the land (Environment Agency, no date).

The Core Management Plan (CCW, 2008a) identified that Management Units 2 and 3, which are in closest proximity to the Enviroparks development, include acid grassland, marshy grassland and species-rich neutral grassland habitats.

The 2009 sHRA report (RT-MME-104641) provided the following data with respect to acid deposition at Blaen Cynon SAC:

- The dry deposition rate for acid deposition as a percentage of the critical load for Blaen Cynon SAC was 14.83%; and,
- The maximum dry deposition rate for acid deposition as a percentage of the critical load for Blaen Cynon SAC was 38.34%.

It is therefore clear that the acid deposition levels associated with the Enviroparks scheme, based on the 2017 assessment, are within a similar range as those modelled for the 2009 sHRA Report (RT-MME-104641). As the 2017 modelling is based on a location in close proximity to the Enviroparks development, this also represents a 'worst-case' figure which is close to the 'maximum' figure outlined above from the 2009 assessment.

Table 6.14 shows that the levels of acid deposition at the closest point of Blaen Cynon SAC to the Enviroparks development could experience acid deposition levels which cannot be screened as insignificant, either alone or in-combination with other projects and plans. Research has shown that acid deposition could have an adverse impact on acid or neutral grassland / fen habitats within the SAC, which in turn could affect the larval foodplant of the marsh fritillary butterfly, although the extent and outcomes of the changes cannot be predicted from the data available.

Consideration should be given to how the project can provide a strategic improvement to the marsh fritillary habitat provision within the area, if evidence proves that the elevated background levels are having an adverse effect on the habitats within Blaen Cynon SAC. A Biodiversity Scheme was agreed with Countryside Council for Wales and the two local planning authorities with respect to the 2008 application in relation to providing additional marsh fritillary habitat within a 5km radius of the proposed Enviroparks site as part of the sHRA works completed in 2009.

A series of measures to mitigate this effect were committed to as part of the previous application. Further details are provided in Chapter 9.

2020 Assessment
Table 6.15 presents the 2020 modelled data for acid deposition at the closest point of Blaen Cynon SAC to the Enviroparks development, taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Acid Deposition	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition of Acid (keq/ha/yr)	0.004697241	0.0120
Current Maximum Background (keq/ha/yr)	1.9	1.9
Predicted Environmental Concentration (PEC) (keq/ha/yr)	1.904697241	1.9120
Lower End of the Critical Load Range (keq/ha/yr)	1.161	1.161
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.40%	1.03%
Is the Long-Term Percentage Less Than 1 %?	Yes	No

Table 6.15: 2020 Modelled Acid Deposition at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.15 shows that the background level (1.9 keq/ha/yr) exceeds the lower critical load for the habitats within Blaen Cynon SAC (1.161 keq/ha/yr), although is slightly lower than the background level applied in the September 2017 assessment (2.19 keq/ha/yr).

Whilst the lower critical load for acid deposition within the SAC is already exceeded due to the background level, further consideration has been given to the potential additional contributions of the proposed development to the levels of acid deposition likely to be experienced at Blaen Cynon SAC. Table 6.15 shows that the development would result in a process contribution of 0.40% of the lower critical load when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%). The in-combination predicted environmental concentration for acid deposition marginally exceeds the 1% insignificance threshold, equating to approximately 1.03 %.

The predicted acid deposition levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Nevertheless, although the acid deposition is screened as 'insignificant' at the closest point of Blaen Cynon SAC to the Enviroparks development, Owen, (2020, *Pers. Comm.*) has confirmed that modelling across a wider area has demonstrated that the long-term process contribution is greater than 1% of the lower critical load at other points across the SAC, both when the development is considered 'alone' and 'in-combination' with other plans and projects. The highest contribution of acid deposition within the wider area would equate to approximately 2.9 % of the critical load, although it should be noted that this level of acid deposition does not occur within the Blaen Cynon SAC and is approximately 235 m away from the nearest point of this receptor. As such, the contributions of acid across the SAC in its entirety will be less than this, but cannot be screened as insignificant.

Based on the updated air quality modelling results obtained in 2020, the potential effects of acid deposition on Blaen Cynon SAC cannot be screened as insignificant. The further consideration of the potential effects on the integrity of the SAC outlined in 2017 (detailed above) remains relevant. The series of measures to mitigate the potential effects of acid deposition on Blaen Cynon SAC were committed to as part of the previous application. Further details are provided in Chapter 9.

6.5.2.3 Ammonia
2017 Assessment
Table 6.16 provides details of the modelled ammonia levels using IED emissions limits data at Blaen Cynon SAC as a result of the Enviroparks development proposals. In-combination data is not provided as there are not any additional local impacts from the other schemes outlined in Chapter 4.

For Blaen Cynon SAC, a critical level of 3 was used as this is the critical level identified by APIS for fen, marsh and swamp, acid grassland and calcareous grassland.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg NH3/m^3 annual mean)	0.64
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.2134
Predicted Environmental Concentration (PEC) (µg NH3/m^3 annual mean)	0.8534
Long-term Environmental Quality Standard Lower Critical Level (µg NH3/m^3 annual mean)	3
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	7.1%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC % of Critical Level	28.45%
Long-term PEC < 70 % of critical level?	Yes

Table 6.16: 2017 Modelled Ammonia Using IED Emissions Limits Data at Blaen Cynon SAC

Table 6.16 shows that the critical level for ammonia has been set by APIS for Blaen Cynon SAC at a level of 3 µg NH3/m^3 annual mean. The current background concentrations of ammonia at the SAC are 0.64 µg NH3/m^3 annual mean, and the process contribution would be 0.2134 µg NH3/m^3 annual mean. The Predicted Environmental Concentration (PEC) would therefore be 0.8534 µg NH3/m^3 annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the habitats may occur, will not be exceeded and as such the scheme can be concluded to have no significant adverse effect from ammonia pollution.

Table 6.16 shows that whilst the process contribution cannot be considered insignificant as it is above 1% of the lower critical level, the PEC values are less than 70% of the critical level.

Table 6.17 presents the data based on the September 2017 Air Dispersion Modelling Assessment (Envisage, 2017d). Table 6.17 shows that the predicted process contribution reduces with the additional technologies.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg NH3/m^3 annual mean)	0.61
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.00087
Predicted Environmental Concentration (PEC) (µg NH3/m^3 annual mean)	0.61087
Long-term Environmental Quality Standard Lower Critical Level (µg NH3/m^3 annual mean)	3
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.03%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC % of Critical Level	20.36%
Long-term PEC < 70 % of critical level?	Yes

Table 6.17: 2017 Modelled Ammonia Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

It can therefore be concluded that there would be no adverse effect on Blaen Cynon SAC as a result of ammonia pollution from the proposed development. No additional in-combination effects are predicted as the other projects outlined in Chapter 4 will not result in an additional local impacts.

2020 Assessment

Table 6.18 presents the 2020 modelled data for ammonia, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Ammonia (NH_3)	Enviroparks Only
Annual Average Process Contribution (PC) NH3 (µg/m3)	0.000430531
Current Background Concentration (µg NH3/m3 annual mean)	0.72
Predicted Environmental Concentration (PEC) (µg NH3/m3 annual mean)	0.720430531
Critical Level (µg NH3/m3 annual mean)	3
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.014%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 6.18: 2020 Modelled Ammonia at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.18 shows that the critical level for ammonia is 3 µg NH3/m³ annual mean. The current background concentrations of ammonia at the SAC are 0.72 µg NH3/m³ annual mean, and the process contribution would be <0.0005 µg NH3/m³ annual mean. The PEC would be 0.720430531 µg NH3/m³ annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the habitats may occur, will not be exceeded. The development would result in a process contribution of 0.014% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted ammonia levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of ammonia arising from the Enviroparks development.

6.5.2.4 Oxides of Nitrogen

2017 Assessment

Table 6.19 provides details of the modelled annual mean oxides of nitrogen levels at Blaen Cynon SAC using IED emissions limits data as a result of the Enviroparks development proposals and in-combination with the other schemes outlined in Chapter 4. Table 6.20 presents the short-term 24-hour mean data based on the same parameters.

The critical levels for NOx are detailed by APIS for Blaen Cynon SAC as:

- Annual mean - 30 µg/m³ over a calendar year; and,
- 24 hour mean - 75 µg/m³.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m³)	9.0186	9.0186
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m³)	4.4697	8.6343
Predicted Environmental Concentration (PEC) (ug/m³ annual mean)	13.4883	17.653
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m³ annual mean)	30	30
Do background levels exceed the long-term Critical Level?	No	No
Do PEC levels exceed the long-term Critical Level?	No	No
Long-term PC as % of Critical Level	14.9%	28.8%
Long-term PC < 1 % of Critical Level?	No	No
Long-term PEC as % of EQS	44.96%	58.84%
Long-term PEC < 70 % of Critical Level?	Yes	Yes

Table 6.19: 2017 Modelled Annual Mean Oxides of Nitrogen Using IED Emissions Limits Data at Blaen Cynon SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m³)	9.0186	9.0186
24-Hour Average Oxides of Nitrogen Process Contribution (PC) (ug/m³)	4.2691	8.1642
Predicted Short-term Environmental Concentration (ug/m³)	13.2877	17.1828
Short-term Environmental Quality Standard (EQS) Critical Level (µg NOx/m³ 24-hour mean)	75	75
Do background levels exceed the short-term Critical Level?	No	No
Do Short-term PEC levels exceed the short-term Critical Level?	No	No
Short-term PC as % of Critical Level	5.69%	10.89%
Short-term PC < 10 %?	Yes	No

Table 6.20: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using IED Emissions Limits Data at Blaen Cynon SAC

As Table 6.19 illustrates, with the Enviroparks development in place the long-term PEC NOx levels will be 13.4883 µg NOx/m³ annual mean. When considering the scheme in-combination with other projects, the long-term PEC will be 17.653 µg NOx/m³ annual mean. It is therefore evident that with the development in place, and taking into account the other in-combination projects, the critical levels for NOx at Blaen Cynon SAC will not be exceeded.

As the critical level will not be exceeded, there is no need to consider the process contributions further as there will be no air pollution from the development (alone or in-combination) which will result in the critical level being exceeded. However, in order to ensure that all data is presented, Table 6.19 shows that the Enviroparks development on its own will result in a long-term process contribution of 14.9% using IED limits data. The long-term Predicted Environmental Concentration (PEC) contribution percentage increase will be 44.96%, based on the annual critical level of 30 µg NOx/m³ annual mean. In-combination with other schemes this percentage contribution will be 58.84%. Both of these are less than 70% of the PEC as a percentage of the critical level.

As the annual mean critical level for NOx will not be exceeded, either alone or in-combination with the other projects set out in Chapter 4, then it can be concluded that there would be no adverse effects on the habitats within Blaen Cynon SAC from long-term NOx pollution as a result of the proposed development.

Table 6.20 also shows that the short-term process contribution will be below the critical level of 75 µg NOx/m³ 24-hour mean and as such any impacts can be screened as insignificant. For the scheme in isolation, the short-term process contribution is also below 10% of the short-term critical level. When considering the in-combination effects, the process contribution is only very slightly above the 10% screening level (at 10.89%) set out in Section 6.4.3, however as outlined above, the critical level is still not exceeded.

Based on the September 2017 Air Dispersion Modelling Assessment (Envisage, 2017d) which includes the additional technologies, Tables 6.21 and 6.22 present the annual mean and 24-hour mean NOx data when the additional technologies are implemented.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m³)	7.81	7.81
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m³)	0.3648	1.2267
Predicted Environmental Concentration (PEC) (ug/m³ annual mean)	8.1748	9.0367
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m³ annual mean)	30	30
Do background levels exceed the long-term Critical Level?	No	No
Do PEC levels exceed the long-term Critical Level?	No	No
Long-term PC as % of Critical Level	1.22%	4.09%
Long-term PC < 1 % of Critical Level?	No	No
Long-term PEC as % of EQS	27.25%	30.12%
Long-term PEC < 70 % of Critical Level?	Yes	Yes

Table 6.21: 2017 Modelled Annual Mean Oxides of Nitrogen Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m³)	10.38	10.38
24-Hour Average Oxides of Nitrogen Process Contribution (PC) (ug/m³)	4.0875	11.3090
Predicted Short-term Environmental Concentration (ug/m³)	14.4675	21.6890
Short-term Environmental Quality Standard (EQS) Critical Level (µg NOx/m³ 24-hour mean)	75	75
Do background levels exceed the short-term Critical Level?	No	No
Do Short-term PEC levels exceed the short-term Critical Level?	No	No
Short-term PC as % of Critical Level	5.45%	15.08%
Short-term PC < 10 %?	Yes	No

Table 6.22: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

Tables 6.21 and 6.22 show that there have been some changes in the calculation of the background data, however, the predicted process contributions reduce with the application of the additional technologies based on the September 2017 modelling work. The critical levels will not be exceeded and as such any potential effects are screened as insignificant.

It can therefore be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of long-term or short-term oxides of nitrogen as a result of the Enviroparks development, either alone or in-combination with the other projects identified in Chapter 4.

2020 Assessment
Tables 6.23 and 6.24 present the 2020 modelled data for the annual mean and 24-hour mean NOx, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Oxides of Nitrogen (NOx) Concentration	**Enviroparks Only**
Annual Average Process Contribution (PC) NOx (µg/m3)	0.0344331
Current Background Concentration (µg NOx/m3 annual mean)	9.56
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	9.5944331
Critical Level (µg NOx/m3 annual mean)	30
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.115%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 6.23: 2020 Modelled Annual Mean Oxides of Nitrogen Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

24-Hour Average Oxides of Nitrogen (NOx) Concentration	**Enviroparks Only**
24-Hour Average Process Contribution (PC) NOx (µg/m3)	0.821433
Current Background Concentration (µg NOx/m3 annual mean)	19.12
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	19.941433
Critical Level (µg NOx/m3 annual mean)	75
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Short-Term PC as Percentage of the Critical Level (%)	1.10%
Is the Short-Term Percentage Less Than 10 %?	Yes

Table 6.24: 2020 Modelled 24-Hour Mean Oxides of Nitrogen Concertation at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.23 shows that the critical level for annual average oxides of nitrogen is 30 µg NO_x/m^3 annual mean. The current long-term background concentrations of oxides of nitrogen at the SAC are 9.56 µg NO_x/m^3 annual mean, and the long-term process contribution would be <0.05 µg m^3. The PEC would be 9.5944331 µg NO_x/m^3 annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the habitats may occur, will not be exceeded. The development would result in a long-term process contribution of 0.115% of the critical level when considered 'alone'. The long-term process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 6.24 also shows that the short-term process contribution will be below the critical level of 75 µg NOx/m^3 annual mean. For the scheme in isolation, the short-term process contribution is also below 10% of the short-term critical level, at 1.10%. This is screened as 'insignificant' and as such, no assessment of in-combination effects is required.

The predicted oxides of nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It is concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of long-term or short-term oxides of nitrogen arising from the Enviroparks development.

6.5.2.5 Sulphur Dioxide
2017 Assessment
Table 6.25 provides details of the modelled sulphur dioxide levels using IED emissions limits data at Blaen Cynon SAC as a result of the Enviroparks development proposals, and in-combination with the other schemes outlined in Chapter 4.

Whilst APIS does not show a critical level for sulphur dioxide (SO_2) the EAW (no date) information (see Table 6.5) states that the critical level should be 20 µg SO_2/m^3 annual mean.

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	2.79	2.79
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	1.0881	1.1455
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	3.878	3.936
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	20	20
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	5.44%	5.7%
Long-term PC < 1 %?	No	-
Long-term PEC as % of Critical Level	19.39%	19.68%
Long-term PEC < 70 %?	Yes	Yes

Table 6.25: 2017 Modelled Sulphur Dioxide Using IED Emissions Limits Data at Blaen Cynon SAC

As detailed in Table 6.25, the long-term PEC will be 3.878 µg SO_2/m^3 annual mean with the Enviroparks scheme in place, and 3.936 µg SO_2/m^3 when the scheme is considered in-combination with the other projects outlined in Chapter 4. These values clearly show that even with all of the proposed developments in place (ie the in-combination data), the levels of SO_2 will still be significantly lower than the critical level of 20 µg SO_2/m^3 annual mean, the level at which concentrations of SO_2 could have a direct adverse effect on habitats within Blaen Cynon SAC. As such, the proposed development is not considered to have an adverse effect on Blaen Cynon SAC as a result of sulphur dioxide pollution.
Table 6.25 also shows whilst the long-term process contribution as a percentage of the critical level is above 1%, the long-term predicted environmental concentrations will be less than 70% of the environmental quality standard (critical level) and as such the effects are considered insignificant using this additional screening criteria.

Based on the September 2017 Air Dispersion Modelling Assessment (Envisage, 2017d) which includes the additional technologies, Table 6.26 presents the modelled sulphur dioxide data when the additional technologies are implemented. The background concentrations have also been revised (see Envisage, 2017d for explanation).

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	0.46	0.46
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	0.1119	0.1287
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	0.5719	0.5887
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	20	20
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	0.56%	0.64%
Long-term PC < 1 %?	Yes	Yes
Long-term PEC as % of Critical Level	2.86%	2.94%
Long-term PEC < 70 %?	Yes	Yes

Table 6.26: 2017 Modelled Sulphur Dioxide Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

Table 6.26 shows that based on the revised background concentrations, and using modelled data taking into account the additional technologies, the predicted environmental concentrations would be below the critical level.

Thus it can be concluded that the proposed development, either alone or in-combination with other projects, will not result in any adverse effects on Blaen Cynon SAC via this pathway.

2020 Assessment
Table 6.27 presents the 2020 modelled data for sulphur dioxide, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Sulphur Dioxide (SO_2) Concentration	Enviroparks Only
Annual Average Process Contribution (PC) SO2 (µg/m3)	0.00861999
Current Background Concentration (µg SO2/m3 annual mean)	1.76
Predicted Environmental Concentration (PEC) (µg SO2/m3 annual mean)	1.76861999
Critical Level (µg SO2/m3 annual mean)	None listed - assessed against 20
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.043%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 6.27: 2020 Modelled Sulphur Dioxide Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.27 shows that the PEC will be 1.76861999 µg SO_2/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the critical level of 20 µg SO_2/m^3 annual mean, the level at which concentrations of SO_2 could have a direct adverse effect on habitats within Blaen Cynon SAC. Table 6.27 also shows that the development would result in a long-term process contribution of 0.043% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted sulphur dioxide levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of sulphur dioxide arising from the Enviroparks development.

6.5.2.6 Metals

2017 Assessment

The GOV.UK guidance on 'Air Emissions Risk Assessment for your Environmental Permit' highlights a requirement to calculate the process contribution for substance deposition and consider the impact they have when absorbed by soil and leaves (known as deposition).

For the Environmental Statement Addendum works (Savills, 2017), deposition of metals was modelled as part of the air quality assessment. The model has provided the outputs shown in Tables 6.28 (cadmium and thallium) and 6.29 (heavy metals), both have been modelled using IED emissions data limits. There are no in-combination affects from the projects outlined in Chapter 4.

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Process Contribution (PC) Cd (ng/m^3)	1.1945
Predicted Environmental Concentration (PEC) (ng Cd/m^3 annual mean)	1.3495
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	23.9%
Long-term PC < 1 % of Critical Level?	No
Long-Term PEC as % of Critical Level	26.99%
Long-term PEC < 70 % of Critical Level?	Yes

Table 6.28: 2017 Modelled Cadmium and Thallium Using IED Emissions Limits Data at Blaen Cynon SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.0111
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.0175
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	4.4%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as % of Critical Level	7.01%
Long-term PEC < 70 % of Critical Level?	Yes

Table 6.29: 2017 Modelled Heavy Metals Using IED Emissions Limits Data at Blaen Cynon SAC

Tables 6.28 and 6.29 show that the critical levels for cadmium and thallium and heavy metals would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4. As such, the scheme will not result in an adverse impact on Blaen Cynon SAC from these pollutants.

Tables 6.28 and 6.29 also illustrate that although the process contribution will be above 1% of the critical level, the long-term predicted environmental concentrations will be less than 70% of the critical level and as such the affects can be screened as insignificant.

Based on the September 2017 Air Dispersion Modelling Assessment (Envisage, 2017d) which includes the additional technologies, Table 6.30 presents the modelled cadmium and thallium data, with Table 6.31 showing the heavy metal data when the additional technologies are implemented. The background concentrations have also been revised (see Envisage, 2017d for explanation).

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Process Contribution (PC) Cd (ng/m^3)	0.0004281
Predicted Environmental Concentration (PEC) (ng Cd/m^3 annual mean)	0.1554281
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.01%
Long-term PC < 1 % of Critical Level?	Yes
Long-Term PEC as % of Critical Level	3.11%
Long-term PEC < 70 % of Critical Level?	Yes

Table 6.30: 2017 Modelled Cadmium and Thallium Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.0000619428
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.006492
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	No
Long-term PC < 1 % of Critical Level?	0.02%
Long-term PEC as % of Critical Level	Yes
Long-term PEC < 70 % of Critical Level?	2.60%

Table 6.31: 2017 Modelled Heavy Metals Using Additional Technologies and IED Emissions Limits Data at Blaen Cynon SAC

Tables 6.30 and 6.31 show that there will be no exceedance of the critical levels and it can therefore be concluded that there would be no adverse effects on Blaen Cynon SAC as a result of pollution from cadmium and thallium, or heavy metals.

2020 Assessment

Table 6.32 presents the 2020 modelled data for cadmium and thallium, taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Cadmium and Thallium Concentration	Enviroparks Only
Annual Average Process Contribution (PC) Cd or Tl (µg/m3)	0.01724
Current Background Concentration (µg Cd or Tl/m3 annual mean)	0.282467
Predicted Environmental Concentration (PEC) (µg Cd or Tl/m3 annual mean)	0.299707
Environmental Assessment Level (EAL) (µg Cd or Tl/m3 annual mean)	5
Do Background Levels Exceed the EAL?	No
Do PEC Levels Exceed the EAL?	No
Long-Term PC as Percentage of the EAL (%)	0.34%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 6.32: 2020 Modelled Cadmium and Thallium Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.32 shows that the PEC will be 0.299707 µg Cd or Tl/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the Environmental Assessment Level (EAL) of 5 µg Cd or Tl/m^3 annual mean, the level at which concentrations of cadmium and thallium could have a direct adverse effect on habitats within Blaen Cynon SAC. Table 6.32 also shows that the development would result in a long-term process contribution of 0.34% of the EAL when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 6.33 presents the 2020 modelled data for heavy metals, assessed against the UK Air Quality Standard for lead, and taking into account the raised height of the emissions stack.

Heavy Metals Concentration Assessed Against the UK Air Quality Standard for Lead	Enviroparks Only
Annual Average Process Contribution (PC) Heavy Metals as Lead (µg/m3)	0.000258131
Current Background Concentration (µg Pb/m3 annual mean)	0.005322549
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m3 annual mean)	0.00558068
Air Quality Standard Objective (AQS) for Lead (µg Pb/m3 annual mean)	0.25
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.10%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 6.33: 2020 Modelled Heavy Metals Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.33 shows that the PEC will be 0.00558068 µg Heavy Metals/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the Air Quality Standard Objective (AQS) for lead of 0.25 µg Pb/m^3 annual mean, the level at which concentrations of heavy metals could have a direct adverse effect on habitats within Blaen Cynon SAC. Table 6.33 also shows that the development would result in a long-term process contribution of 0.10% of the AQS when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted cadmium, thallium and heavy metals levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of pollution from cadmium and thallium, or heavy metals arising from the Enviroparks development.

6.5.2.7 Volatile Organic Compounds (VOC)

2017 Assessment

For the Environmental Statement Addendum works (Savills, 2017), volatile organic compounds (VOCs) as benzene were modelled as part of the air quality assessment, using IED emissions limits data. The model has provided the outputs shown in Table 6.34. There are no in-combination affects from the projects outlined in Chapter 4.

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.207
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.2232
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.4302
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	4.5%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as % of Critical Level	8.60%
Long-term PEC < 70 % of Critical Level?	Yes

Table 6.34: 2017 Modelled Volatile Organic Compounds Using IED Emissions Levels Data at Blaen Cynon SAC

Table 6.34 shows that the critical levels for VOCc as benzene would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4. As such, the scheme will not result in an adverse impact on Blaen Cynon SAC from these pollutants.

Table 6.34 also illustrates that although the process contribution is more than 1% of the critical level, it is also possible to conclude that any effects would be insignificant due to the fact that the predicted environmental concentration is less than 70% of the critical level.

Table 6.35 shows the data for VOCs based on the September 2017 modelling data with the new technologies implemented and the re-calculated background concentrations.

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.207
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.0911
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.2981
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	1.82%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as % of Critical Level	5.96%
Long-term PEC < 70 % of Critical Level?	Yes

Table 6.35: 2017 Modelled Volatile Organic Compounds Using Additional Technologies and IED Emissions Levels Data at Blaen Cynon SAC

Table 6.35 shows that the critical level would not be exceeded based on the September 2017 modelling data and as such, it can be concluded that there would be no adverse effects on Blaen Cynon SAC as a result of deposition from VOCs as benzene.

2020 Assessment

Table 6.36 presents the 2020 modelled data for VOC concentration, assessed against the UK Air Quality Standard for benzene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Volatile Organic Compound Concentration	Enviroparks Only
Annual Average Process Contribution (PC) VOC (µg/m3)	0.00861999
Current Background Concentration (µg C6H6/m3 annual mean)	0.161622
Predicted Environmental Concentration (PEC) (µg C6H6/m3 annual mean)	0.17024199
Air Quality Standard Objective (AQS) for Benzene (µg C6H6/m3 annual mean)	5
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.17%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 6.36: 2020 Modelled Volatile Organic Compounds Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.36 shows that the PEC will be 0.17024199 µg C6H6/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AQS for benzene of 0.25 µg C6H6/m^3 annual mean, the level at which concentrations of VOCs could have a direct adverse effect on habitats within Blaen Cynon SAC. Table 6.36 also shows that the development would result in a long-term process contribution of 0.17% of the AQS when considered ‘alone’. This process contribution is screened as ‘insignificant’ (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted VOC levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of VOCs arising from the Enviroparks development.

6.5.2.8 Polycyclic Aromatic Hydrocarbons (PAH)

2017 Assessment

Table 6.37 shows the modelled data, using IED emissions limits data, for Polycyclic Aromatic Hydrocarbons (PAH). There are no in-combination affects from the projects outlined in Chapter 4.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ng/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ng/m^3)	0.0222
Predicted Environmental Concentration (PEC) (ng PAH/m^3 annual mean)	0.2102
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	2.2%
Long-term PC < 1 % of EQS?	No
Long-term PEC as % of EQS	21.02%
Long-term PEC < 70 % of EQS?	Yes

Table 6.37: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using IED Emissions Levels Data at Blaen Cynon SAC

Table 6.37 shows that the critical levels for PAH would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4. As such, the scheme will not result in an adverse impact on Blaen Cynon SAC from these pollutants.

Table 6.37 also shows that whilst the process contribution is more than 1% of the critical level, it is possible to conclude that any effects would be insignificant due to the fact that the predicted environmental concentration is less than 70% of the environmental quality standard.

Table 6.38 shows the data for PAHs based on the September 2017 modelling data with the new technologies implemented and the re-calculated background concentrations.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ug/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ug/m^3)	0.00191311
Predicted Environmental Concentration (PEC) (µg PAH/m^3 annual mean)	0.1899131
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	0.1913%
Long-term PC < 1 % of EQS?	Yes
Long-term PEC as % of EQS	18.991%
Long-term PEC < 70 % of EQS?	Yes

Table 6.38: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using Additional Technologies and IED Emissions Levels Data at Blaen Cynon SAC

Table 6.38 shows that the critical level would not be exceeded based on the September 2017 modelling data and as such, it can be concluded that there would be no adverse effects on Blaen Cynon SAC as a result of deposition from VOCs as benzene.

2020 Assessment
Table 6.39 presents the 2020 modelled data for PAH concentration, assessed against the Ambient Air Directive Standard for Benzo[a]Pyrene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Polycyclic Aromatic Hydrocarbon (PAH) Concentration	Enviroparks Only
Annual Average Process Contribution (PC) PAH (µg/m3)	0.000861999
Current Background Concentration (µg B[a]P/m3 annual mean)	< 0.1
Predicted Environmental Concentration (PEC) (µg B[a]P/m3 annual mean)	0.100861999
Ambient Air Directive Standard (AAD) (µg B[a]P/m3 annual mean)	1
Do Background Levels Exceed the AAD?	No
Do PEC Levels Exceed the AAD?	No
Long-Term PC as Percentage of the AAD (%)	0.09%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 6.39: 2020 Modelled Polycyclic Aromatic Hydrocarbon Concentration at Blaen Cynon SAC, accounting for Raised Emissions Stack

Table 6.39 shows that the PEC will be 0.100861999 µg B[a]P/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the Ambient Air Directive Standard (AAD) of 1 µg B[a]P/m^3 annual mean, the level at which concentrations of PAHs could have a direct adverse effect on habitats within Blaen Cynon SAC. Table 6.39 also shows that the development would result in a long-term process contribution of 0.09% of the AAD when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted PAH levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of PAHs arising from the Enviroparks development.

6.5.2.9 Ozone
2017 Assessment
The EAW data outlined in Tables 6.4 and 6.5 identify that ozone could also potentially have an adverse effect on the habitats within Blaen Cynon SAC which support marsh fritillary butterfly. The air quality consultants, Envisage (Owen, *Pers. Comm.,* 2017) confirmed that the technology providers have not suggested any releases from ozone.

It is therefore concluded that there would be no adverse effects on Blaen Cynon SAC as a result of ozone releases from the proposed development, either alone or in-combination with other schemes.

2020 Assessment
The conclusion drawn in 2017 remains unchanged. There would be no adverse effects on Blaen Cynon SAC as a result of ozone releases from the proposed development, either alone or in-combination with other schemes.

6.5.2.10 Traffic Considerations
2017 Assessment
Chapter 9 Air Quality of the 2017 Environmental Statement confirms that:

> *"In preparing the ES Addendum, the potential changes in proposed traffic levels and resultant emissions has been considered in chapter 8 and in a supporting Transport Statement.*

With respect to traffic generated during the construction phase of the development, the following information is provided in Chapter 9 Air Quality:

> *"Traffic movements during construction have been estimated based on the identified technology requirements, and likely staffing and labour figures…They result in a significant increase in the numbers proposed by the original scheme, and these may also coincide with other committed development construction periods… the methodology applied by the Design Manual for Roads and Bridges (DMRB,* [2007]*) has been used to assess the likely impact of construction vehicles, whether alone or in combination with other committed developments, during the proposed construction phase (2017 – 2019)."*

The 2017 assessment concludes that:
> *"Similarly to the 2008 assessment, the DMRB screening methodology concludes that the increase in pollutant concentrations for each year from the development construction traffic showed little change in all pollutant concentrations, with increases being consistently less than 1 µg m^{-3}. The largest increase was predicted at the petrol station on the A465 to the east, where the traffic from the construction of the Enviroparks site, the Abergorki Wind Farm and the Hirwaun Power facility in combination could result in an additional contribution to the background levels of Oxides of Nitrogen of 0.1 µg m^{-3} in 2018. This obviously assumes that each of the developments is indeed constructed at their proposed timescales, but still results in the impact of the proposed development traffic on the local air quality being considered to be insignificant."*

With respect to the potential impacts of traffic during the operational phase of the development, Chapter 9 Air Quality states that:

> *In summary, levels of operational traffic reduce substantially, largely due to the fact that the revised scheme will not accept waste from refuse collection vehicles, the local fleet of which would otherwise visit the site several times each day. Site staffing numbers also reduce… As such…the operational vehicle movements have reduced* [compared with the 2008 assessment] *and have not therefore been assessed further by the Transport Statement,"*

The 2009 sHRA Report (RT-MME-104641) concluded the following with respect to the additional impacts of traffic during operation of the site, compared with the emissions from the proposed industrial process:

> *"the difference in the percentage contribution to the critical loads of industrial emissions and industrial and transport emissions and shows that the contribution of predicted traffic emissions to the process contribution is negligible."*

As the operational traffic levels are predicted to decrease under the new scheme proposals, it can be concluded that the contribution of operational traffic to the air quality assessment provided above would also be considered negligible.

No additional effects on Blaen Cynon SAC as a result of air pollution are therefore predicted from traffic generated by the development, during construction or operation, either alone or in-combination with other projects and plans.

2020 Assessment

The conclusions drawn in 2017 remain unchanged. There would be no adverse effects on Blaen Cynon SAC as a result of air pollution from traffic generated by the development, during construction or operation, either alone or in-combination with other projects and plans.

7. COEDYDD NEDD A MELLTE SAC

7.1 Qualifying Criteria

The following information is taken from the Joint Nature Conservation Committee (JNCC) site description and accompanying Natura 2000 data sheet, both of which are available at:
https://sac.jncc.gov.uk/site/UK0030141

Information has also been obtained from the Countryside Council for Wales (CCW, 2008b) Core Management Plan for the site.

Country:	Wales
Unitary Authority:	East Wales
Centroid:	SN919093
Latitude:	51.77222222
Longitude:	-3.567222222
Site Code:	UK0030141
Status:	Designated Special Area of Conservation (SAC)
Area (ha):	376.32

Coedydd Nedd a Mellte SAC is underpinned by Dyffrynoedd Nedd a Mellte, Moel Penderyn SSSI and Blaen Nedd SSSI. The area covered by these SSSI is greater than that of the SAC. These SSSI are notified for a wide range of biological and geological features, but it is the bulk of the oak and ash woodland which comprises the SAC interests.

The CCW Drawing in Appendix 2 shows the SAC and SSSI boundaries of the nature conservation site.

7.1.1 SAC Qualifying Criteria

7.1.1.1 Qualifying Habitats

The site contains the following Annex I habitats (Habitats Directive: 92/43/EEC) that are listed as primary reasons for selection:

<u>91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles</u>

Coedydd Nedd a Mellte is a very large and diverse example of old sessile oak wood in south Wales. The woods extend along a series of deeply incised valleys and ravines, and contain complex mosaics of sessile oak *Quercus petraea* woodland, ash *Fraxinus excelsior* woodland (some of which is referable to Annex I type 9180 *Tilio-Acerion* forests of slopes, screes and ravines), and transitions to lowland woodland types. The whole site is biologically rich, with many woodland plant communities represented and rich bryophyte and lichen assemblages. Notable higher plant species include wood fescue *Festuca altissima* and the ferns *Dryopteris aemula*, *Hymenophyllum tunbrigense* and *Asplenium viride*.
The site also contains the following Annex 1 habitats that are present as a qualifying feature, but are not a primary reason for selection:

<u>9180 Tilio-Acerion forests of slopes, screes and ravines</u>

Semi-natural broad-leaved woodland corresponding to the following NVC types:

- W8 *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland (sub-communities d-g)
- W9 *Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis* woodland

7.1.1.2 Qualifying Species

The site does not support any Annex II species that are listed as primary reasons for selection.

7.2 Conservation Objectives

The CCW (2008b) Core Management Plan for Coedydd Nedd a Mellte SAC includes the conservation objectives for designated features. Each conservation objective consists of the following two elements: vision for the feature; and, performance indicators. During a meeting on 9th May 2017 with Natural Resources Wales, it was confirmed that whilst an updated management plan for Coedydd Nedd a Mellte SAC is currently being produced, this has not yet been published and therefore the 2008 plan is considered to represent the most up to date management plan for the site. At the time of writing this RevC version of the report, an updated management plan did not appear to have been produced.

7.2.1 SAC Feature: Old sessile oak woods with Ilex and Blechnum in the British Isles

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Sessile oak woodland will occupy at least 175 ha of the total site area.
- The canopy should be predominantly oak and locally native trees will be common in the woodland.
- Ferns will be common ground flora species.
- Bryophytes will continue to be abundant and the bryophyte flora will continue to include those western/Atlantic species that mark out this woodland type. A suite of rarer species and species at the edge of their geographical range will continue to be present.
- Heathy species such as bilberry and common heather *Calluna vulgaris* will be common in some areas.
- Introduced invasive species such as rhododendron will be absent and any conifers seeding in from adjoining plantations will be removed whilst at the seedling/sapling stage.
- Damage to the ground flora and soil erosion due to public pressure will be at a minimum.
- All factors affecting the achievement of these conditions are under control.

The performance indicators for the condition of the feature and the factors affecting the feature are provided in Table 7.1.

Performance Indicators for Feature Condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Extent of sessile oak woodland	The extent should not fall below the area mapped in 1996. The maximum extent is governed by the underlying geology and soil types.	*Upper limit*: None (but is naturally limited). *Lower limit*: 175 ha
A2. Distribution	Should be present in the following units: Blaen Nedd: Units BN7, BN8, BN9. Dyffrynoedd Nedd a Mellte: DNM3-11, DNM13-16	*Upper limit*: none *Lower limit*: Significant presence in all units indicated in adjoining column.
A3. Canopy cover	Continuous canopy cover to be met with in at least 90% of samples over the whole site.	*Upper limit* : 100% *Lower limit*:90%
A4. Canopy composition & understorey composition	The canopy and understorey composition will consist of at least 95% native woody species typical of the habitat in at least 90% of samples over the whole site.	*Upper limit:* None *Lower limit:* 90%
A5. Regeneration	To be met in at least 50% of significant gaps in canopy. Such gaps should be recorded at each monitoring visit. Gaps should be created naturally and a more varied age structure should develop. Evidence of regeneration elsewhere on the site would be a positive sign that any grazing is sufficiently low. There should also be a note made of regeneration of non-native species like beech or conifers.	*Upper limit:* None *Lower limit:* Presence of viable saplings at least 1.5 m high within 10-15 years of gap appearing.
A6. Woodland structure	To be met in at least 75% of samples over the site as a whole.	*Upper limit:* None *Lower limit:* Presence of understorey and field layer, consisting of locally native species.
A7. Deadwood	To be met in at least 50% of samples over the site as a whole.	*Upper limit:* None *Lower limit:* Presence of standing and/or fallen deadwood with a minimum diameter of 20 cm and minimum length of 2 m.
A8. Ground flora	At least 80% of woodland flora the cover of typical ground flora woodland plants is 30%. Ferns should be common (see definitions - may need refining). See also under A9 bryophytes.	*Upper limit:* None *Lower limit:* 30 % cover
A9. Bryophytes, lichens and filmy ferns	Bryophytes define this woodland type - further work is required to be able to set suitable limits, but typical ground covering species should be present at high cover in about 80% of the woodland. The range of scarcer species of bryophyte, lichens and filmy ferns should continue to have viable populations.	*Upper limit:* None *Lower limit:* 80% of woodland ground cover in core areas should have 50 % cover of typical bryophytes (provisional).

Table 7.1: Performance Indicators for Coedydd Nedd a Mellte SAC Feature: **Old sessile oak woods (continues)**

Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Livestock grazing	Grazing to the extent practiced routinely by the farming community prevents regeneration of woodland and damages the field layer. Cessation of all grazing over a long period, however, may be detrimental to the field layer, especially bryophytes, as these become shaded out. The ideal may be to mimic the very low level within a natural woodland ecosystem, or to periodically vary grazing pressure. It is something that is kept under constant review.	*Upper limit*: grazing levels likely to be in the region of 0.1 LSU/ha/yr or less. *Lower limit*: None
F2. Non-native species	As many of the bryophytes typical of this habitat grow on the trunks of the oak trees, there will be low tolerance of non-native species. In particular there will be zero tolerance of invasive species such as Rhododendron, which has not yet got a foothold in the site. A maximum of about 5% of non-native trees and shrubs, including conifers, will be tolerated.	*Upper limits:* 5% cover of non-native trees in the canopy. AND: No rhododendron (or other invasive non-native shrubs) in the understorey or shrub layer *Lower limit:* None.
F3. Woodland Management	Natural ecological processes should be allowed to operate as far as possible. In the majority of units these should gradually create greater structural diversity. Any areas can be identified which may benefit from thinning; the thinning should focus on removing the non-native species. As thinning would alter the relative humidity of the site, limits would need to be imposed.	*Upper limit:* *Lower limit:*
F4. Access and visitor management and human and grazing induced bare ground	Poorly maintained footpaths, coupled with increasing visitor numbers have resulted in erosion problems in some areas. In addition, the area has proved to be very popular with outdoor groups engaging in such activities as gorge walking. Further investigation is required to assess and address impacts from these activities and will be incorporated into the management plan for the whole area. Throughout the site the cover of bare soil or denuded rocks due to footpaths, trampling and grazing and other activities undertaken by visitors (but not including natural landslips, naturally bare ground where leaf litter etc), should be less than X % (limit to be determined but likely to be close to the area taken up by footpaths). Additional limits may need to be set to address issues in more sensitive parts of the site.	*Upper limit:* X% (to be determined) bare ground due to human or animal induced activities. *Lower limit:*

Table 7.1 (continued): Performance Indicators for Coedydd Nedd a Mellte SAC Feature: **Old sessile oak woods**

7.2.2 SAC Feature: Tilio-Acerion forests of slopes, screes and ravines

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Upland ash woodland will occupy at least 18 ha of the total site area.
- The canopy should be predominantly ash and the following trees will be common in the
- woodland:
- Ferns will be common ground flora species.
- Although they may be present in the canopy in small quantities, sycamore and beech should not
- become dominant at the expense of ash.
- Introduced invasive species will be absent and any conifers seeding in from adjoining plantations
- will be removed whilst at the seedling/sapling stage.
- Damage to the ground flora and soil erosion due to public pressure will be at a minimum.
- All factors affecting the achievement of these conditions are under control.

The performance indicators for the condition of the feature and the factors affecting the feature are provided in Table 7.2 below.

Performance Indicators for Feature Condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Extent of upland as woodland	The extent should not fall below the area mapped in 1996. The maximum extent is governed by the underlying geology and soil types.	*Upper limit*: None (but is naturally limited). *Lower limit*: 18 ha
A2. Distribution	Should be present in the following units: Blaen Nedd: Units BN7, BN8, BN9. Dyffrynoedd Nedd a Mellte: DNM2, DNM4, DNM9, DNM11, DNM16	*Upper limit*: none *Lower limit*: Significant presence in all units indicated in adjoining column.
A3. Canopy cover	Continuous canopy cover to be met with in at least 90% of samples over the whole site.	*Upper limit*: 100% *Lower limit:* 90%
A4. Canopy composition and understorey composition	The canopy and understorey composition will consist of at least 95% native woody species typical of the habitat in at least 90% of samples over the whole site.	*Upper limit:* None *Lower limit:* 90%
A5. Regeneration	To be met in at least 50% of significant gaps in canopy. Such gaps should be recorded at each monitoring visit. Gaps should be created naturally and a more varied age structure should develop. Evidence of regeneration elsewhere on the site would be a positive sign that any grazing is sufficiently low. There should also be a note made of regeneration of non-native species like sycamore, beech or conifers.	*Upper limit:* None *Lower limit:* Presence of viable saplings at least 1.5m high within 10-15 years of gap appearing.
A6. Woodland structure	To be met in at least 75% of samples over the site as a whole.	*Upper limit:* None *Lower limit:* Presence of understorey and field layer, consisting of locally native species.
A7. Deadwood	To be met in at least 50% of samples over the site as a whole.	*Upper limit:* None *Lower limit:* Presence of standing and/or fallen deadwood with a minimum diameter of 20cm and minimum length of 2m.
A8. Ground flora	At least 80% of woodland flora the cover of typical ground flora woodland plants is 30%. Ferns should be common (see definitions - may need refining).	*Upper limit:* None *Lower limit:* 30 % cover
A9. Bryophytes and lichens	Bryophytes are often abundant in this type of woodland, but are not as important a component in defining the woodland types as they are in defining 'sessile oakwood'. However, the two woodland types often grow in close proximity and it may be sensible to treat the upland ash woodland in the same manner as for the sessile oakwood until limits can be refined following further study and monitoring. Typical ground covering species should be present at high cover in about 80%? of the woodland. The range of scarcer species of bryophyte and lichens should continue to have viable populations.	*Upper limit:* None *Lower limit:* 80% of woodland ground cover in core areas should have 50 % cover of typical bryophytes (provisional).
Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Livestock grazing	Grazing to the extent practiced routinely by the farming community prevents regeneration of woodland and damages the field layer. Cessation of all grazing over a long period, however, may be detrimental to the field layer as these may become shaded out. The ideal may be to mimic the very low level within a natural woodland ecosystem, or to periodically vary grazing pressure. It is something that kept under constant review.	*Upper limit*: grazing levels likely to be in the region of 0.1 LSU/ha/yr or less. *Lower limit*: None

Table 7.2: Performance Indicators for Coedydd Nedd a Mellte SAC Feature: Tilio-Acerion forests of slopes, screes and ravines (continues)

Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F2. Non-native species	There will be low tolerance of non-native species. Although some sycamore will be tolerated, it should not be allowed to become dominant over ash. A maximum of about 5% of non-native trees and shrubs, including conifers, will be tolerated.	*Upper limits:* 5% cover of non-native trees in the canopy. Sycamore - a limit AND: No invasive non-native shrubs in the understorey or shrub layer *Lower limit:* None.
F3. Woodland Management	Natural ecological processes should be allowed to operate as far as possible. In the majority of units these processes should gradually create greater structural diversity. Any areas can be identified which may benefit from thinning; the thinning should focus on removing the non-native species. As thinning would alter the relative humidity of the site, limits would need to be imposed.	*Upper limit:* *Lower limit:*
F4. Access and visitor management and human and grazing induced bare ground	Poorly maintained footpaths, coupled with increasing visitor numbers have resulted in erosion problems in some areas. In addition, the area has proved to be very popular with outdoor groups engaging in such activities as gorge walking and climbing. Further investigation is required to assess and address impacts from these activities and will be incorporated into a wide ranging management plan for the whole area. Throughout the site the cover of bare soil or denuded rocks due to footpaths, trampling and grazing and other activities undertaken by visitors (but not including natural landslips, naturally bare ground where leaf litter etc), should be less than X % (limit to be determined but likely to be close to the area taken up by footpaths). Additional limits may need to be set to address issues in more sensitive parts of the site.	*Upper limit:* X% (to be determined) bare ground due to human or animal induced activities. *Lower limit:*

Table 7.2 (continued): Performance Indicators for Coedydd Nedd a Mellte SAC Feature: **Tilio-Acerion forests of slopes, screes and ravines**

During consultations regarding the assessment works, a plan was provided by Natural Resources Wales showing the NVC Phase II Woodland Habitat within Coedydd Nedd a Mellte SAC. A copy of this plan is included in Appendix 2. This plan shows that the habitats which are closest to the Enviroparks scheme include the following National Vegetation Classification habitats:

- W7a - *Alnus-Fraxinus-Lysimachia* woodland, *Urtica* sub-community;
- W10a - *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, Typical sub-community; and,
- W17c - *Quercus petraea-Betula pubescens-Dicranum majus* woodland *Anthoxanthum odoratum Agrostis capillaris* sub-community.

7.3 VULNERABILITY OF THE SAC

The CCW Core Management Plan (2008b) includes an assessment of the conservation status of qualifying features and management requirements to maintain or restore each feature.

7.3.1 SAC Feature: Old sessile oak woods with Ilex and Blechnum in the British Isles

A 2006 assessment found the conservation status of this feature to be **unfavourable**, due to:

- The presence of non-native species;
- Insufficient understorey cover in parts of the site due to heavy grazing in the past; and,
- Negative effects as a result of visitor pressure.

Further details are provided in Table 7.3.

Issue contributing to Unfavourable Status of Feature	Explanation and Management Required
The presence of non-native species	Some thinning may be necessary to remove some of the non-native species in Unit DNM2. Some thinning of non-native trees may be required.
Insufficient understorey cover in parts of the site due to heavy grazing in the past	Units DNM2, DNM11, DNM16 are currently (2008) under management agreement but a sufficient understorey will take time to develop. Units DNM14 & DNM15 are largely unmanaged and ungrazed and an understorey should develop in time. Units DNM4 & DNM8 are largely fenced from grazing, although trespassing sheep do enter the wood from time to time, and an understorey should develop in time.
Negative effects as a result of visitor pressure	A management plan covering the wider 'waterfalls area' is being progressed (2008) by the BBNPA, FC and CCW, which amongst other things which amongst other things will be addressing issues arising from increasing numbers of visitors in the SAC and supporting SSSI.

Table 7.3: Summary of Issues Contributing to Unfavourable Status of Feature and Management Required

7.3.2 SAC Feature: Tilio-Acerion forests of slopes, screes and ravines

A 2006 assessment found the conservation status of this feature to be **unfavourable**, due to:

- The presence of non-native species;
- Insufficient understorey cover in parts of the site due to heavy grazing in the past; and,
- Negative effects as a result of visitor pressure.

Further details are provided in Table 7.4.

Issue contributing to Unfavourable Status of Feature	Explanation and Management Required
The presence of non-native species	Much of Unit DNM16 has now been fenced under a management agreement, however a sufficient understorey will take time to develop and some thinning may be necessary to remove some of the non-native species. Similar fencing has occurred in Units BN7 & BN9, with some thinning and coppicing initiated to reduce the frequency of sycamore.
Insufficient understorey cover in parts of the site due to heavy grazing in the past	As above
Negative effects as a result of visitor pressure	A management plan covering the wider 'waterfalls area' is being progressed (2008) by the BBNPA, FC and CCW, which amongst other things will be addressing issues arising from increasing numbers of visitors in the SAC and supporting SSSI.

Table 7.4: Summary of Issues Contributing to Unfavourable Status of Feature and Management Required

7.3.3 Current Threats to SAC

The Natura 2000 – Standard Data Form (2015b) states that the main threats to this SAC are:

High-rank threats:

- Air pollution, airborne pollutants – both inside and outside the SAC;
- Interspecific floral relations – both inside and outside the SAC; and,
- Outdoor sports, leisure activities and recreational activities – inside the SAC.

Low-rank threats:

- Grazing – inside the SAC;
- Forest plantation management and use – inside the SAC; and,
- Problematic native species – inside the SAC.

7.4 POTENTIAL EFFECTS ON COEDYDD NEDD A MELLTE SAC – STAGE 1: SCREENING

This section of the report provides an assessment of the potential effects of the proposed development on the Coedydd Nedd a Mellte SAC. The section has been structured to provide consideration of each of the likely pathways for impacts and the site's vulnerabilities as identified in Sections 7.2 and 7.3. Some of the identified 'risks' are identified from the 2008 Core Management Plan for the site (CCW, 2008b), and some are from the 2015 Natura 2000 Standard Data Form. Where there are overlaps between the 'risks' outlined in the two documents, these have been discussed together.

DIRECT EFFECTS

7.4.1 Negative Effects as a Result of Visitor Pressure / Outdoor Sports, Leisure Activities and Recreational Activities

These types of threats are considered to be high-rank threats in the 2015 Natura 2000 Standard Data Form. Due to the nature of the proposed development being of an industrial nature, the proposed development will have no impact on visitor pressure or recreational activities, therefore no likely significant effects are predicted from this pathway, either alone or in-combination with other plans and projects. No further assessment is required.

7.4.2 Insufficient Understorey Cover in Parts of the Site due to Heavy Grazing in the Past / Grazing / Forest Plantation Management and Use / Problematic Native Species / Interspecific Floral Relations

These threats are considered to be high-rank (interspecific floral relations) and low-rank (grazing, forest plantation management and use, and problematic native species) threats in the 2015 Natura 2000 Standard Data Form.

Given the distance between the proposed development site and the SAC and the nature of the development, it can be concluded that the proposed development will have no impact on grazing or forest plantation management, including management with respect to problematic native species or the composition of flora, therefore no likely significant effects are predicted from this pathway, either alone or in-combination with other plans and projects. No further assessment is required.

7.4.3 The Presence of Non-Native Species

Coedydd Nedd a Mellte SAC is located 1.24 km west north-west of the proposed development site. Given the distance from the proposed development to the SAC it can be concluded that there would be no impacts regarding introduction, disturbance or spread of non-native species on the SAC as a result of the proposed development. No likely significant effects with respect to the presence of non-native species are predicted, either alone or in-combination with other plans and projects. No further assessment is required.

INDIRECT EFFECTS

7.4.4 Air Pollution and Airborne Pollutants

As for Blaen Cynon SAC, the detailed assessment work that has been undertaken in relation to potential air pollution impacts on Coedydd Nedd a Mellte SAC is considered to provide enough information to allow the competent authority to undertake an Appropriate Assessment, and is therefore presented separately, in Section 7.5.

7.4.5 Conclusions Following Stage 1: Screening

The Stage 1: Screening exercise has identified that the proposed development will have no 'Likely Significant Effect' on Coedydd Nedd a Mellte SAC as a result of the following threats/pressures:

- Negative effects as a result of visitor pressure / outdoor sports, leisure activities and recreational activities;
- Insufficient understorey cover in parts of the site due to heavy grazing in the past / grazing / forest plantation management and use / problematic native species / interspecific floral relations; or,
- The presence of non-native species.

These threats/pressures are not considered further.

7.5 COEDYDD NEDD A MELLTE SAC – STAGE 2: APPROPRIATE ASSESSMENT

The Stage 1: Screening exercise has identified that, in the absence of mitigation, the following threat has the potential to result in a 'Likely Significant Effect' on Blaen Cynon SAC, and therefore requires further assessment:

- Air pollution, airborne pollutants.

This issue is discussed in more detail below.

7.5.1 Air Pollution and Airborne Pollutants

This section of the report provides modelling data associated with air quality changes as a result of the Enviroparks scheme, both alone and in-combination with other projects, on Coedydd Nedd a Mellte SAC. The methodologies applied to the modelling works are as outlined in Section 6.5.2 and as such are not repeated here.

For Coedydd Nedd a Mellte SAC, the modelling is based on the closest point of the SAC to the development site, located at grid reference 292525, 207199. This location is within SAC Management Unit DNM4 which contains both *Tilio-Acerion* forests of slopes, screes and ravines and Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles as key habitats (Core Management Plan, 2008b).

The screening criteria outlined Section 6.5.2 for Blaen Cynon SAC has also been applied to the assessment for Coedydd Nedd a Mellte SAC.

7.5.1.1 Nutrient Nitrogen

2017 Assessment

Table 7.5 provides a summary of the modelled deposition rates using IED emissions limits for nutrient nitrogen at Coedydd Nedd a Mellte SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4. This data is considered to represent a worst case scenario, likely to be only experienced when the gasifiers are emitting at the limits of their permits. Table 7.6 presents the data based on the Laxen and Marner (2005) assessment methodology and Table 7.7 presents the data using the Laxen and Marner (2005) methodology and based on long-term realistic emissions data.

For Coedydd Nedd a Mellte SAC, a lower critical load of 10 was used as this is the lowest critical load identified by APIS, and a higher critical load of 15 was used (see http://www.apis.ac.uk/srcl/select-a-feature?site=UK0030141&SiteType=SAC&submit=Next) which would be relevant to some of the habitats found within the SAC, and particularly those within Management Unit DNM4, closest to the Enviroparks development site. These critical loads relate to ‘Old sessile oak woods with Ilex and Blechnum in the British Isles’. The higher critical load presented in Tables 7.5 to 7.8 was 15, again taken from APIS.

Nutrient Nitrogen (N)	**Enviroparks Only**	**In-Combination**
Current Minimum Background (kg N/ha/yr)	23.57	23.57
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.182	0.305
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.75	23.88
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**1.8%**	**3.0%**
Long-term PC < 1 % of lower Critical Load?	**See below**	**No**
Long-term PEC as % of lower Critical Load	**237.5%**	**238.8%**
Long-term PEC < 1 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical Load R (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	**1.2%**	**2.0%**
Long-term PC < 1 % of higher Critical Load?	**See below**	**No**
Long-term PEC as % of higher Critical Load	**158.3%**	**159.2%**
Long-term PEC < 1 % of higher Critical Load?	**No**	**No**

Table 7.5: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Coedydd Nedd a Mellte SAC

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	23.57	23.57
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.140	0.263
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.71	23.83
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	1.4%	**2.6%**
Long-term PC < 1 % of lower Critical Load?	See below	**No**
Long-term PEC as % of lower Critical Load	**237.1%**	**238.3%**
Long-term PEC < 1 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical Load R (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.9%	**1.8%**
Long-term PC < 1 % of higher Critical Load?	Yes	**No**
Long-term PEC as % of higher Critical Load	158.1%	**158.9%**
Long-term PEC < 1 % of higher Critical Load?	No	**No**

Table 7.6: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Coedydd Nedd a Mellte SAC and Laxen and Marner (2006) Assessment Method

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	23.57	23.57
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.130	0.252
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	23.7	23.822
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	1.3%	**2.5%**
Long-term PC < 1 % of lower Critical Load?	See below	**No**
Long-term PEC as % of lower Critical Load	237%	**238.2%**
Long-term PEC < 1 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical Load R (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.08%	**1.7%**
Long-term PC < 1 % of higher Critical Load?	Yes	**No**
Long-term PEC as % of higher Critical Load	158%	**158.8%**
Long-term PEC < 1 % of higher Critical Load?	No	**No**

Table 7.7: 2017 Modelled Nutrient Nitrogen Deposition Using Long-Term Realistic Emissions Data at Coedydd Nedd a Mellte SAC and Laxen and Marner (2005) Assessment Methods

Tables 7.5 to 7.7 clearly show that the background concentrations of nutrient nitrogen within Coedydd Nedd a Mellte SAC are already significantly above the lower and higher critical load (10 and 15 kg N/ha/yr respectively) for 'Old sessile oak woods with Ilex and Blechnum in the British Isles' (the most sensitive of the habitat-types within the SAC to nutrient nitrogen deposition). The background levels are also above the higher critical load for 'Old sessile oak woods with Ilex and Blechnum in the British Isles' which is 15 kg N/ha/yr and above the lower (15 kg N/ha/yr) and higher (20 kg N/ha/yr) critical loads for 'Tilio-Acerion forests of slopes, screes and ravines'.

Based on the data presented in Tables 7.5 to 7.7 the Enviroparks scheme, when considered on its own, will result in only a small increase in nutrient nitrogen above the 1% screening level based on the lower critical load; 1.8% based on the worst case modelling data in Table 7.5; 1.4% based on the Laxen and Marner (2005) methodology and 1.3% when considering the long-term realistic emissions data results in Table 7.6. If the data presented for the Enviroparks scheme was rounded to the nearest whole number, it would be 2% based on the worst case data in Table 7.5 and 1% based on the Laxen and Marner (2005) assessment methodology (Table 7.6) and the long-term realistic emissions data (Table 7.7), which, in accordance with the screening methodology set out in Section 6.5.2, would mean that any potential effects could be screened out.

Table 7.8 presents the data from the September 2017 modelling work (Envisage, 2017d) which takes into account the additional technologies, uses IED emissions limits data, applies a conversion of 70% NOx to NO_2 and includes the updated background concentrations provided by APIS and accessed in August 2017.

Nutrient Nitrogen (N)	**Enviroparks Only**	**In-Combination**
Current Minimum Background (kg N/ha/yr)	26.6	26.6
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.0076	0.0291
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	26.6076	26.6291
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	10	10
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.08%	0.29%
Long-term PC < 1 % of lower Critical Load?	Yes	Yes
Long-term PEC as % of lower Critical Load	266.08%	266.29%
Long-term PEC < 1 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical Load R (kg N/ha/yr)	15	15
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.05%	0.19%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	266.08%	266.29%
Long-term PEC < 1 % of higher Critical Load?	No	No

Table 7.8: 2017 Modelled Nutrient Nitrogen Deposition Using Additional Technologies and IED Emissions Limits Data at Coedydd Nedd a Mellte SAC and 70% Conversion of NOx to NO_2

Table 7.8 also shows that the background concentrations of nutrient nitrogen within Coedydd Nedd a Mellte SAC (originally 23.57 kg N/ha/yr, but increased to 26.6 kg N/ha/yr based on the August and September 2017 modelling work) are already significantly above the lower and higher critical load (10 and 15 kg N/ha/yr respectively) for 'Old sessile oak woods with Ilex and Blechnum in the British Isles' (the most sensitive of the habitat-types within the SAC to nutrient nitrogen deposition). The background levels are also above the higher critical load for 'Old sessile oak woods with Ilex and Blechnum in the British Isles' which is 15 kg N/ha/yr and above the lower (15 kg N/ha/yr) and higher (20 kg N/ha/yr) critical loads for 'Tilio-Acerion forests of slopes, screes and ravines'.

Using the abatement technologies proposed with a 70% conversion of NOx to NO_2 the data presented in Table 7.8 shows that the scheme alone would result in a process contribution of 0.08% of the critical load, which is clearly at a level which could be screened as 'insignificant'.

Based on the higher critical load, the levels presented in Tables 7.5 to 7.8 to would be considered insignificant for the development alone.

Based on the data presented in Table 7.5, under the worst case model where the plant was operating at the IED emission limits at all times, and without any additional mitigating technologies, there would be an in-combination level of nutrient nitrogen deposition from the scheme which was 3.0% of the lower critical load. Based on the more realistic modelled data in Table 7.7, the in-combination effects of the process contribution would be 2.5% of the lower critical level. However, based on the modelled data presented which takes into account the additional technologies, using IED limits and a 70% conversion of NOx to NO_2, the in-combination effects of the scheme on Coedydd Nedd a Mellte SAC would be 0.29% of the lower critical load (see Table 7.8). At these levels, the potential effects of the scheme when considered in-combination would be screened as 'insignificant'.

The process contribution, when considered in-combination, would be between 0.19% (Table 7.8) and 3.0% (Table 7.5) of the higher critical load.

Further consideration is given below to the key risks identified in the Core Management Plan for the site to consider whether the small-scale increase in nutrient nitrogen shown in Tables 7.5 and 7.7 from the Enviropark scheme would really be considered 'significant'. Consideration is given to the potential effects of the predicted nutrient nitrogen increase on the habitats within the SAC, however, if the technological mitigation which has been used to inform the modelled data presented in Table 7.8, is implemented, then as the levels would be 'insignificant' this further consideration is not required.

WHO (2000) states that an increase in the supply of an essential nutrient such as nitrogen will stimulate tree growth, and the initial impact of enhanced nitrogen will therefore be a fertiliser effect. However, continuous high inputs of nitrogen produce negative effects on tree growth (Chaplin, 1980, cited by WHO, 2000), and Wellburn (1988, cited by WHO, 2000) states that under such conditions, the health of the tree declines and their sensitivity to drought, frost, insect pests and pathogens can increase markedly.

JNCCb (no date) state that the *Tilio-Acerion* forests at Coedydd Nedd a Mellte SAC provide habitat for a number of uncommon vascular plants, including, dark-red helleborine *Epipactis atrorubens*, violet helleborine *Epipactis purpurata*, wood fescue *Festuca altissima*, purple gromwell *Lithospermum purpureocaeruleum* and herb-Paris *Paris quadrifolia*.

Some localities within the SAC have important assemblages of epiphytic lichens. WHO (2000) state that a survey in central Netherlands concluded that between 1958 and 1981 when nitrogen input increased from 20 N kg/ha/yr to 40 N kg/ha/yr all lichens disappeared from the woodland. A study from a large semi-natural *Fagus-Quercus* stand in France identified that between 1972 and 1991, where changes in the calcareous soils were followed, a significant increase in nitrophilous ground flora was observed in high pH (6.9) stands, and with an ambient deposition of 15-20 N kg/ha/yr a distinct effect of increasing nitrogen availability could be detected in the vegetation (Thimonier, 1994).

APIS states that the impacts of exceedance of the critical load on 'Old sessile oak woods with Ilex and Blechnum in the British Isles' includes a decrease in mycorrhiza, loss of epiphytic lichens and bryophytes and changes in ground vegetation and for 'Tilio-Acerion forests of slopes, screes and ravines' exceedance of nutrient nitrogen critical levels results in changes in ground vegetation.

Caporn et al (2016) state that the impact of N deposition on vegetation composition within deciduous broadleaved woodland is poorly understood partly due to the strong influence that tree canopy structure places on ground flora through inception of light, rainfall and pollution and the effect of woodland management and nitrogen deposition upon this structure. Nevertheless, the authors state that work has demonstrated that understory plants such as bryophytes, lichens and forbs can be negatively affected by N.

Caporn et al (2016) cite a study from mixed woodland around four intensive livestock units in Scotland which showed a change in species composition within 300m downwind of the units with grasses *Deschampsia flexuosa* and *Holcus lantantus* and the shrub *Rubus idaeus* and forbs *Urtica dioica* increasing in abundance close to the units. Another study of 103 woodlands between 1971 and 2001 showed that overall species richness was unaffected by N but changes in composition were found, with some species responding positively to N (*Poa nemoralis/trivialis, Galium aparine, Allium ursinum, Athyrium filix-femina, Carex pendula, Urtica dioica*) and other responding negatively (*Deschampsia flexuosa, Agrostis capillaris, Ajuga reptans, Holcus lanatus, Pteridium aquilinum, Vaccinium myrtillus*).

Caporn et al (2016) conclude that with respect to deciduous broadleaved woodland, the lack of an overall relationship between species richness and N deposition makes it difficult to assume a dose-response relationship to broad-scale N deposition in woodlands over a national gradient, however, it seems likely that the edges of the woodlands are likely to be more strongly affected by a nearby pollutant source (such as an intensive livestock farm).

The Core Management Plan (2008b) for Coedydd Nedd a Mellte SAC states the following with respect to the conservation and management status of the SAC feature 1 Tilio-Acerion forests of slopes, screes and ravines (EU habitat Code: 9180):

> ***Conservation Status of Feature 1 - Tilio-Acerion forests of slopes, screes and ravines (EU habitat Code: 9180)***
> *The conservation status of the feature within the site is* ***Unfavourable*** *(2006).*
> *Further monitoring is required to fully assess the condition as the 2006 assessment used slightly different management units to those in the current plan.*
>
> *The upland ash woodland is considered to be unfavourable largely because of the presence of non-native species and insufficient understorey cover in parts of the site due to heavy grazing in the past - particularly in Unit DNM16 and Units BN7 and BN9.*
>
> *Negative effects as a result of visitor pressure are also affecting the feature, however at this stage (2008), the significance is not clear and further investigation is required. Following some initial*

monitoring work in 2007, it appears that the main problem areas are in Units DNM4, DNM11 and Unit BN7.

Management Requirements of Feature 1 - Tilio-Acerion forests of slopes, screes and ravines (EU habitat Code: 9180)
Much of Unit DNM16 has now been fenced under a management agreement, however a sufficient understorey will take time to develop and some thinning may be necessary to remove some of the non-native species. Similar fencing has occurred in Units BN7 & BN9, with some thinning and coppicing initiated to reduce the frequency of sycamore.

A management plan covering the wider 'waterfalls area' is being progressed (2008) by the BBNPA, FC and CCW, which amongst other things will be addressing issues arising from increasing numbers of visitors in the SAC and supporting SSSI.

The Core Management Plan (2008b) for Coedydd Nedd a Mellte SAC states the following with respect to the conservation and management status of the SAC feature 2 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (EU Habitat Code: 91A0).

Conservation Status of Feature 2 - Old sessile oak woods with Ilex and Blechnum in the British Isles (EU Habitat Code: 91A0)
*The conservation status of the feature within the site is **Unfavourable** (2006).*
Further monitoring is required to fully assess the condition as the 2006 assessment used slightly different management units to those in the current plan.

The sessile oak woodland is considered to be unfavourable largely because of the presence of non-native species in management Units DNM4, DNM8, DNM14.

The understorey was also considered to be insufficient in parts of the site, usually due to heavy grazing in the past - particularly in Units DNM2, DNM4, DNM8, DNM11, DNM14, DNM15, DNM16. Negative effects as a result of visitor pressure are also affecting the feature, however at this stage (2008), the significance is not clear and further investigation is required. Sizeable areas of ground, particularly around waterfalls are heavily trampled and denuded with the prospects for tree regeneration greatly reduced. Ultimately, some areas could lose their canopy cover. Following some initial monitoring work in 2007, it appear that the main problem areas are in Units DNM4, DNM5, DNM7, DNM8, DNM11.

Management Requirements of Feature 2 - Old sessile oak woods with Ilex and Blechnum in the British Isles (EU Habitat Code: 91A0)
Units DNM2, DNM11, DNM16 are currently (2008) under management agreement but a sufficient understorey will take time to develop. Some thinning may be necessary to remove some of the non-native species in Unit DNM2.

Units DNM14 & DNM15 are largely unmanaged and ungrazed and an understorey should develop in time. Some thinning of non-native trees may be necessary.
Units DNM4 & DNM8 are largely fenced from grazing, although trespassing sheep do enter the wood from time to time, and an understorey should develop in time. Some thinning of non-native trees may be required.

A management plan covering the wider 'waterfalls area' is being progressed (2008) by the BBNPA, FC and CCW, which amongst other things which amongst other things will be addressing issues arising from increasing numbers of visitors in the SAC and supporting SSSI.

It should be noted that the nutrient nitrogen deposition rates presented in Tables 7.5 to 7.7 are modelled from the closest point within the Coedydd Nedd a Mellte SAC to the Enviroparks development and as such represent a worst-case scenario deposition rate for the whole of the SAC. This is particularly the case with the data in Table 7.5. Table 7.7 is considered to represent the long-term realistic emissions data from the proposed development (and shows that nitrogen deposition from the development itself would be screened as insignificant, even at the closest point of the SAC to the Enviroparks scheme).

The Envisage (2017b) report and Chapter 9 Air Quality of the Environmental Statement Addendum (Savills, 2017) presents data from an original set of modelling which utilised a central point within Coedydd Nedd a

Mellte SAC for the modelling based on emissions data being at IED levels (ie worst case scenario). The modelling was from grid reference 291900, 209300, which is located in the centre of the SAC, c.3km north-west of the Enviroparks site. Table 16 from the Envisage (2017b) report shows that based on this central grid reference the process contribution would be 0.42% as a percentage of the lower critical load in isolation, and 0.6% in-combination with the other projects outlined in Chapter 4.

Based on the data presented in Table 7.8, it can be concluded that the proposed development would not have a significant adverse effect on the integrity of the SAC based on the Enviroparks scheme alone. It should also be recognised, that even based on the earlier modelled data in Tables 7.5 and 7.7, the nitrogen deposition at the closest point of Coedydd Nedd a Mellte SAC was predicted to only be slightly above the 1% screening level from the Enviroparks scheme alone when considering the worst case IED emissions data, based on consideration of the more likely long-term realistic modelling data from Table 7.7, the IAQM (2016) Position Statement, and the fact that the levels of nutrient deposition which are above 1% will not be experienced across that whole of the SAC (which totals 376.32 ha).

Tables 7.5 to 7.8 also present data associated with the 'in-combination' effect of the scheme when considered with the other projects outlined in Chapter 4. As identified in Section 6.5.2, the IAQM Position Statement (IAQM, 2016) concludes that the use of the 1% screening level for process contributions as a percentage of the critical load, was not designed to be used as a screening threshold for 'in-combination' assessments. However, it has not been able to source any guidance from the Environment Agency / Natural Resources Wales / Institute of Air Quality Management, with respect to a screening threshold for in-combination effects. Based on the data in Table 7.8, it is clear that the in-combination effects would be below the 1% screening level for schemes when considered alone, and as such it can be concluded that assuming that the additional technologies are implemented, then impacts can be screened as insignificant.

It is clear that based on the long-term realistic emissions data (Table 7.7), and the scenario which includes additional technology provisions (Table 7.8), the nitrogen deposition levels at the closest point of Coedydd Nedd a Mellte SAC to the Enviroparks development would be screened as insignificant.

When the Enviroparks scheme is considered in-combination with the other projects outlined in Chapter 4, there are no screening criteria which can be applied related to the process contribution as a percentage of the critical loads, however, it is clear from the data in Table 7.8 that any in-combination effects would be below 1% of the critical load.

2020 Assessment

Table 7.9 presents the 2020 modelled data for nutrient nitrogen deposition, which takes into account the raised height of the emissions stack. As Nitric Oxide does not deposit to any significant extent, the deposition of total NOx has been reduced by 30 % to represent deposition from NO_2 only. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Nutrient Nitrogen	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.005276155	0.0195
Current Maximum Background (kg N/ha/yr)	26.5	26.5
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	26.50527616	26.5195
Lower End of the Critical Load Range (kg N/ha/yr)	10	10
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.053%	0.12%
Is the Long-Term Percentage Less Than 1 %?	Yes	Yes

Table 7.9: 2020 Modelled Nutrient Nitrogen Deposition at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.9 shows that the background concentration of nutrient nitrogen within Coedydd Nedd a Mellte SAC based on the 2020 modelling work (26.5 kg N/ha/yr) is significantly above the lower critical load (10 kg N/ha/yr) identified by APIS for 'Old sessile oak woods with Ilex and Blechnum in the British Isles'. This is broadly consistent with the September 2017 assessment, when the background concentration of nutrient nitrogen within Blaen Cynon SAC was 26.6 kg N/ha/yr.

Whilst the lower critical load for nutrient nitrogen within the SAC is already exceeded due to the background levels, further consideration has been given to the potential additional contributions of the proposed development to the levels of nutrient nitrogen likely to be experienced at Coedydd Nedd a Mellte SAC. Table 7.9 shows that the development would result in a long-term process contribution of 0.053% of the lower critical load when considered 'alone', and a long-term process contribution of 0.12% of the lower critical load when considered in-combination with other projects and plans. These process contributions can be screened as 'insignificant' (less than 1%).

The predicted nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of nutrient nitrogen deposition arising from the Enviroparks development.

7.5.1.2 Acid Deposition

2017 Assessment

Table 7.10 provides a summary of the worst case scenario modelled deposition rates using the IED emissions data for acid deposition at Coedydd Nedd a Mellte SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4. Table 7.11 presents the worst case scenario modelled deposition rates using the IED emissions data when modelled using the Laxen and Marner (2005) assessment methods.

Table 7.12 presents the long-term realistic emissions data, applying the Laxen and Marner (2005) assessment method.

The critical load has been determined using data from APIS for Coedydd Nedd a Mellte SAC. The lower critical load used for acid deposition is comprised of the lowest critical load provided for N plus the lowest critical load provided for S. The higher critical load for acid deposition is calculated as the highest critical load provided for N plus the highest critical load provided for S.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.254	2.254
Process Contribution (PC) Acid (keq/ha/yr)	0.0464	0.0592
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.30	2.31
Lower Critical Load:		
Lower Critical load (keq)	1.694	1.694
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**2.7%**	**3.5%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term % of higher Critical Load	**136%**	**136%**
Long-term PEC < 70 % of lower critical load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	15.708	15.708
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.3%	0.4%
Long-term PC < 1 % of higher Critical Load?	Yes	-
% of higher Critical Load	14.6%	14.7%
PEC < 70 % of higher Critical Load?	Yes	Yes

Table 7.10: 2017 Modelled Acid Deposition Using IED Emission Levels Data at Coedydd Nedd a Mellte SAC

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.254	2.254
Process Contribution (PC) Acid (keq/ha/yr)	0.0434	0.0562
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.29	2.31
Lower Critical Load:		
Lower Critical load (keq)	1.694	1.694
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**2.6%**	**3.3%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**135%**	**136%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	15.708	15.708
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.3%	0.4%
Long-term PC < 1 % of higher Critical Load?	Yes	-
Long-term PEC as % of higher Critical Load	14.6%	14.7%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 7.11: 2017 Modelled Acid Deposition Using IED Emission Levels Data at Coedydd Nedd a Mellte SAC and Laxen and Marner (2006) Assessment Method

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.254	2.254
Process Contribution (PC) Acid (keq/ha/yr)	0.0434	0.0562
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.29	2.31
Lower Critical Load:		
Lower Critical load (keq)	1.694	1.694
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**2.6%**	**3.3%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**135%**	**136%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	15.708	15.708
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.3%	0.4%
Long-term PC < 1 % of higher Critical Load?	Yes	-
Long-term PEC as % of higher Critical Load	14.6%	14.7%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 7.12: 2017 Modelled Acid Deposition Using Long-Term Realistic Emissions Data at Coedydd Nedd a Mellte SAC and Laxen and Marner (2006) Assessment Method

Tables 7.10 to 7.12 show that based on either the worst case scenario model, using the Laxen and Marner (2005) assessment method, or the long-term realistic emissions data model, the 1% screening threshold for process contribution as a percentage of the lower critical load for acid deposition will not be achieved and the effects of the scheme, in isolation cannot be considered insignificant at the closest point of the SAC to the development. The background acid deposition (2.254 keq/ha/yr) already significantly exceeds the lower critical load for Coedydd Nedd a Mellte SAC (1.694 keq/ha/yr) and as such the PEC as a percentage of the lower critical load is greater than the 70% screening threshold.

When considering the in-combination data, Tables 7.10 to 7.12 show that based on the previously modelled data, the process contribution will result in percentage increases of between 3.5% (worst case scenario) and 3.3% (long-term realistic data) of the lower critical load.

Table 7.13 provides the data modelled during September 2017 associated with the implementation of additional technologies, data at IED limits and 70% conversation of NOx to NO_2 and using updated APIS background data.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	2.34	2.34
Process Contribution (PC) Acid (keq/ha/yr)	0.0032	0.0075
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	2.3432	2.3475
Lower Critical Load:		
Lower Critical load (keq)	1.694	1.694
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.19%	0.44%
Long-term PC < 1 % of lower Critical Load?	Yes	Yes
Long-term PEC as % of lower Critical Load	138.32%	138.58%
Long-term PEC < 70 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical load (keq)	15.708	15.708
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.02%	0.05%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	14.92%	14.94%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 7.13: 2017 Modelled Acid Deposition Using Additional Technologies and IED Emissions Data at Coedydd Nedd a Mellte SAC and 70% Conversation of NOx to NO_2

Table 7.13 shows that the background acid deposition (updated to 2.34 keq/ha/yr in the August and September 2017 models) already significantly exceeds the lower critical load for Coedydd Nedd a Mellte SAC (1.694 keq/ha/yr) and as such the PEC as a percentage of the lower critical load is greater than the 70% screening threshold.

However, Table 7.13 shows that with the application of additional mitigating technologies and use of a 70% conversion of NOx to NO_2, the process contribution alone would be 0.19% of the lower critical load and as such can be considered insignificant.

With the additional technologies applied, Table 7.13 shows that the in-combination effects would comprise 0.44% of the lower critical load, and as such the effects can be considered insignificant.

The higher critical load for Coedydd Nedd a Mellte SAC will not be exceeded as a result of the proposed development, either alone or in-combination with the other projects outlined in Chapter 4.

Kros et al (2016) developed a model associated with acid deposition and groundwater levels on habitat quality and plant species diversity in grassland, heathland and woodland habitats. These authors cite earlier studies which conclude that N deposition is the most important driver for biodiversity loss in northern temperate forests.

APIS concludes that the exceedance impacts on ‘Tilio-Acerion forests of slopes, screes and ravines’ and ‘Old sessile oak woods with Ilex and Blechnum in the British Isles’ from acid deposition could result in leaching which will cause a decrease in soil base saturation, increasing the availability of Al3+ ions. Mobilisation of Al3+ may cause toxicity to plants and mycorrhiza and acid deposition may cause a decline in tree vitality and changes in ground flora species composition. It may also have a direct effect on lower plants (bryophytes and lichens) and may cause increased susceptibility to pathogens and pests.

The 2009 sHRA Report (RT-MME-104641) concluded that with respect to acid deposition, the dry deposition acid deposition as a percentage of the critical load for Coedydd Nedd a Mellte SAC was 0.12%. As with the discussion associated with the nitrogen deposition in Section 7.5.1.1, it should be noted that this related to a modelled location in the centre of this large SAC, rather than the worst-case scenario that the current model data in Table 7.10 is based on.

The Environmental Statement Addendum (Savills, 2017) presented acid deposition data for Coedydd Nedd a Mellte SAC from a central grid reference (291900, 209300, c.3km north-west of the Enviroparks scheme). This modelled data shows that the process contribution as a percentage of the critical load was 0.53% in isolation, and 0.59% when considered in-combination with other projects. It is therefore evident that the worst-case scenario for acid deposition presented in Table 7.9 would not be experienced across the whole of this large SAC as the deposition would drop well below 1% within the central section of the site.

However, based on the data presented in Table 7.13 showing the data when applying the additional technology now proposed, the 1% screening criteria, whether applied to the scheme alone or in-combination, would not be exceeded, and as such effects from the proposed development would be considered insignificant.

2020 Assessment
Table 7.14 presents the 2020 modelled data for acid deposition, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Acid Deposition	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition of Acid (keq/ha/yr)	0.004790966	0.0076
Current Maximum Background (keq/ha/yr)	2.3	2.3
Predicted Environmental Concentration (PEC) (keq/ha/yr)	2.304790966	2.3076
Lower End of the Critical Load Range (keq/ha/yr)	1.837	1.837
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.26%	0.41%
Is the Long-Term Percentage Less Than 1 %?	Yes	Yes

Table 7.14: 2020 Modelled Acid Deposition at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.14 shows that the background level (2.3 keq/ha/yr) exceeds the lower critical load for the habitats within Coedydd Nedd a Mellte SAC. Whilst the lower critical load for acid deposition within the SAC is already exceeded due to the background level, further consideration has been given to the potential additional contributions of the proposed development to the levels of acid deposition likely to be experienced at Coedydd Nedd a Mellte SAC. Table 7.14 shows that the development would result in a process contribution of 0.26% of the lower critical load when considered 'alone', and a process contribution of 0.41% of the lower critical load when considered in-combination with other projects and plans. These process contributions can be screened as 'insignificant' (less than 1%).

The predicted acid deposition levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of acid deposition arising from the Enviroparks development.

7.5.1.3 Ammonia
2017 Assessment
Table 7.15 provides details of the modelled ammonia levels at Coedydd Nedd a Mellte SAC using data at IED emissions levels as a result of the Enviroparks development proposals. In-combination data is not provided as there are not any additional local impacts from the other schemes outlined in Chapter 4.

For Coedydd Nedd a Mellte SAC, a critical level of 3 is shown by APIS. However, for this assessment a critical level of 1 was used based on the guidance from GOV.UK in relation to critical levels for ammonia where lichens or bryophytes (including mosses, landworts and hornworts) were present.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg NH3/m^3 annual mean)	0.64
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.0126
Predicted Environmental Concentration (PEC) (µg NH3/m^3 annual mean)	0.6526
Long-Term Environmental Quality Standard Critical Level (µg NH3/m^3 annual mean)	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as a % of Critical Level	1.3%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as a % of EQS	65.26%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.15: 2017 Modelled Ammonia at Coedydd Nedd a Mellte SAC

Table 7.15 shows that with the Enviroparks scheme in place, the critical level, above which significant effects on the SAC habitats from ammonia could be experienced, will not be exceeded and as such there is not considered to be any adverse effect on Coedydd Nedd a Mellte SAC as a result of ammonia pollution.

In addition, based on the initial screening assessment outlined above, Table 7.15 illustrates that whilst the long-term process contribution cannot be considered insignificant as it is above 1% of the long-term critical level, based on the additional screening criteria outlined in Section 6.5.2, the PEC for the Enviroparks development as a percentage of the critical level will be 65.26% (ie below 70%) and any effects can therefore be screened out.

Table 7.16 shows the data for ammonia based on the September 2017 Air Dispersion Modelling Assessment (Envisage, 2017d). This takes into account the revisions to the background concentration calculations and the application of additional technologies.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg $NH3/m^3$ annual mean)	0.54
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.00008
Predicted Environmental Concentration (PEC) (µg $NH3/m^3$ annual mean)	0.54008
Long-Term Environmental Quality Standard Critical Level (µg $NH3/m^3$ annual mean)	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as a % of Critical Level	0.01%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as a % of EQS	54.01%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.16: 2017 Modelled Ammonia Using Additional Technologies and IED Limits at Coedydd Nedd a Mellte SAC

Table 7.16 shows that the predicated environmental concentrations will not exceed the critical level and as such there would be no adverse effect on the habitats at Coedydd Nedd a Mellte SAC from ammonia.

It can therefore be concluded that there would be no adverse effect on Coedydd Nedd a Mellte SAC as a result of ammonia pollution from the proposed development. No additional in-combination effects are predicted as the other projects outlined in Chapter 4 will not result in an additional local impacts.

2020 Assessment
Table 7.17 presents the 2020 modelled data for ammonia, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Ammonia Concentration	Enviroparks Only
Annual Average Process Contribution (PC) NH3 (µg/m3)	0.000231164
Current Background Concentration (µg NH3/m3 annual mean)	0.8
Predicted Environmental Concentration (PEC) (µg NH3/m3 annual mean)	0.800231164
Critical Level (µg NH3/m3 annual mean)	1
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.023%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 7.17: 2020 Modelled Ammonia at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.17 shows that the critical level for ammonia is 1 µg $NH3/m^3$ annual mean. The current background concentrations of ammonia at the SAC are 0.8 µg $NH3/m^3$ annual mean, and the process contribution would be <0.0005 µg $NH3/m^3$ annual mean. The PEC would be 0.800231164 µg $NH3/m^3$ annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the SAC habitats may occur, will not be exceeded. The development would result in a process contribution of 0.023% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted ammonia levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of ammonia arising from the Enviroparks development.

7.5.1.4 Oxides of Nitrogen

2017 Assessment

Table 7.18 provides details of the modelled annual mean oxides of nitrogen levels using IED emissions level data at Coedydd Nedd a Mellte SAC as a result of the Enviroparks development proposals and in-combination with the other schemes outlined in Chapter 4. Table 7.19 presents the short-term 24-hour mean data based on the same parameters.

The critical levels for NOx are detailed by APIS for Coedydd Nedd a Mellte SAC as:

- Annual mean - 30 µg/m^3 over a calendar year; and,
- 24 hour mean - 75 µg/m^3.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration NOx (ug/m^3)	6.1720	6.1720
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.2922	0.7179
Predicted Environmental Concentration (ug/m^3 annual mean)	6.464	6.890
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 annual mean)	30	30
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-term PC as a % of Critical Level	0.97%	2.4%
Long-term PC < 1 % of Critical Level?	Yes	No
Long-term Predicted Environmental Concentration (PEC) % of Critical Level	21.55%	22.97%
Long-term PEC < 70 % of Critical Level?	Yes	Yes

Table 7.18: 2017 Modelled Annual Mean Oxides of Nitrogen Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration NOx (ug/m^3)	6.1720	6.1720
24-Hour Average Oxides of Nitrogen Process Contribution (ug/m^3)	0.2896	0.6934
Short Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 24-hour mean)	75	75
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Short-Term PC as % of Critical Level	0.39%	0.92%
Short-term PC < 10 %?	Yes	Yes

Table 7.19: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.18 shows that the Enviroparks development on its own will not result in a long-term process contribution (PC) that exceeds the critical level for NOx and as a such the levels of NOx will remain at a level at which there would be no adverse effects of the habitats within Coedydd Nedd a Mellte SAC.

Table 7.18 shows that the Enviroparks scheme will result in long-term NOx pollution which is below 1% of the critical level, and as such can be screened as insignificant.

However, as Table 7.18 illustrates, with the Enviroparks development in place the long-term PEC NOx levels will be less than 70% of the critical level, both alone and in-combination with other projects.

Table 7.19 shows that when considering short-term NOx, the process contribution will not result in an exceedance of the short-term critical level and as such no effects are predicted. Based on the short-term careening process detailed in Section 6.5.2, Table 7.19 also shows that the process contribution is less than 10% of the short-term critical level, both alone and in-combination with other projects, and as such the short-term effects can be screened as insignificant.

Tables 7.20 and 7.21 shows the data from the September 2017 modelling (Envisage, 2017d) which takes into account the revised background concentrations and the additional technologies.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration NOx (ug/m^3)	5.91	5.91
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.0348	0.1376
Predicted Environmental Concentration (ug/m^3 annual mean)	5.9448	6.0476
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 annual mean)	30	30
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-term PC as a % of Critical Level	0.12%	0.46%
Long-term PC < 1 % of Critical Level?	Yes	Yes
Long-term Predicted Environmental Concentration (PEC) % of Critical Level	19.82%	20.16%
Long-term PEC < 70 % of Critical Level?	Yes	Yes

Table 7.20: 2017 Modelled Annual Mean Oxides of Nitrogen Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration NOx (ug/m^3)	9.3	9.3
24-Hour Average Oxides of Nitrogen Process Contribution (ug/m^3)	0.7972	3.20
Predicted Short-term Environmental Concentration (ug/m^3)	10.0972	12.50
Short Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 24-hour mean)	75	75
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Short-Term PC as % of Critical Level	1.06%	4.27%
Short-term PC < 10 %?	Yes	Yes

Table 7.21: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.20 and 7.21 show that based on the application of additional technologies, the predicted environmental concentrations would not exceed the critical levels for annual mean NOx or short-term NOX and as such no adverse effects are predicted.

It can therefore be concluded that there would be no adverse effect on the integrity of Coedydd Nedd a Mellte SAC from the Enviroparks scheme, either alone or in-combination, as a result of oxides of nitrogen.

2020 Assessment
Tables 7.22 and 7.23 present the 2020 modelled data for the annual mean and 24-hour mean NOx, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Oxides of Nitrogen Concentration	Enviroparks Only
Annual Average Process Contribution (PC) NOx (µg/m3)	0.0184881
Current Background Concentration (µg NOx/m3 annual mean)	8.73
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	8.7484881
Critical Level (µg NOx/m3 annual mean)	30
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.062%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 7.22: 2020 Modelled Annual Mean Oxides of Nitrogen Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

24-Hour Average Oxides of Nitrogen Concentration	Enviroparks Only
24-Hour Average Process Contribution (PC) NOx (µg/m3)	0.538507
Current Background Concentration (µg NOx/m3 annual mean)	17.46
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	17.998507
Critical Level (µg NOx/m3 annual mean)	75
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Short-Term PC as Percentage of the Critical Level (%)	0.72%
Is the Short-Term Percentage Less Than 10 %?	Yes

Table 7.23: 2020 Modelled 24-Hour Mean Oxides of Nitrogen Concertation at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.22 shows that the critical level for annual average oxides of nitrogen is 30 µg NO_x/m^3 annual mean. The current long-term background concentrations of oxides of nitrogen at the SAC are 8.73 µg NO_x/m^3 annual mean, and the long-term process contribution would be <0.05 µg m^3. The PEC would be 8.7484881 µg NO_x/m^3 annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the SAC habitats may occur, will not be exceeded. The development would result in a long-term process contribution of 0.062% of the critical level when considered 'alone'. The long-term process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 7.23 also shows that the short-term process contribution will be below the critical level of 75 µg NOx/m^3 annual mean. For the scheme in isolation, the short-term process contribution is also below 10% of the short-term critical level, at 0.72%. This is screened as 'insignificant' and as such, no assessment of in-combination effects is required.

The predicted oxides of nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It is concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of long-term or short-term oxides of nitrogen arising from the Enviroparks development.

7.5.1.5 Sulphur Dioxide

2017 Assessment

Table 7.24 provides details of the modelled sulphur dioxide levels at Coedydd Nedd a Mellte SAC, using IED limits emissions data, as a result of the Enviroparks development proposals, and in-combination with the other schemes outlined in Chapter 4.

The critical level for sulphur dioxide at Coedydd Nedd a Mellte SAC used in the assessment was 10 µg SO_2/m^3 annual mean.

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	2.48	2.48
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	0.0648	0.0818
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	2.5448	2.5618
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	10	10
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	0.6%	0.8%
Long-term PC < 1 %?	Yes	Yes
Long-term PEC as % of Critical Level	25.4%	25.6%
Long-term PEC < 70 %?	Yes	Yes

Table 7.24: 2017 Modelled Sulphur Dioxide Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

As detailed in Table 7.24, the long-term PEC will be below the critical level for sulphur dioxide with the Enviroparks scheme in place, and when the scheme is considered in-combination with the other projects outlined in Chapter 4. As such, the proposed development is not considered to have an adverse effect on Coedydd Nedd a Mellte SAC as a result of sulphur dioxide pollution.

Table 7.24 also shows that the long-term process contribution as a percentage of the critical level is below 1%, and the long-term predicted environmental concentrations will be less than 70% of the critical level and as such the effects are also considered insignificant using this additional screening criteria.

Table 7.25 shows the data for sulphur dioxide based on the September 2017 modelling work (Envisage, 2017d), and using updated background concentrations from APIS.

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	0.28	0.28
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	0.009995	0.013201
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	0.28999	0.29320
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	10	10
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	0.10%	0.13%
Long-term PC < 1 %?	Yes	Yes
Long-term PEC as % of Critical Level	2.90%	2.93%
Long-term PEC < 70 %?	Yes	Yes

Table 7.25: 2017 Modelled Sulphur Dioxide Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Based on the data in Tables 7.24 and 7.25, it can be concluded that the proposed development, either alone or in-combination with other projects, will not result in any adverse effects on Coedydd Nedd a Mellte SAC via this pathway.

2020 Assessment

Table 7.26 presents the 2020 modelled data for sulphur dioxide, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Sulphur Dioxide Concentration	Enviroparks Only
Annual Average Process Contribution (PC) SO2 (µg/m3)	0.0046283
Current Background Concentration (µg SO2/m3 annual mean)	1.31
Predicted Environmental Concentration (PEC) (µg SO2/m3 annual mean)	1.3146283
Critical Level (µg SO2/m3 annual mean)	10
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.046%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 7.26: 2020 Modelled Sulphur Dioxide Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.26 shows that the PEC will be 1.3146283 µg SO_2/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the critical level of 10 µg SO_2/m^3 annual mean, the level at which concentrations of SO_2 could have a direct adverse effect on habitats within Coedydd Nedd a Mellte SAC. Table 7.26 also shows that the development would result in a long-term process contribution of 0.046% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted sulphur dioxide levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of sulphur dioxide arising from the Enviroparks development.

7.5.1.6 Metals

2017 Assessment

The GOV.UK guidance on 'Air Emissions Risk Assessment for your Environmental Permit' highlights a requirement to calculation the process contribution for substance deposition and consider the impact they have when absorbed by soil and leaves (known as deposition).

For the Environmental Statement Addendum works (Savills, 2017), deposition of metals was modelled as part of the air quality assessment. The model has provided the output shown in Table 7.27 for cadmium and thallium and Table 7.28 for heavy metals. There are no in-combination affects from the projects outlined in Chapter 4.

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Process Contribution (PC) Cd (ng/m^3)	0.0788
Predicted Environmental Concentration (PEC) (ng Cd/m^3 annual mean)	0.2338
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-Term Process Contribution % of EQS	1.6%
PC < 1 % of EQS?	No
Long-Term Predicted Environmental Concentration % of EQS	4.68%
PEC < 70 % of EQS?	Yes

Table 7.27: 2017 Modelled Cadmium and Thallium Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.000732
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.007162
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.29%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	2.9%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.28: 2017 Modelled Heavy Metals Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Tables 7.27 and 7.28 show that the critical levels for cadmium and thallium and heavy metals would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4 (no additional contributions from other projects are predicted). As such, the scheme will not result in an adverse impact on Coedydd Nedd a Mellte SAC from these pollutants.

Table 7.27 also illustrates that although the process contribution will be above 1% of the critical level for cadmium and thallium, the long-term predicted environmental concentrations will be less than 70% of the critical level and as such the affects can be screened as insignificant.

Tables 7.29 and 7.30 present the data based on the September 2017 modelling work and the application of additional technologies.

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Process Contribution (PC) Cd (ng/m^3)	=0.0000411437
Predicted Environmental Concentration (PEC) (ng Cd/m^3 annual mean)	0.15504114
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-Term Process Contribution % of EQS	0.001%
PC < 1 % of EQS?	No
Long-Term Predicted Environmental Concentration % of EQS	3.10%
PEC < 70 % of EQS?	Yes

Table 7.29: 2017 Modelled Cadmium and Thallium Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.000006
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.006436
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.00%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as % of Critical Level	2.57%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.30: 2017 Modelled Heavy Metals Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Tables 7.29 and 7.30 show that the predicted environmental contributions will not exceed the critical level for either cadium and thallium, or heavy metals and as such the potential effects from the proposed development can be screened as insignificant.

It can therefore be concluded that there would be no adverse effects on Coedydd Nedd a Mellte SAC as a result of pollution from cadmium and thallium, or heavy metals, either alone or in-combination with the other projects in Chapter 4.

2020 Assessment

Table 7.31 presents the 2020 modelled data for cadmium and thallium, taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Cadmium and Thallium Concentration	Enviroparks Only
Annual Average Process Contribution (PC) Cd or Tl (µg/m3)	0.0092566
Current Background Concentration (µg Cd or Tl/m3 annual mean)	0.282467
Predicted Environmental Concentration (PEC) (µg Cd or Tl/m3 annual mean)	0.2917236
Environmental Assessment Level (EAL) (µg Cd or Tl/m3 annual mean)	5
Do Background Levels Exceed the EAL?	No
Do PEC Levels Exceed the EAL?	No
Long-Term PC as Percentage of the EAL (%)	0.19%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 7.31: 2020 Modelled Cadmium and Thallium Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.31 shows that the PEC will be 0.2917236 µg Cd or Tl/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the EAL of 5 µg Cd or Tl/m^3 annual mean, the level at which concentrations of cadmium and thallium could have a direct adverse effect on habitats within Coedydd Nedd a Mellte SAC. Table 7.31 also shows that the development would result in a long-term process contribution of 0.19% of the EAL when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 7.32 presents the 2020 modelled data for heavy metals, assessed against the UK Air Quality Standard for lead, and taking into account the raised height of the emissions stack.

Heavy Metals Concentration Assessed Against the UK Air Quality Standard for Lead	Enviroparks Only
Annual Average Process Contribution (PC) Heavy Metals as Lead (µg/m3)	0.000138598
Current Background Concentration (µg Pb/m3 annual mean)	0.005322549
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m3 annual mean)	0.005461147
Air Quality Standard Objective (AQS) for Lead (µg Pb/m3 annual mean)	0.25
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.06%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 7.32: 2020 Modelled Heavy Metals Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.32 shows that the PEC will be 0.005461147 µg Heavy Metals/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AQS for lead of 0.25 µg Pb/m^3 annual mean, the level at which concentrations of heavy metals could have a direct adverse effect on habitats within Coedydd Nedd a Mellte SAC. Table 7.32 also shows that the development would result in a long-term process contribution of 0.06% of the AQS when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted cadmium, thallium and heavy metals levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of pollution from cadmium and thallium, or heavy metals arising from the Enviroparks development.

7.5.1.7 Volatile Organic Compounds (VOC)

2017 Assessment

For the Environmental Statement Addendum works (Savills, 2017), volatile organic compounds (VOCs) as benzene were modelled as part of the air quality assessment. The model has provided the outputs shown in Table 7.33. There are no in-combination affects from the projects outlined in Chapter 4.

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.1936
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.0147
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.2083
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.3%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	4.2%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.33: 2017 Modelled Volatile Organic Compounds Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.33 shows that the critical levels for VOCc as benzene would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4. As such, the scheme will not result in an adverse impact on Coedydd Nedd a Mellte SAC from these pollutants. Table 7.33 also illustrates that the process contribution is less than 1% of the critical level, and as such it would be possible to screen out any effects as insignificant.

Table 7.34 shows the data from the September 2017 modelling works taking into account background concentrations and the application of additional technologies.

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.207
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.00876
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.21576
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.18%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	4.32%
Long-term PEC < 70 % of Critical Level?	Yes

Table 7.34: 2017 Modelled Volatile Organic Compounds Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.34 shows that the predicted environmental contributions will not be exceeded with the development in place and as such the impacts from the proposed development can be screened out.

It can therefore be concluded that there would be no adverse effects on Coedydd Nedd a Mellte SAC as a result of deposition from VOCs as benzene.

2020 Assessment
Table 7.35 presents the 2020 modelled data for VOC concentration, assessed against the UK Air Quality Standard for benzene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Volatile Organic Compound Concentration Assessed Against the UK Air Quality Standard for Benzene	Enviroparks Only
Annual Average Process Contribution (PC) VOC (µg/m3)	0.0046283
Current Background Concentration (µg C6H6/m3 annual mean)	0.161622
Predicted Environmental Concentration (PEC) (µg C6H6/m3 annual mean)	0.1662503
Air Quality Standard Objective (AQS) for Benzene (µg C6H6/m3 annual mean)	5
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.09%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 7.35: 2020 Modelled Volatile Organic Compounds Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.35 shows that the PEC will be 0.1662503 µg C6H6/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AQS for benzene of 5 µg C6H6/m^3 annual mean, the level at which concentrations of VOCs could have a direct adverse effect on habitats within Coedydd Nedd a Mellte SAC. Table 7.35 also shows that the development would result in a long-term process contribution of 0.09% of the AQS when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted VOC levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of VOCs arising from the Enviroparks development.

7.5.1.8 Polycyclic Aromatic Hydrocarbons (PAH)
2017 Assessment
Table 7.36 shows the modelled data for Polycyclic Aromatic Hydrocarbons (PAH) at Coedydd Nedd a Mellte SAC. There are no in-combination affects from the projects outlined in Chapter 4.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ng/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ng/m^3)	0.0015
Predicted Environmental Concentration (PEC) (ng PAH/m^3 annual mean)	0.1895
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	0.2%
Long-term PC < 1 % of EQS?	Yes
Long-term PEC as % of EQS	19.0%
Long-term PEC < 70 % of EQS?	Yes

Table 7.36: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.36 shows that the critical levels for PAH would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4 (no contributions from other projects are predicted for PAH). As such, the scheme will not result in an adverse impact on Coedydd Nedd a Mellte SAC SAC from these pollutants. Table 7.36 also illustrates that the process contribution is less than 1% of the critical level, and as such it would be possible to screen out any effects as insignificant.

Table 7.37 shows the data for PAH based on the September 2017 data.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ng/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ng/m^3)	0.0001839
Predicted Environmental Concentration (PEC) (ng PAH/m^3 annual mean)	0.1881839
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	0.0184%
Long-term PC < 1 % of EQS?	Yes
Long-term PEC as % of EQS	18.82%
Long-term PEC < 70 % of EQS?	Yes

Table 7.37: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using Additional Technologies and IED Emissions Levels Data at Coedydd Nedd a Mellte SAC

Table 7.37 shows that when taking the proposed development into account, the critical level would not be exceeded.

It can therefore be concluded that there would be no adverse effects on Coedydd Nedd a Mellte SAC as a result of deposition from PAH.

2020 Assessment

Table 7.38 presents the 2020 modelled data for PAH concentration, assessed against the Ambient Air Directive Standard for Benzo[a]Pyrene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Polycyclic Aromatic Hydrocarbon Concentration Assessed Against the Ambient Air Directive Standard for Benzo[a]Pyrene	Enviroparks Only
Annual Average Process Contribution (PC) PAH (µg/m3)	0.00046283
Current Background Concentration (µg B[a]P/m3 annual mean)	< 0.1
Predicted Environmental Concentration (PEC) (µg B[a]P/m3 annual mean)	0.10046283
Ambient Air Directive Standard (AAD) (µg B[a]P/m3 annual mean)	1
Do Background Levels Exceed the AAD?	No
Do PEC Levels Exceed the AAD?	No
Long-Term PC as Percentage of the AAD (%)	0.05%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 7.38: 2020 Modelled Polycyclic Aromatic Hydrocarbon Concentration at Coedydd Nedd a Mellte SAC, accounting for Raised Emissions Stack

Table 7.38 shows that the PEC will be 0.10046283 µg B[a]P/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AAD of 1 µg B[a]P/m^3 annual mean, the level at which concentrations of PAHs could have a direct adverse effect on habitats within Coedydd Nedd a Mellte SAC. Table 7.38 also shows that the development would result in a long-term process contribution of 0.05% of the AAD when considered ‘alone’. This process contribution is screened as ‘insignificant’ (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted PAH levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Coedydd Nedd a Mellte SAC as a result of PAHs arising from the Enviroparks development.

7.5.1.9 Traffic Considerations

Additional effects on traffic during construction and operation of the proposed development are considered in Section 6.5.2.10 for Blaen Cynon SAC. This section of the report shows that the impacts on traffic generated during construction and operation of the site on the air quality data presented above is insignificant and therefore need not be considered further.

No additional effects on Coedydd Nedd a Mellte SAC as a result of air pollution are therefore predicted from traffic generated by the development, during construction or operation, either alone or in-combination with other projects and plans.

8. CWM CADLAN SAC

8.1 QUALIFYING CRITERIA

The following information is taken from the Joint Nature Conservation Committee (JNCC) site description and accompanying Natura 2000 data sheet, both of which are available at:
https://sac.jncc.gov.uk/site/UK0013585

Country:	Wales
Unitary Authority:	East Wales
Centroid:	SN961098
Latitude:	51.77722222
Longitude:	-3.505277778
Site Code:	UK0013585
Status:	Designated Special Area of Conservation (SAC)
Area (ha):	84.2

Cwm Cadlan SAC is situated approximately 1 km north-east of the village of Penderyn and about 4 km north of Hirwaun, near Aberdare. The site was notified in 2000 and incorporates the former Cwm Cadlan Grasslands SSSI and Glyn-Perfedd Meadow SSSI. The SAC interests are '*Molinia* meadows on calcareous, peaty or clayey silt-laden soils (*Molinion caeruleae*)' and 'Alkaline Fens'. Both these habitats are considered to be 'best areas in the United Kingdom'. Part of the site is owned by CCW and was declared a National Nature Reserve (NNR) in 2006.

8.1.1 SAC Qualifying Criteria

8.1.1.1 Qualifying Habitats

The site contains the following Annex I habitats (Habitats Directive: 92/43/EEC) that are listed as primary reasons for selection:

6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
Cwm Cadlan has the largest recorded example of *Molinia* meadows in Wales. The typical form of *Molinia caerulea* – *Cirsium dissectum* fen-meadow (M24b) is extensively developed, and there are clearly-displayed transitions to a range of associated habitats, including base-rich flush and neutral grassland. Globe-flower *Trollius europaeus* occurs in the *Molinia* meadows here towards the southern limit of its British distribution.

7230 Alkaline fens
Cwm Cadlan supports an outstanding suite of flushed short-sedge mire communities on glacial drift overlying Carboniferous limestone within the valley of the Nant Cadlan on the southern fringe of Brecon Beacons National Park. Communities referable to NVC type M10 *Carex dioica* – *Pinguicula vulgaris* mire occur widely, often in close association with flushed examples of purple moor-grass *Molinia caerulea* meadow (M24 *Molinia caerulea* – *Cirsium dissectum* fen-meadow), and characteristic species include common butterwort *Pinguicula vulgaris*, bog pimpernel *Anagallis tenella*, marsh arrowgrass *Triglochin palustris* and the moss *Campylium stellatum*. Other sedge-rich swards are also present which display floristic affinities to both M10 and M24; basophilous elements of this vegetation include tawny sedge *Carex hostiana*, flea sedge *Carex pulicaris* and quaking-grass *Briza media*

8.1.1.2 Qualifying Species

The site does not support any Annex II species that are listed as primary reasons for selection.

Cwm Cadlan SAC comprises 10 no. management units, shown on the CCW Management Units plan in Appendix 3.

8.2 CONSERVATION OBJECTIVES

The CCW (2008c) Core Management Plan for Cwm Cadlan SAC includes the conservation objectives for designated features. Each conservation objective consists of the following two elements: vision for the feature; and, performance indicators. During a meeting on 9th May 2017 with Natural Resources Wales, it was confirmed that whilst an updated management plan for Cwm Cadlan SAC is currently being produced, this has not yet been published and therefore the 2008 plan is considered to represent the most up to date management plan for the site. It was also confirmed that up to date habitat surveys of this site were completed in 2016 by NRW as part of a condition assessment survey, although the reports are not yet available. At the time of writing this RevC version of the report, an updated management plan or updated habitat survey reports did not appear to have been produced.

8.2.1 SAC Feature: *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Fen-meadow will occupy at least 26 ha of a total area of marshy grassland habitat which itself will cover at least 42 ha.
- The remainder of the site will mainly consist of other semi-natural habitat, including alkaline fen.
- Typical fen-meadow plants will be common.
- Plants indicating agricultural modification or alteration to hydrology and drying of soils will be absent or present at only low cover.
- Although rushes are frequent, the more bulky species will not exceed 33% cover.
- Bare ground will generally not exceed 5% cover and vegetation litter 25%.
- Dense scrub will be largely absent from the fen-meadow, but it is probably desirable for invertebrates and birds to have a sparse scattering of shrubs or trees.
- All factors affecting the achievement of these conditions are under control.

The performance indicators for the condition of the feature and the factors affecting the feature are provided in Table 8.1. This table also encompasses the SSSI feature marshy grassland (non-SAC) with associated wet heath and acidic flushes (see Section 8.2.3).

Performance Indicators for Feature Condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Extent and distribution of marshy grassland	Extent is based on ground surveys (1991/1998 & 1999) and aerial photographs. For detailed rationale, see Annex of the CCW Core Management Plan (2008).	*Upper limit*: N/A, constrained by hydrology. *Lower limit*: 42 ha, of which 26 ha is fen-meadow (these figures represent the extent indicated by the most recent vegetation surveys). Located in units 1-9.
A2. Habitat quality	For the purposes of assessment against these criteria the main fen-meadow areas have been defined for all site units (see Annex for rationale and maps).	*Upper limit*: 100% of the vegetation meets the criteria listed below. *Lower limits*: In each of the fen-meadow areas shown on the map (see Annex), at least 75% of the vegetation meets the definition listed below for fen-meadow AND: 75% of the remaining marshy grassland meets the definition listed below for 'marshy grassland'.
Definition of fen-meadow: In any 0.5m radius, purple moor-grass **and** at least 4 out of the following are present: quaking grass; tawny sedge; flea sedge; bog pimpernel; meadow thistle; devil's-bit scabious; marsh valerian. **and** together the following species do not exceed 10%: creeping buttercup; common mouse-ear; crested dog's-tail; Yorkshire fog; creeping bent; ribwort plantain and white clover; **and** the cover of tall rushes does not exceed 33%; **and** cover of purple moor-grass does not exceed 66%; **and** the cover of vegetation litter does not exceed 25%; **and** the cover of bare ground does not exceed 5%; **and** scrub/woody species are largely absent.		
Definition marshy grassland: As fen-meadow is mixed in with these other marshy grassland types, it is expected that focussing monitoring on the fen-meadow component should reflect quality of the other marshy grassland types: The various marshy grassland stands generally reflect the NVC/vegetation types mapped during the vegetation surveys (see Annex of Core Management Plan). The marshy grassland is essentially pasture dominated by a mixture of purple moor-grass and rush spp. in varying proportions, with at least one of the following species present: common marsh bedstraw, fen bedstraw, greater bird's-foot trefoil, quaking grass, carnation sedge, flea sedge, tawny sedge, meadow thistle, devil's-bit scabious, marsh valerian……. (NB – CCW Core Management Plan states that this will need further work to better define the types present). **and** in any 1m radius, the vegetation height is between 5 and 40 cm tall (excluding tall rushes and flower heads); **and** the cover of vegetation litter does not exceed 25%; **and** the cover of bare ground does not exceed 5%; **and** scrub/woody species are largely absent.		

Table 8.1: Performance Indicators for Cwm Cadlan SAC Feature: *Molinia* **meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (continues)**

Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Livestock grazing	The marshy grassland has been maintained through traditional farming practices. Without an appropriate grazing regime, the grassland would become rank and eventually turn to scrub and woodland. Light grazing by mainly cattle and ponies between April and November each year is essential in maintaining the marshy grassland and fen-meadow communities.	*Lower limits:* The wetland areas will be subject to light summer grazing by cattle and/or ponies at least 4 in every 5 years. *Upper limits:* No significant grazing outside the growing season or heavy grazing at any time during the summer. Light summer grazing is defined as - cattle and/or ponies at a rate of 0.4 LSU/ha/year for the period April to October. Heavy grazing is defined as greater than 1 LSU/ha/year (1 LSU is equivalent to a cow/horse, plus calf/foal).
F2. Drainage	The marshy grassland communities are strongly influenced by the quantity and base status of the groundwater. Reductions in the quality and quantity of the water in the springs and watercourses feeding the site may lead to a loss of marshy grassland or changes in species composition. Conversely, reduced/impeded drainage may lead to ground-water stagnation and a different change in species composition, e.g. increased abundance of rushes. Infilling some of the many ditches at the site is likely to lead to re-wetting of some marshy grassland. Dewatering of the adjacent quarry has potential to affect the hydrology of the site.	*Upper limit:* No new drainage ditches to be installed within the open meadow areas of the site. NB. It is not possible to set more specific pending a fuller understanding of current situation and habitat requirements. Rewetting could lead to a switch from marshy grassland to alkaline fen, which should be acceptable as this would be the more natural (and scarcer) community. Monitoring of the quarry dewatering should give an early indication that the dewatering is affecting the site.
F3. Adjacent land use	Management of adjoining land has potential to affect the nutrient status of soils (some marshy grassland is at the base of slopes with the rest of the field managed as hay-meadow).	No limits set. Monitoring vegetation should indicate any changes. Much adjoining land is under sympathetic management, and so the risk of any adverse impact is low.
F.4 Scrub encroachment	Open wetland areas are prone to invasion by alder and willow scrub. Optimum grazing levels should help control spread of scrub, but occasionally active scrub eradication is necessary. Scrub and woodland is also a natural component of such wetland complexes and enhances the site both biologically and visually, therefore older well-established stands will be retained.	The maximum area of mature dense wet woodland will be 6.5ha (extent in 1999). Scattered scrub will be tolerated within the following limits: *Lower limits:* Scattered scrub present in defined locations. *Upper limits:* No scrub covering area greater than 5m x 5m within stands mapped as marshy grassland (see Annex of Core Management Plan).
F.5 Atmospheric pollution.	The alkaline fen may be the more sensitive vegetation type present.	See Section 8.2.2 below.

Table 8.1 (continued): Performance Indicators for Cwm Cadlan SAC Feature: ***Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)**

8.2.2 SAC Feature: Alkaline Fen

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Alkaline Fen will occupy about 11 ha or more.
- The remainder of the site will mainly consist of other semi-natural habitat including fen-meadow.
- Typical alkaline fen plants will be common.
- Plants indicating agricultural modification or alteration of hydrology and drying of soils will be absent or present only at low cover.
- Although rushes are frequent, the more bulky species will not exceed 33% cover.
- Bare ground will generally not exceed 5% cover and vegetation litter 10%.

- Scrub species will be largely absent from the alkaline fen.
- At selected springheads, water should flow in all but the most severe drought conditions.
- All factors affecting the achievement of these conditions are under control.

The performance indicators for the condition of the feature and the factors affecting the feature are provided in Table 8.2.

Performance Indicators for Feature Condition		
Attribute	***Attribute rationale and other comments***	***Specified limits***
A1. Extent and distribution	Extent is based on ground surveys and 2006 aerial photographs. For detailed rationale, see Annex of the Core Management Plan (2008).	*Upper limit*: N/A, constrained by hydrology. *Lower limit*: 11 ha. Located in Units 1-4, 6-9 (NB - some of the quarry monitoring is carried out in small stands in Unit 1 L7 (see Annex of Core Management Plan) - here the alkaline fen occurs mainly as small runnels too small to map individually)
A2. Habitat quality	For the purposes of assessment against these criteria the main areas of alkaline fen have been identified (see maps in Annex of this plan). For detailed rationale see Annex of the Core Management Plan (2008).	*Upper limit*: 100% of the vegetation meets the criteria listed below. *Lower limits*: In each of the main areas of fen at least 75% of the vegetation meets the definition listed below.
Definition of alkaline fen: In any 0.5m radius, the vegetation height is between 5 and 20 cm tall; **And** at least 5 out of the following are present: tawny sedge; flea sedge; dioecious sedge; intermediate hook-moss *Drepanocladus cossonii*; yellow starry feather-moss *Campylium stellatum*; curled hookmoss *Palustriella commutata*; marsh bryum *Bryum pseudotriquetrum*; maidenhair pocket-moss *Fissidens adianthoides*; bog pimpernel; marsh lousewort; common butterwort; quaking grass; water mint; marsh pennywort; marsh valerian and marsh arrowgrass; **and,** the cover of 'brown' mosses (see above) is over 10%; **and,** the cover of creeping buttercup, lesser spearwort and white clover does not exceed 10%. **and** the cover of tall rushes and purple moor-grass does not exceed 33%; **and** there is no discernable cover of vegetation litter - less than 10%; **and** the cover of bare ground does not exceed 5%; **and** scrub/woody species are largely absent.		
Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F1. Grazing	The alkaline fen has been maintained through traditional farming practices. Without an appropriate grazing regime, the sward would become rank and eventually turn to scrub and woodland. Light grazing by mainly cattle and ponies between April and November each year is essential in maintaining the habitat.	See Section 8.2.1
F2. Drainage	The alkaline fen communities are strongly influenced by the quantity and base status of the groundwater. Reductions in the quality and quantity of the water in the springs and watercourses feeding the site may lead to a loss of alkaline fen or changes in species composition. Conversely, reduced/impeded drainage may lead to ground-water stagnation and a different change in species composition, e.g. increased abundance of rushes. Infilling some of the many ditches at the site is likely to lead to re-wetting of some former alkaline fen areas. Dewatering of the adjacent quarry has potential to affect the hydrology of the site.	See Section 8.2.1
F3. Adjacent land use	See Section 8.2.1	See Section 8.2.1
F4. Scrub encroachment	See Section 8.2.1	See Section 8.2.1

Table 8.2: Performance Indicators for Cwm Cadlan SAC Feature: Alkaline Fen (continues)

Performance Indicators for Factors Affecting the Feature		
Factor	***Factor rationale and other comments***	***Operational Limits***
F5. Atmospheric pollution.	Atmospheric deposition at this site has the potential to harm the alkaline fen feature. Dust deposition is likely to be high given the close proximity of Penderyn Quarry, and the absence of a published critical load for this pollutant against this habitat should be taken as indicating lack of impact. Atmospheric N deposition in this area is estimated at 21.8 kg N/ha/yr which lies above the lower critical load limit for this pollutant (15-35 kg N / ha / yr). It is likely that the critical load for N for M10 forms of alkaline fen is towards the lower end of this range.	Lower limits: None set – very low dust and N deposition regimes may be beneficial. Upper limits: Suggest 15 kg N / ha / year for N. None yet defined for dust – further advice needed.

Table 8.2 (continued): Performance Indicators for Cwm Cadlan SAC Feature: **Alkaline Fen**

During the consultation process, Natural Resources Wales provided a plan showing the location of the Annex 1 Habitats within Cwm Cadlan SAC, based on 2016 SAC monitoring data. This plan, which is included in Appendix 3, shows that the habitats which are closest to the Enviroparks scheme include alkaline fens and M*olina* meadows, with *Molinia* meadow habitat mosaics located slightly further away from the Enviroparks scheme, but still within the western section of the site.

8.2.3 Additional SSSI Features

The SAC also supports the following three SSSI features, for which conservation objectives are provided in the Core Management Plan for the SAC:

- Marshy grassland (non-SAC) with associated wet heath and acidic flushes;
- Unimproved neutral grassland; and,
- Globeflower *Trollius europaeus*.

Conservation objectives for SSSI feature ‘marshy grassland (non-SAC) with associated wet heath and acidic flushes’ are included within Table 8.1.

The SSSI feature ‘unimproved neutral grassland’ corresponds to NVC type MG5. Most of this is present as small areas on better-drained ground within fields of mainly wet pasture. Conservation objectives for this feature have not yet been provided.

The SSSI feature ‘Globeflower *Trollius europaeus*’ is probably the largest population of this declining plant in south Wales, occurring mainly in stands of fen-meadow, alkaline fen and neutral grassland. Conservation objectives for this feature have not yet been provided.

8.3 VULNERABILITY OF THE SAC

The Core Management Plan (CCW, 2008c) includes an assessment of the conservation status of qualifying features and management requirements to maintain or restore each feature.

8.3.1 SAC Feature: *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (and SSSI Feature marshy grassland (non-SAC) with associated wet heath and acidic flushes)

In 2007, the conservation status of these features was considered to be **unfavourable**. Assessment carried out in 2004 indicated that the condition of these features was **unfavourable, no change**. This was predominantly due to unsuitable grazing practices, and the Core Management Plan (2008c) states that there is continuing uncertainty over the impacts of drainage and quarrying.

Management requirements were provided for the following issues, for which further information is provided in Table 8.3:

- Grazing;
- Control of nutrient inputs;
- Scrub encroachment; and,
- Drainage.

Issue contributing to Unfavourable Status of Feature	Explanation and Management Required
Grazing	The fen-meadow is mixed in with other marshy grassland and mire types, but each management unit is subjected to one prescription (excepting those areas that are mown for hay). Management should focus on maintaining or restoring the condition of the fen-meadow and therefore the condition of the remaining areas of marshy grassland will be of secondary importance, but it is likely that if management is suitable for the fen-meadow it should also benefit most other forms of marshy grassland. Maintaining or restoring the marshy grassland should be attainable through the implementation of the present grazing regime and scrub control, with cattle producing the best sward structure. The site has been managed under a relatively light grazing regime in recent years. The present management is considered to be generally acceptable for recovery of modified stands in the long term, and site management will be reviewed periodically. Stocking rates should be guided by the values listed in the Lowland Grassland Handbook. Some grazing earlier in the year and mowing to remove the ranker vegetation should help to encourage grazing in those areas of ranker grassland, control scrub development and reduce the build-up of any litter. Grazing levels need monitoring and management agreements adjusted if required. Monitoring structural elements (bare ground, litter) will identify any problems with the intensity of grazing management. Any excessive grazing pressure would be expected to increase the frequency and cover of bare ground and agricultural species. These are all covered by attributes in the feature objectives. Stocking levels are dependant on the growth of vegetation, which may vary from year to year, but the agreed management policy allows for this. Cessation of cattle farming could affect the vegetation, as sheep are more selective grazers.
Control of nutrient inputs	There has been concern about fertilizer run-off from some adjacent improved fields causing localised nutrient enrichment. Any effects from agricultural run-off from adjacent fields will be identified through monitoring the quality of the vegetation under the feature objectives, looking for increases in the cover of perennial ryegrass and white clover and other indicator plants and reductions in the frequency of sedges and other plants of value. Management agreements on adjacent land will partly address this problem.
Scrub encroachment	Scrub developing within the areas of marshy grassland will on the whole be controlled, although the presence of a few scattered scrub and trees will benefit invertebrates and birds. The marshy grassland areas could be increased beyond the current extent by cutting back the scrub edges and is something that needs to be kept under review, should opportunities arise. The established stands of alder and willow woodland should not be viewed unfavourably as they lend structure to the site and also provides habitat for invertebrates and birds, with the ground vegetation also containing plant species of note (e.g. meadow saxifrage) and the trees themselves supporting good moss and liverwort communities and uncommon lichens. In addition, some stands afford a refuge for colonies of globeflower. However, woodland and scrub should not encroach further into the unimproved grassland, in particular the communities of highest conservation value (alkaline fen, fen-meadow and neutral grassland).
Drainage	The networks of ditches throughout the SSSI have obviously affected the hydrology and vegetation. These ditches should be allowed to infill naturally (as some have already). Where possible, active restoration of the hydrology should be considered, although this may be difficult in some areas as there would be conflict with the monitoring associated with the quarrying activities. Should dewatering of Penderyn quarry affect the hydrology of the SSSI and/or if the recent run of very dry summers in which watercourses have dried-up continue, then floristic changes are likely to occur.

Table 8.3: Summary of Issues Contributing to Unfavourable Status of Feature and Management Required

With respect to the non-SAC marshy grassland, which mainly comprises rush and purple moor-grass dominated vegetation and tall-herb fen, management of the SAC features should ensure that the non-SAC marshy grassland is kept in favourable condition. There may be a need from time to time to cut rushes where they have thickened up.

6.3.2 SAC Feature: Alkaline Fen

In 2007, the conservation status of this feature was considered to be **unfavourable**. Assessment carried out in 2004 indicated that the condition of this feature was **unfavourable, recovering**. This was predominantly due to modification of the habitat as a result of drainage, unsuitable grazing practices, and inappropriate tree planting.

Management requirements were provided for the following issues, for which further information is provided in Table 6.4:

- Grazing;
- Scrub encroachment;
- Drainage; and,
- Atmospheric deposition.

Issue contributing to Unfavourable Status of Feature	Explanation and Management Required
Grazing	These areas will be subject to the same grazing regime as the marshy grassland (see Table 8.3 above) because they occur together in the same management units. Therefore it is considered inappropriate to specify specific grazing regimes for this habitat. Structural attributes will help to ensure that this habitat is grazed appropriately, so long as this is compatible with achieving the required condition for the marshy grassland. As the alkaline fen is some of the wettest habitat at the site, damage by overgrazing, e.g. excessive poaching, is likely to be readily observed.
Scrub encroachment	Scrub can be monitored by a simple inspection of the site; in most cases the limits should not be exceeded before those limits for other attributes. This and compliance with the management agreement can be determined while monitoring other attributes. See Table 8.3 above.
Drainage	See Table 8.3 above.
Atmospheric deposition	N deposition emanates from point and diffuse sources. Reductions in N emissions from the latter require ongoing policy reform and advice at national (Wales and UK) levels. Point source impacts need to be evaluated and minimised through RoC and the planning system. Dust deposition from the quarry should be minimised by standard good working practice. Dust deposition should be monitored by the quarry, and appropriate thresholds sought from the literature. Comparison of the two may reveal the need for modifications to working practice.

Table 8.4: Summary of Issues Contributing to Unfavourable Status of Feature and Management Required

8.3.2 Current Threats to SAC

The Natura 2000 – Standard Data Form (2015c) states that the main threats to this SAC are:

High-rank threats:

- Air pollution, air-borne pollutants – both inside and outside of the SAC;

Medium-rank threats:

- Fertilisation - both inside and outside of the SAC;
- Grazing – inside of the SAC;
- Human induced changes in hydraulic conditions – both inside and outside of the SAC;
- Problematic native species – both inside and outside of the SAC;

Low-rank threats:

- Biocenotic evolution, succession – both inside and outside of the SAC.

8.4 POTENTIAL EFFECTS ON CWM CADLAN SAC – STAGE 1: SCREENING

This section of the report provides an assessment of the potential effects of the proposed development on the Cwn Cadlan SAC. The section has been structured to provide consideration of each of the likely pathways for impacts and the site's vulnerabilities as identified in Sections 8.2 and 8.3. Some of the identified 'risks' are identified from the 2008 Core Management Plan for the site (CCW, 2008c), and some are from the 2015 Natura 2000 Standard Data Form. Where there are overlaps between the 'risks' outlined in the two documents, these have been discussed together.

DIRECT EFFECTS

8.4.1 Fertilization / Grazing / Forest Plantation Management and Use

These risks are considered in the 2015 Natura 2000 Standard Data Form to be a high-rank risk to the SAC, from impacts both inside and outside of the SAC boundary.

The proposed development will have no impact on grazing or forest plantation management, therefore no likely significant effects are predicted on the SAC from this pathway, either alone or in-combination with other plans or projects. No further assessment is required.

8.4.2 Scrub Encroachment / Interspecific Floral Relations / Problematic Native Species

Cwm Cadlan SAC is located 2.48 km north of the proposed development site. Given the nature of the proposed development, and the distance between the proposed development site and the SAC it can be concluded that the proposed development will have no impact on scrub encroachment, interspecific floral relations or problematic native species and therefore no likely significant effects on the SAC from this pathway are predicted, either alone or in-combination with other projects or plans. No further assessment is required.

INDIRECT EFFECTS

8.4.3 Atmospheric Deposition / Air Pollution, Airborne Pollutants

This risk is considered in the 2015 Natura 2000 Standard Data Form to be a high-rank risk to the SAC, from impacts both inside and outside of the SAC boundary.

As for Blaen Cynon SAC and Coedydd Nedd a Mellte SAC, the detailed assessment work that has been undertaken in relation to potential air pollution impacts on Cwm Cadlan SAC is considered to provide enough information to allow the competent authority to undertake an Appropriate Assessment, and is therefore presented separately, in Section 8.5.

8.4.4 Human Induced Changes in Hydraulic Conditions

The 2009 sHRA assessment (Report RT-MME-104641) concluded that

> *"Given the location of Cwm Cadlan SAC 2.48 km north-east of the proposed Enviroparks development site and the fact that the two sites are not hydrologically linked by surface water or groundwater it is not anticipated that these will be any significant effect on the integrity of Cwm Cadlan SAC as a result of hydrological changes brought about by the proposed development."*

The current proposals do not result in any changes which would also this assessment, and as such it can be concluded that there no likely significant effects on the SAC from this pathway, either alone or in-combination with other plans or projects. No further assessment is required.

8.4.5 Conclusions Following Stage 1: Screening

The Stage 1: Screening exercise has identified that the proposed development will have no 'Likely Significant Effect' on Cwm Cadlan SAC as a result of the following threats/pressures:

- Fertilization / grazing / forest plantation management and use;
- Scrub encroachment / interspecific floral relations / problematic native species; or,
- Human induced changes in hydraulic conditions.

These threats/pressures are not considered further.

8.5 COEDYDD NEDD A MELLTE SAC – STAGE 2: APPROPRIATE ASSESSMENT

The Stage 1: Screening exercise has identified that, in the absence of mitigation, the following threat has the potential to result in a 'Likely Significant Effect' on Cwm Cadlan SAC, and therefore requires further assessment:

- Atmospheric Deposition / Air Pollution, Airborne Pollutants.

This issue is discussed in more detail below.

8.5.1 Atmospheric Deposition / Air Pollution, Airborne Pollutants

This section of the report provides modelling data associated with air quality changes as a result of the Enviroparks scheme, both alone and in-combination with other projects, on Cwm Cadlan SAC. The methodologies applied to the modelling works are as outlined in Section 6.5.2 and as such are not repeated here.

For Cwm Cadlan SAC, the modelling is based on the closest point of the SAC to the development site, located at grid reference 294970, 209125. This location is within SAC Management Unit 2 which contains both 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (H6410)' and 'Alkaline fens (H7230)' as key habitats (Core Management Plan, 2008c).

8.5.1.1 Nutrient Nitrogen

2017 Assessment

Table 8.5 provides a summary of the modelled deposition rates using IED emissions limits for nutrient nitrogen at Cwm Cadlan SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4. This data is considered to represent a worst case scenario, likely to be only experienced when the gasifiers are emitting at the limits of their permits. The data in Table 8.6 shows the results of modelling using the Laxen and Marner (2005) assessment method.

For Cwm Cadlan SAC, a lowest critical load of 15 was used as this is the lowest critical load identified by APIS (see http://www.apis.ac.uk/srcl/select-a-feature?site=UK0013585&SiteType=SAC&submit=Next t) which would be relevant to some of the habitats found within the SAC, and particularly those within Management Unit 2, closest to the Enviroparks development site. The higher critical load for this site used in the calculations was 25.

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	19.6	19.6
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.128	0.203
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	19.728	19.803
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	15	15
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.9%	1.4%
Long-term PC < 1 % of lower Critical Load?	No	Yes (rounded down data)
Long-term PEC as % of lower Critical Load	**131.5%**	**132.0%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical Load (kg N/ha/yr)	25	25
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.5%	0.8%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	78.9%	79.2%
Long-term PEC < 70 % of higher Critical Load?	No	No

Table 8.5: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Cwm Cadlan SAC

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	19.6	19.6
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.103	0.178
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	19.703	19.778
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	15	15
Do background levels exceed the lower critical load?	**Yes**	**Yes**
Do PEC levels exceed the lower critical load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.7%	1.2%
Long-term PC < 1 % of lower Critical Load?	Yes	Yes (rounded down data)
Long-term PEC as % of lower Critical Load	131.35%	131.85%
Long-term PEC < 70 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical Load (kg N/ha/yr)	25	25
Do background levels exceed the higher critical load?	No	No
Do PEC levels exceed the higher critical load?	No	No
Long-term PC as % of higher Critical Load	0.5%	0.8%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	78.9%	79.2%
Long-term PEC < 70 % of higher Critical Load?	No	No

Table 8.6: 2017 Modelled Nutrient Nitrogen Deposition Using IED Limits Emissions Data at Cwm Cadlan SAC and Laxen and Marner (2005) Assessment Method

Table 8.7 presents the data using the Laxen and Marner (2005) methodology and based on long-term realistic emissions data.

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	19.6	19.6
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.096	0.172
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	19.696	19.772
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	15	15
Do background levels exceed the lower critical load?	**Yes**	**Yes**
Do PEC levels exceed the lower critical load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.6%	1.15% (rounded down data)
Long-term PC < 1 % of lower Critical Load?	Yes	Yes
Long-term PEC as % of lower Critical Load	131.3%	131.8%
Long-term PEC < 70 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical Load (kg N/ha/yr)	25	25
Do background levels exceed the higher critical load?	No	No
Do PEC levels exceed the higher critical load?	No	No
Long-term PC as % of higher Critical Load	0.4%	0.7%
Long-term PC < 1 % of higher Critical Load?	Yes	-
Long-term PEC as % of higher Critical Load	78.8%	79.1%
Long-term PEC < 70 % of higher Critical Load?	No	No

Table 8.7: 2017 Modelled Nutrient Nitrogen Deposition Using Long-Term Realistic Emissions Data at Cwm Cadlan SAC and Laxen and Marner (2005) Assessment Method

Tables 8.5 to 8.7 show that the background concentrations of nutrient nitrogen within Cwm Cadlan SAC (19.6 kg N/ha/yr) are already above the lower critical load (15 kg N/ha/yr) for the SAC habitats, although they do not exceed the higher critical load.

Alone, the proposed Enviroparks development will not result in a process contribution which is greater than 1% of the lower or the higher critical load, using either the worst case IED levels emissions data (Table 8.5), the Laxen and Marner (2005) model approach (Table 8.6) or the long-term realistic emissions data model shown in Table 8.7. As such any potential effects of nutrient deposition from the scheme alone can be screened out.

Tables 8.5 to 8.7 identify that the 'in-combination' process contributions, when based on the worst case scenario would be 1.2% of the lower critical load. However when the long-term realistic emissions data is modelled, the 'in-combination' process contributions would be 1.15%.

Tables 8.5 to 8.7 show that even with the development in place and in-combination with other projects, the higher critical load for this site will not be exceeded. Capon et al (2016) state that the integrity of sites may be threatened at higher loads of long-term nitrogen deposition beyond the critical load range by graminoid domination and structural change. The proposed development will not result in levels of nitrogen deposition at Cwm Cadlan SAC which are above the higher critical load for the habitats and as such, it is not considered that the scheme would result in an adverse effect on the integrity of the SAC as a result of nitrogen deposition.

In response to the consultation response from NRW and further consultation with them during the planning process, additional modelling works were completed in September 2017 (see Envisage, 2017d). The data presented in Table 8.8 provides the modelled results taking into account the application of additional technologies, using IED emissions data, and a conversion of 70% NOx to NO_2. Table 8.8 also provides the updated background concentrations from APIS which were accessed in August 2017.

Nutrient Nitrogen (N)	Enviroparks Only	In-Combination
Current Minimum Background (kg N/ha/yr)	21.42	21.42
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.0062	0.0189
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	21.4262	21.4389
Lower Critical Load:		
Lower Critical Load (kg N/ha/yr)	15	15
Do background levels exceed the lower critical load?	**Yes**	**Yes**
Do PEC levels exceed the lower critical load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.04%	0.13%
Long-term PC < 1 % of lower Critical Load?	Yes	Yes
Long-term PEC as % of lower Critical Load	142.84%	142.93%
Long-term PEC < 70 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical Load (kg N/ha/yr)	25	25
Do background levels exceed the higher critical load?	No	No
Do PEC levels exceed the higher critical load?	No	No
Long-term PC as % of higher Critical Load	0.02%	0.08%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	85.70%	85.76%
Long-term PEC < 70 % of higher Critical Load?	No	No

Table 8.8: 2017 Modelled Nutrient Nitrogen Deposition Using Additional Technologies and IED Limits Emissions Data at Cwm Cadlan SAC and 70% Conversion of NOx and NO_2

Table 8.8 shows that the background concentrations of nutrient nitrogen within Cwm Cadlan SAC (updated to 21.42 kg N/ha/yr in the August and September 2017 modelling work) are already above the lower critical load (15 kg N/ha/yr) for the SAC habitats, although they do not exceed the higher critical load.

Alone, the proposed Enviroparks development will not result in a process contribution which is greater than 1% of the lower or the higher critical load, using the modelled data assuming the implementation of additional technologies, IED limits emissions data and 70% conversion of NOx to NO_2. As such any potential effects of nutrient deposition from the scheme alone can be screened out.

When the emissions are modelled at IED limits, with the additional technology included, and a 70% conversion of NOx to NO2, the in-combination effects are 0.13% of the critical load (see Table 8.8). As discussed in Section 6.5.2, the 1% screening threshold does not apply to consideration of the combined effects of a number of different projects, however, if the same screening criteria were used, then based on the additional technology option, the impacts of the scheme in-combination with other projects and plans would be considered insignificant.

Based on the considerations above, it can be concluded that the Enviroparks scheme would not result in any adverse effects on Cwm Cadlan SAC as a result N deposition, either alone or in-combination with other projects.

2020 Assessment
Table 8.9 presents the 2020 modelled data for nutrient nitrogen deposition, which takes into account the raised height of the emissions stack. A 70% conversion of NOx to NO_2 has been applied. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Nutrient Nitrogen	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition as N (kg N/ha/yr)	0.008069042	0.0180
Current Maximum Background (kg N/ha/yr)	21.1	21.1
Predicted Environmental Concentration (PEC) (kg N/ha/yr)	21.10806904	21.118
Lower End of the Critical Load Range (kg N/ha/yr)	15	15
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.054%	0.12%
Is the Long-Term Percentage Less Than 1 %?	Yes	Yes

Table 8.9: 2020 Modelled Nutrient Nitrogen Deposition at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.9 shows that the background concentration of nutrient nitrogen within Cwm Cadlan SAC based on the 2020 modelling work (21.1 kg N/ha/yr) is above the lower critical load (15 kg N/ha/yr) identified by APIS for the qualifying habitats within the SAC. This is broadly consistent with the September 2017 assessment, when the background concentration of nutrient nitrogen within Cwm Cadlan SAC was 21.42 kg N/ha/yr.

Whilst the lower critical load for nutrient nitrogen within the SAC is already exceeded due to the background levels, further consideration has been given to the potential additional contributions of the proposed development to the levels of nutrient nitrogen likely to be experienced at Cwm Cadlan SAC. Table 8.9 shows that the development would result in a long-term process contribution of 0.054% of the lower critical load when considered 'alone' and a long-term process contribution of 0.12% of the lower critical load when considered in-combination with other projects and plans. These process contributions can be screened as 'insignificant' (less than 1%).

The predicted nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Blaen Cynon SAC as a result of nutrient nitrogen deposition arising from the Enviroparks development.

8.5.1.2 Acid Deposition
2017 Assessment
Table 8.10 provides a summary of the modelled deposition rates for acid deposition using IED emissions limits at Cwm Cadlan SAC taking the Enviroparks scheme only into account, and also when considering the effects in-combination with the other schemes identified in Chapter 4. Table 8.11 presents the data using the Laxen and Marner (2005) assessment method.

The lower critical load has been determined using data from APIS for Cwm Cadlan SAC. The lower critical load used for acid deposition is comprised of the lowest critical load provided for N plus the lowest critical load provided for S. The higher critical load for acid deposition is calculated as the highest critical load provided for N plus the highest critical load provided for S.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	1.86	1.86
Process Contribution (PC) Acid (keq/ha/yr)	0.0279	0.0352
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	1.89	1.90
Lower Critical Load:		
Lower Critical load (keq)	0.803	0.803
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**3.5%**	**4.4%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**235%**	**236%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	8.763	8.763
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.3%	0.4%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	22%	22%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 8.10: 2017 Modelled Acid Deposition Using IED Limits Emissions Data at Cwm Cadlan SAC

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	1.86	1.86
Process Contribution (PC) Acid (keq/ha/yr)	0.0262	0.0334
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	1.89	1.89
Lower Critical Load:		
Lower Critical load (keq)	0.803	0.803
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**3.3%**	**4.2%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**235%**	**236%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	8.763	8.763
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.3%	0.4%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	22%	22%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 8.11: 2017 Modelled Acid Deposition Using IED Limits Emissions Data at Cwm Cadlan SAC and Laxen and Marner (2005) Assessment Method

Table 8.12 presents the long-term realistic emissions data, applying the Laxen and Marner (2005) assessment method.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	1.86	1.86
Process Contribution (PC) Acid (keq/ha/yr)	0.0152	0.0225
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	1.88	1.88
Lower Critical Load:		
Lower Critical load (keq)	0.803	0.803
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	**1.9%**	**2.8%**
Long-term PC < 1 % of lower Critical Load?	**No**	**No**
Long-term PEC as % of lower Critical Load	**234%**	**234%**
Long-term PEC < 70 % of lower Critical Load?	**No**	**No**
Higher Critical Load:		
Higher Critical load (keq)	8.763	8.763
Do background levels exceed the higher Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the higher Critical Load?	**Yes**	**Yes**
Long-term PC as % of higher Critical Load	0.2%	0.3%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	21%	21%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 8.12: 2017 Modelled Acid Deposition Using Long-Term Realistic Emissions Data at Cwm Cadlan SAC and Laxen and Marner (2005) Assessment Method

Tables 8.10 to 8.12 show that the lower critical load for acid deposition at Cwm Cadlan SAC is already exceeded due to background levels, although the higher critical level is not exceeded. Based on the worst-case scenario (Table 8.10), the process contribution as a percentage of the lower critical load would be 3.5%, although the long-term realistic emissions data model would conclude that this was more likely to be in the region of 1.9%.

APIS identifies that the alkaline fens with the SAC are not sensitive to acid deposition. However, for the Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) habitat exceedance impacts could result in leaching which will cause a decrease in soil base saturation, increasing the availability of Al^{3+} ions. The mobilisation of Al^{3+} may cause toxicity to plants and mycorrhiza and may have direct effect on lower plants (bryophytes and lichens). The mapped data from NRW regarding habitat distribution at the site (see Appendix 3) shows that both of these habitat types are present within the part of the SAC closest to the Enviroparks development site.

The 2009 sHRA report (RT-MME-104641) stated that with respect to acid deposition at this site:

> *"the result of the predicted acid deposition at Cwm Cadlan SAC…clearly shows that the percentage of the critical load with respect to acid deposition at Cwm Cadlan SAC is below 1% and can therefore be considered to be insignificant."*

With respect to in-combination impacts, the data in Tables 8.10 to 8.12 show that if a screening level of 1% was used for in-combination effects, the impacts of the scheme could not be ruled out.

The data presented in Table 8.13 provides the modelled results taking into account the application of additional technologies, using IED emissions data, and a conversion of 70% NOx to NO_2. Updated background concentration data from APIS is also utilised.

Acid Deposition	Enviroparks Only	In-Combination
Background levels (keq/ha/yr)	1.96	1.96
Process Contribution (PC) Acid (keq/ha/yr)	0.0026	0.0046
Predicted Environmental Contribution (PEC) Acid (keq/ha/yr)	1.9626	1.9646
Lower Critical Load:		
Lower Critical load (keq)	0.803	0.803
Do background levels exceed the lower Critical Load?	**Yes**	**Yes**
Do PEC levels exceed the lower Critical Load?	**Yes**	**Yes**
Long-term PC as % of lower Critical Load	0.32%	0.57%
Long-term PC < 1 % of lower Critical Load?	Yes	Yes
Long-term PEC as % of lower Critical Load	244.40%	244.66%
Long-term PEC < 70 % of lower Critical Load?	No	No
Higher Critical Load:		
Higher Critical load (keq)	8.763	8.763
Do background levels exceed the higher Critical Load?	No	No
Do PEC levels exceed the higher Critical Load?	No	No
Long-term PC as % of higher Critical Load	0.03%	0.05%
Long-term PC < 1 % of higher Critical Load?	Yes	Yes
Long-term PEC as % of higher Critical Load	22.40%	22.42%
Long-term PEC < 70 % of higher Critical Load?	Yes	Yes

Table 8.13: 2017 Modelled Acid Deposition Using Additional Technologies and IED Emissions Limits Data at Cwm Cadlan SAC and 70% Conversion of NOx to NO_2

When applying the new technologies, using IED emissions limit data and a 70% conversion of NOx to NO2, Table 8.13 shows that the scheme alone would have a process contribution of 0.32% of the critical load. Based on the IAQM (2016) screening thresholds, if the additional mitigating technologies were applied, then the effects of the proposed development alone could be screened as insignificant.

As identified in Table 8.13, with the application of additional mitigating technology and a 70% conversation of NOx to NO2, the in-combination effects (0.57%) would be below the screening level identified by IAQM (2016) for projects alone. As such, under this scenario, it is considered that the in-combination effects would be insignificant.

The Environmental Statement Addendum (Savills, 2017) data for Cwm Cadlan SAC was modelled from a central point within the SAC at grid reference 296100, 209800, c.3.7km north north-east of the Enviroparks development. This data showed acid deposition from the Enviroparks scheme as a percentage of the lower critical load was 3.5% based on IED limits emissions data, increasing to 4.4% when considered in-combination. The Cwm Cadlan SAC is 84.2 ha in size, and based on the data provided, the acid deposition may be experienced across much of the SAC. However, as has been shown in Table 8.13, it is possible to provide additional technologies within the scheme to ensure that any effects of acid deposition at Cwm Cadlan SAC can be screened as insignificant, both alone and in-combination with other projects and plans.

2020 Assessment

Table 8.14 presents the 2020 modelled data for acid deposition, which takes into account the raised height of the emissions stack. A 70% conversion of NOx to NO_2 has been applied. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Acid Deposition	Enviroparks Only	In-Combination
Process Contribution (PC) Rate of Total Deposition of Acid (keq/ha/yr)	0.0067906	0.0076
Current Maximum Background (keq/ha/yr)	1.9	1.9
Predicted Environmental Concentration (PEC) (keq/ha/yr)	1.9067906	1.9076
Lower End of the Critical Load Range (keq/ha/yr)	1.161	1.161
Do Background Levels Exceed the Lower Critical Load?	Yes	Yes
Do PEC Levels Exceed the Lower Critical Load?	Yes	Yes
Long-Term PC as Percentage of the Lower Critical Load (%)	0.58%	0.66%
Is the Long-Term Percentage Less Than 1 %?	Yes	Yes

Table 8.14: 2020 Modelled Acid Deposition at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.14 shows that the background level (1.9 keq/ha/yr) exceeds the lower critical load for the habitats within Cwm Cadlan SAC (1.161 keq/ha/yr). Whilst the lower critical load for acid deposition within the SAC is already exceeded due to the background level, further consideration has been given to the potential additional contributions of the proposed development to the levels of acid deposition likely to be experienced at Cwm Cadlan SAC. Table 8.14 shows that the development would result in a process contribution of 0.58% of the lower critical load when considered 'alone', and a process contribution of 0.66% of the lower critical load when considered in-combination with other projects and plans. These process contributions can be screened as 'insignificant' (less than 1%).

The predicted acid deposition levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of acid deposition arising from the Enviroparks development.

8.5.1.3 Ammonia
2017 Assessment
Table 8.15 provides details of the modelled ammonia levels at Cwm Cadlan SAC using IED emissions limits data as a result of the Enviroparks development proposals. In-combination data is not provided as there are not any additional local impacts from the other schemes outlined in Chapter 4.

For Cwm Cadlan SAC, a critical level of 1 was used based on data provided by APIS for this SAC site.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg NH3/m^3 annual mean)	0.64
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.0150
Predicted Environmental Concentration (PEC) (µg NH3/m^3 annual mean)	0.6550
Long-Term Environmental Quality Standard Critical Level (µg NH3/m^3 annual mean)	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	1.5%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC % of Critical Level	65.50%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.15: 2017 Modelled Ammonia Using IED Limits Emissions Data at Cwm Cadlan SAC

Table 8.15 shows that with the Enviroparks scheme in place, the critical level for ammonia at Cwm Cadlan SAC will not be exceeded and as such there will not be any adverse effects on the habitats as a result of ammonia pollution. Table 8.15 also shows that whilst the long-term process contribution cannot be considered insignificant as it is above 1% of the long-term critical level, the PEC for the Enviroparks development as a percentage of the critical level will be 65.50% and thus any effects can therefore be screened out.

Table 8.16 presents the data for ammonia based on the September 2017 (Envisage, 2017d) modelling work.

Ammonia (NH_3)	Enviroparks Only
Background Concentration (µg NH3/m^3 annual mean)	0.49
Annual Average Process Contribution (PC) NH3 (ug/m^3)	0.00012
Predicted Environmental Concentration (PEC) (µg NH3/m^3 annual mean)	0.49012
Long-Term Environmental Quality Standard Critical Level (µg NH3/m^3 annual mean)	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.01%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC % of Critical Level	49.01%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.16: 2017 Modelled Ammonia Using Additional Technologies and IED Limits Emissions Data at Cwm Cadlan SAC

Table 8.16 shows that based on the revised modelling data, the predicted environmental contributions would not exceed the critical level.

It can therefore be concluded that there would be no adverse effect on Cwm Cadlan SAC as a result of ammonia pollution from the proposed development. No additional in-combination effects are predicted as the other projects outlined in Chapter 4 will not result in an additional local impacts.

2020 Assessment
Table 8.17 presents the 2020 modelled data for ammonia, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Ammonia Concentration	Enviroparks Only
Annual Average Process Contribution (PC) NH3 (µg/m3)	0.000639039
Current Background Concentration (µg NH3/m3 annual mean)	0.72
Predicted Environmental Concentration (PEC) (µg NH3/m3 annual mean)	0.720639039
Critical Level (µg NH3/m3 annual mean)	1
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.064%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 8.17: 2020 Modelled Ammonia at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.17 shows that the critical level for ammonia is 1 µg NH3/m^3 annual mean. The current background concentrations of ammonia at the SAC are 0.72 µg NH3/m^3 annual mean, and the process contribution would be <0.005 µg NH3/m^3 annual mean. The PEC would be 0.720639039 µg NH3/m^3 annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the habitats within the SAC may occur, will not be exceeded. The development would result in a process contribution of 0.064% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted ammonia levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of ammonia arising from the Enviroparks development.

8.5.1.4 Oxides of Nitrogen
2017 Assessment
Table 8.18 provides details of the modelled annual mean nitrogen oxide levels at Cwm Cadlan SAC as a result of the Enviroparks development proposals and in-combination with the other schemes outlined in Chapter 4. Table 8.19 presents the short-term 24-hour mean data based on the same parameters.

The critical levels for NOx are detailed by APIS for Cwm Cadlan SAC as:

- Annual mean - 30 µg/m^3 over a calendar year; and,
- 24 hour mean - 75 µg/m^3.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	8.4435	8.4435
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.3456	0.8713
Predicted Environmental Concentration (PEC) (ug/m^3 annual mean)	8.789	9.315
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 annual mean)	30	30
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-term PC as % of Critical Level	1.2%	2.9%
Long-term PC < 1 % of Critical Level?	See below	-
Long-Term PEC as % of EQS	29.30%	31.05%
Long-term PEC < 70 % of CL?	Yes	Yes

Table 8.18: 2017 Modelled Annual Mean Oxides of Nitrogen Using IED Limits Emissions Data at Cwm Cadlan SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	8.4435	8.4435
24-Hour Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.3291	0.8227
Short Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 24-hour mean)	75	75
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Short-term PC as % of EQS	0.44%	1.10%
Short-term PC < 10 %?	Yes	Yes

Table 8.19: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using IED Limits Emissions Data at Cwm Cadlan SAC

Table 8.18 shows that under the worst-case scenario (ie with the in-combination effects considered), there will not be an exceedance of the long-term critical level at Cwm Cadlan SAC as a result of the development and as such the levels would remain below a point at which there could be any effects on the SAC habitats.

Table 8.18 shows that the Enviroparks development on its own will result in a long-term process contribution very slightly greater than 1%, although as discussed in Section 6.5.2, the levels are only very slightly over 1% and as such would be rounded down to 1% and therefore considered insignificant. Table 8.18 also illustrates that, with the Enviroparks development in place the long-term PEC NOx levels will be significantly less than 70% of the critical level, both alone and in-combination with other projects.

Table 8.19 shows that when considering short-term NOx, the critical level would not be exceeded with the Enviroparks scheme in place, either alone or in-combination with other projects. The process contribution is less than 10% of the short-term critical level, both alone and in-combination with other projects, and as such the short-term effects can be screened as insignificant.

Tables 8.20 and 8.21 show the data using the September 2017 (Envisage, 2017d) modelling work.

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	6.86	6.86
Annual Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.0549	0.1773
Predicted Environmental Concentration (PEC) (ug/m^3 annual mean)	6.9149	7.0373
Long Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 annual mean)	30	30
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-term PC as % of Critical Level	0.18%	0.59%
Long-term PC < 1 % of Critical Level?	Yes	Yes
Long-Term PEC as % of EQS	23.05%	23.46%
Long-term PEC < 70 % of CL?	Yes	Yes

Table 8.20: 2017 Modelled Annual Mean Oxides of Nitrogen Using Additional Technologies and IED Limits Emissions Data at Cwm Cadlan SAC

Oxides of Nitrogen (NOx)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	8.31	8.31
24-Hour Average Oxides of Nitrogen Process Contribution (PC) (ug/m^3)	0.381	1.786
Predicted Short-term Environmental Concentration (ug/m^3)	8.691	10.096
Short Term Environmental Quality Standard (EQS) Critical Level (µg NOx/m^3 24-hour mean)	75	75
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Short-term PC as % of EQS	0.51%	2.38%
Short-term PC < 10 %?	Yes	Yes

Table 8.21: 2017 Modelled 24-Hour Mean Oxides of Nitrogen Using Additional Technologies and IED Limits Emissions Data at Cwm Cadlan SAC

Tables 8.20 and 8.21 shows that the predicted environmental concentration would remain below the critical level, both alone and in-combination, and as such the proposed development would not have any adverse effect on Cwm Cadlan SAC.

It can therefore be concluded that there would be no adverse effect on the integrity of Cwm Cadlan SAC from the Enviroparks scheme, either alone or in-combination, as a result of oxides of nitrogen.

2020 Assessment

Tables 8.22 and 8.23 present the 2020 modelled data for the annual mean and 24-hour mean NOx, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Oxides of Nitrogen Concentration	Enviroparks Only
Annual Average Process Contribution (PC) NOx (µg/m3)	0.0511091
Current Background Concentration (µg NOx/m3 annual mean)	8.34
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	8.3911091
Critical Level (µg NOx/m3 annual mean)	30
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.17%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 8.22: 2020 Modelled Annual Mean Oxides of Nitrogen Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

24-Hour Average Oxides of Nitrogen Concentration	Enviroparks Only
24-Hour Average Process Contribution (PC) NOx (µg/m3)	0.430633
Current Background Concentration (µg NOx/m3 annual mean)	16.68
Predicted Environmental Concentration (PEC) (µg NOx/m3 annual mean)	17.110633
Critical Level (µg NOx/m3 annual mean)	75
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Short-Term PC as Percentage of the Critical Level (%)	0.57%
Is the Short-Term Percentage Less Than 10 %?	Yes

Table 8.23: 2020 Modelled 24-Hour Mean Oxides of Nitrogen Concertation at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.22 shows that the critical level for annual average oxides of nitrogen is 30 µg NO_x/m^3 annual mean. The current long-term background concentration of oxides of nitrogen at the SAC is 8.34 µg NO_x/m^3 annual mean, and the long-term process contribution would be c. 0.05 µg m^3. The PEC would be 8.3911091 µg NO_x/m^3 annual mean. This means that even with the proposed development in operation, the critical level, above which direct adverse effects on the habitats may occur, will not be exceeded. The development would result in a long-term process contribution of 0.17% of the critical level when considered 'alone'. The long-term process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 8.23 also shows that the short-term process contribution will be below the critical level of 75 µg NOx/m^3 annual mean. For the scheme in isolation, the short-term process contribution is also below 10% of the short-term critical level, at 0.57%. This is screened as 'insignificant' and as such, no assessment of in-combination effects is required.

The predicted oxides of nitrogen levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It is concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of long-term or short-term oxides of nitrogen arising from the Enviroparks development.

8.5.1.5 Sulphur Dioxide

2017 Assessment

Table 8.24 provides details of the modelled sulphur dioxide levels at Cwm Cadlan SAC as a result of the Enviroparks development proposals, and in-combination with the other schemes outlined in Chapter 4.

The critical level for sulphur dioxide at Cwm Cadlan SAC used in the assessment was 10 µg SO_2/m^3 annual mean.

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	2.48	2.48
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	0.0793	0.095
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	2.5593	2.575
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	10	10
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	0.8%	0.95%
Long-term PC < 1 %?	Yes	Yes
Long-term PEC as % of Critical Level	25.6%	25.8%
Long-term PEC < 70 %?	Yes	Yes

Table 8.24: 2017 Modelled Sulphur Dioxide Using IED Emissions Levels Data at Cwm Cadlan SAC

As detailed in Table 8.24, the long-term PEC will be below the critical level for sulphur dioxide with the Enviroparks scheme in place, and when the scheme is considered in-combination with the other projects outlined in Chapter 4. As such, the proposed development is not considered to have an adverse effect on Cwm Cadlan SAC as a result of sulphur dioxide pollution.

Table 8.24 also shows that the long-term process contribution as a percentage of the critical level is below 1%, and the long-term predicted environmental concentrations will be less than 70% of the critical level and as such the effects are also considered insignificant using this additional screening criteria.

Table 8.25 shows the data for sulphur dioxide based on the September 2017 (Envisage, 2017d) modelling work.

Sulphur Dioxide (SO_2)	Enviroparks Only	In-Combination
Background Concentration (ug/m^3)	0.37	0.37
Annual Average Process Contribution (PC) SO_2 (ug/m^3)	0.01607	0.01941
Predicted Environmental Concentration (µg SO_2/m^3 annual mean)	0.38607	0.389412
Long Term Environmental Quality Standard (EQS) Critical Level (µg SO_2/m^3 annual mean)	10	10
Do background levels exceed the Critical Level?	No	No
Do PEC levels exceed the Critical Level?	No	No
Long-Term PC as % of Critical Level	0.16%	0.19%
Long-term PC < 1 %?	Yes	Yes
Long-term PEC as % of Critical Level	3.86%	3.89%
Long-term PEC < 70 %?	Yes	Yes

Table 8.25: 2017 Modelled Sulphur Dioxide Using Additional Technologies and IED Emissions Levels Data at Cwm Cadlan SAC

Table 8.25 shows that the critical level for sulphur dioxide would not be exceeded with the scheme either alone or in-combination with other projects and plans.

Thus it can be concluded that the proposed development, either alone or in-combination with other projects, will not result in any adverse effects on Cwm Cadlan SAC via this pathway.

2020 Assessment
Table 8.26 presents the 2020 modelled data for sulphur dioxide, which takes into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Annual Average Sulphur Dioxide Concentration	Enviroparks Only
Annual Average Process Contribution (PC) SO2 (µg/m3)	0.0127947
Current Background Concentration (µg SO2/m3 annual mean)	2.4
Predicted Environmental Concentration (PEC) (µg SO2/m3 annual mean)	2.4127947
Critical Level (µg SO2/m3 annual mean)	10
Do Background Levels Exceed the Critical Level?	No
Do PEC Levels Exceed the Critical Level?	No
Long-Term PC as Percentage of the Critical Level (%)	0.128%
Is the Long-Term Percentage Less Than 1 %?	Yes

Table 8.26: 2020 Modelled Sulphur Dioxide Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.26 shows that the PEC will be 2.4127947 µg SO_2/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the critical level of 10 µg SO_2/m^3 annual mean, the level at which concentrations of SO_2 could have a direct adverse effect on habitats within Cwm Cadlan SAC. Table 8.26 also shows that the development would result in a long-term process contribution of 0.128% of the critical level when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted sulphur dioxide levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of sulphur dioxide arising from the Enviroparks development.

8.5.1.6 Metals

2017 Assessment

The GOV.UK guidance on 'Air Emissions Risk Assessment for your Environmental Permit' highlights a requirement to calculate the process contribution for substance deposition and consider the impact they have when absorbed by soil and leaves (known as deposition).

For the Environmental Statement Addendum works (Savills, 2017), deposition of metals was modelled as part of the air quality assessment. The model has provided the output shown in Table 8.27 for cadmium and thallium and Table 8.28 for heavy metals. There are no in-combination affects from the projects outlined in Chapter 4.

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Cd (ng/m^3)	0.0921
Predicted Environmental Concentration (ng Cd/m^3 annual mean)	0.2471
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-Term PC as % of Critical level	1.8%
PC < 1 % of EQS?	No
Long-Term Predicted Environmental Concentration % of EQS	4.94%
PEC < 70 % of EQS?	Yes

Table 8.27: 2017 Modelled Cadmium and Thallium Using IED Emissions Levels Data at Cwm Cadlan SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.000855
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.007285
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.34%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	2.9%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.28: 2017 Modelled Heavy Metals Using IED Emissions Levels Data at Cwm Cadlan SAC

Tables 8.27 and 8.28 show that under the worst case scenario, there will not be an exceedance of the long-term critical levels for metals at Cwm Cadlan SAC as a result of the development and as such the levels would remain below a point at which there could be any effects on the SAC habitats.

Table 8.27 shows that although the first screening criteria of having a PC less than 1% of the environmental quality standard is not achieved for cadmium and thallium, it is possible to also conclude that the effects from cadmium and thallium would be insignificant due to the fact that the PEC is less than 70% of the critical level.

Table 8.29 and 8.30 show the data using the September 2017 modelling data (Envisage, 2017d).

Cadmium and Thallium	Enviroparks Only
Background Concentration (ng/m^3)	0.155
Annual Average Cd (ng/m^3)	0.000064246
Predicted Environmental Concentration (ng Cd/m^3 annual mean)	0.155064
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-Term PC as % of Critical level	0.001%
PC < 1 % of EQS?	Yes
Long-Term Predicted Environmental Concentration % of EQS	3.10%
PEC < 70 % of EQS?	Yes

Table 8.29: 2017 Modelled Cadmium and Thallium Using Additional Technologies and IED Emissions Levels Data at Cwm Cadlan SAC

Heavy Metals	Enviroparks Only
Background Concentration (ug/m^3)	0.00643
Annual Average Heavy Metals Process Contribution (PC) (ug/m^3)	0.00000929614
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m^3 annual mean)	0.006439
Long Term Environmental Quality Standard (EQS) Critical Level	0.25
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.0037%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	2.58%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.30: 2017 Modelled Heavy Metals Using Additional Technologies and IED Emissions Levels Data at Cwm Cadlan SAC

Tables 8.29 and 8.30 show that the critical levels will not be exceeded when the development is taken into account.

It can therefore be concluded that there would be no adverse effects on Cwm Cadlan SAC as a result of deposition from cadmium and thallium or heavy metals.

2020 Assessment

Table 8.31 presents the 2020 modelled data for cadmium and thallium, taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Cadmium and Thallium Concentration	Enviroparks Only
Annual Average Process Contribution (PC) Cd or Tl (µg/m3)	0.0255893
Current Background Concentration (µg Cd or Tl/m3 annual mean)	0.282467
Predicted Environmental Concentration (PEC) (µg Cd or Tl/m3 annual mean)	0.3080563
Environmental Assessment Level (EAL) (µg Cd or Tl/m3 annual mean)	5
Do Background Levels Exceed the EAL?	No
Do PEC Levels Exceed the EAL?	No
Long-Term PC as Percentage of the EAL (%)	0.51%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 8.31: 2020 Modelled Cadmium and Thallium Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.31 shows that the PEC will be 0.3080563 µg Cd or Tl/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the EAL of 5 µg Cd or Tl/m^3 annual mean, the level at which concentrations of cadmium and thallium could have a direct adverse effect on habitats within Cwm Cadlan SAC. Table 8.31 also shows that the development would result in a long-term process contribution of 0.51% of the EAL when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

Table 8.32 presents the 2020 modelled data for heavy metals, assessed against the UK Air Quality Standard for lead, and taking into account the raised height of the emissions stack.

Heavy Metals Concentration Assessed Against the UK Air Quality Standard for Lead	Enviroparks Only
Annual Average Process Contribution (PC) Heavy Metals as Lead (µg/m3)	0.000383145
Current Background Concentration (µg Pb/m3 annual mean)	0.005322549
Predicted Environmental Concentration (PEC) (µg Heavy Metals/m3 annual mean)	0.005705694
Air Quality Standard Objective (AQS) for Lead (µg Pb/m3 annual mean)	0.25
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.15%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 8.32: 2020 Modelled Heavy Metals Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.32 shows that the PEC will be 0.005705694 µg Heavy Metals/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AQS for lead of 0.25 µg Pb/m^3 annual mean, the level at which concentrations of heavy metals could have a direct adverse effect on habitats within Cwm Cadlan SAC. Table 8.32 also shows that the development would result in a long-term process contribution of 0.15% of the AQS when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted cadmium, thallium and heavy metals levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. It can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of pollution from cadmium and thallium, or heavy metals arising from the Enviroparks development.

8.5.1.7 Volatile Organic Compounds (VOC)

2017 Assessment

For the Environmental Statement Addendum works (Savills, 2017), volatile organic compounds (VOCs) as benzene were modelled as part of the air quality assessment. The model has provided the outputs shown in Table 8.33 for Cwm Cadlan SAC. There are no in-combination affects from the projects outlined in Chapter 4.

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.17828
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.0172
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.19548
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	0.3%
Long-term PC < 1 % of Critical Level?	Yes
Long-term PEC as % of Critical Level	3.9%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.33: 2017 Modelled Volatile Organic Compounds Using IED Emissions Levels Data at Cwm Cadlan SAC

Table 8.33 shows that the critical levels for VOCc as benzene would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4. As such, the scheme will not result in an adverse impact on Cwm Cadlan SAC from these pollutants. Table 8.33 also illustrates that the process contribution is less than 1% of the critical level, and as such it would be possible to screen out any effects as insignificant.

Table 8.34 shows the data for VOCs based on the September 2017 modelling work (Envisage, 2017).

Volatile Organic Compounds (VOC as benzene)	Enviroparks Only
Background Concentration VOC (ug/m^3)	0.207
Annual Average Process Contribution (PC) VOC (ug/m^3)	0.0911
Predicted Environmental Concentration (PEC) (µg VOC/m^3 annual mean)	0.2981
Long Term Environmental Quality Standard (EQS) Critical Level	5
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of Critical Level	1.82%
Long-term PC < 1 % of Critical Level?	No
Long-term PEC as % of Critical Level	5.96%
Long-term PEC < 70 % of Critical Level?	Yes

Table 8.34: 2017 Modelled Volatile Organic Compounds Using Additional Technologies and IED Emissions Levels Data at Cwm Cadlan SAC

Table 8.34 shows that the critical level for VOCs would not be exceeded when taking the proposed development into account.

It can therefore be concluded that there would be no adverse effects on Cwm Cadlan SAC as a result of deposition from VOCs as benzene.

2020 Assessment

Table 8.35 presents the 2020 modelled data for VOC concentration, assessed against the UK Air Quality Standard for benzene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Volatile Organic Compound Concentration Assessed Against the UK Air Quality Standard for Benzene	Enviroparks Only
Annual Average Process Contribution (PC) VOC (µg/m3)	0.0127947
Current Background Concentration (µg C6H6/m3 annual mean)	0.161622
Predicted Environmental Concentration (PEC) (µg C6H6/m3 annual mean)	0.1744167
Air Quality Standard Objective (AQS) for Benzene (µg C6H6/m3 annual mean)	5
Do Background Levels Exceed the AQS?	No
Do PEC Levels Exceed the AQS?	No
Long-Term PC as Percentage of the AQS (%)	0.26%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 8.35: 2020 Modelled Volatile Organic Compounds Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.35 shows that the PEC will be 0.1744167 µg C6H6/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AQS for benzene of 5 µg C6H6/m^3 annual mean, the level at which concentrations of VOCs could have a direct adverse effect on habitats within Cwm Cadlan SAC. Table 8.35 also shows that the development would result in a long-term process contribution of 0.26% of the AQS when considered ‘alone’. This process contribution is screened as ‘insignificant’ (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted VOC levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of VOCs arising from the Enviroparks development.

8.5.1.8 Polycyclic Aromatic Hydrocarbons (PAH)

2017 Assessment

Table 8.36 shows the modelled data for Polycyclic Aromatic Hydrocarbons (PAH) at Cwm Cadlan SAC. There are no in-combination affects from the projects outlined in Chapter 4.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ng/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ng/m^3)	0.0017
Predicted Environmental Concentration (PEC) (ng PAH/m^3 annual mean)	0.1897
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	0.2%
Long-term PC < 1 % of EQS?	Yes
Long-term PEC as % of EQS	19.0%
Long-term PEC < 70 % of EQS?	Yes

Table 8.36: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using IED Emissions Levels Data at Cwm Cadlan SAC

Table 8.36 shows that the critical levels for PAH would not be exceeded with the proposed development in place, either alone or in-combination with the other projects detailed in Chapter 4 (no contributions from other projects are predicted for PAH). As such, the scheme will not result in an adverse impact on Cwm Cadlan SAC from these pollutants.

Table 8.36 also illustrates that the process contribution is less than 1% of the critical level, and as such it would be possible to screen out any effects as insignificant.

Polycyclic Aromatic Hydrocarbons (PAH)	Enviroparks Only
Background Concentration PAH (ug/m^3)	0.188
Annual Average Process Contribution (PC) PAH (ug/m^3)	0.000287112
Predicted Environmental Concentration (PEC) (µg PAH/m^3 annual mean)	0.188287
Long Term Environmental Quality Standard (EQS) Critical Level	1
Do background levels exceed the Critical Level?	No
Do PEC levels exceed the Critical Level?	No
Long-term PC as % of EQS	0.0287%
Long-term PC < 1 % of EQS?	Yes
Long-term PEC as % of EQS	18.829%
Long-term PEC < 70 % of EQS?	Yes

Table 8.37: 2017 Modelled Polycyclic Aromatic Hydrocarbons Using Additional Technologies and IED Emissions Levels Data at Cwm Cadlan SAC

Table 8.37 shows that the critical level would not be exceeded with the development.

It can therefore be concluded that there would be no adverse effects on Cwm Cadlan SAC as a result of deposition from PAH.

2020 Assessment

Table 8.38 presents the 2020 modelled data for PAH concentration, assessed against the Ambient Air Directive Standard for Benzo[a]Pyrene, and taking into account the raised height of the emissions stack. The emission concentrations applied are levels specified by the technology provider as being achievable by the proposed plant and are in line with, or more stringent than, the Best Available Techniques Associated Emission Levels (BAT-AELs) stated in Chapter 5 of the 'Best Available Techniques (BAT) Reference Document for Waste Incineration' (Neuwahl *et al*, 2019).

Polycyclic Aromatic Hydrocarbon Concentration Assessed Against the Ambient Air Directive Standard for Benzo[a]Pyrene	Enviroparks Only
Annual Average Process Contribution (PC) PAH (µg/m3)	0.00127947
Current Background Concentration (µg B[a]P/m3 annual mean)	< 0.1
Predicted Environmental Concentration (PEC) (µg B[a]P/m3 annual mean)	0.10127947
Ambient Air Directive Standard (AAD) (µg B[a]P/m3 annual mean)	1
Do Background Levels Exceed the AAD?	No
Do PEC Levels Exceed the AAD?	No
Long-Term PC as Percentage of the AAD (%)	0.13%
Is the Long Term-Percentage Less Than 1 %?	Yes

Table 8.38: 2020 Modelled Polycyclic Aromatic Hydrocarbon Concentration at Cwm Cadlan SAC, accounting for Raised Emissions Stack

Table 8.38 shows that the PEC will be 0.10127947 µg B[a]P/m^3 annual mean with the Enviroparks scheme in place, which is significantly lower than the AAD of 1 µg B[a]P/m^3 annual mean, the level at which concentrations of PAHs could have a direct adverse effect on habitats within Cwm Cadlan SAC. Table 8.38 also shows that the development would result in a long-term process contribution of 0.13% of the AAD when considered 'alone'. This process contribution is screened as 'insignificant' (less than 1%), and as such, no assessment of in-combination effects is required.

The predicted PAH levels based on the 2020 modelling are lower than the levels predicted based on the 2017 modelling. Based on the 2020 modelling, it can be concluded that there would be no significant adverse effect on the integrity of Cwm Cadlan SAC as a result of PAHs arising from the Enviroparks development.

8.5.1.9 Traffic Considerations

Additional effects on traffic during construction and operation of the proposed development are considered in Section 6.5.2.10 for Blaen Cynon SAC. This section of the report shows that the impacts on traffic generated during construction and operation of the site on the air quality data presented above is insignificant and therefore need not be considered further.

No additional effects on Cwm Cadlan SAC as a result of air pollution are therefore predicted from traffic generated by the development, during construction or operation, either alone or in-combination with other projects and plans. No further assessment is required.

9. MITIGATION MEASURES

9.1 INTRODUCTION

This chapter sets out the proposed mitigation measures to ensure that any identified potential effects from the Enviroparks scheme, either alone or in-combination with the other projects outlined in Chapter 4, can be controlled.

9.2 BLAEN CYNON SAC

The 2017 assessment identified that the proposed Enviroparks development had the potential to impact on Blaen Cynon SAC via the following pathways:

- Indirect impacts on the SAC as a result of dust deposition during construction and operation of the Enviroparks site; and,
- Indirect impacts on the SAC as a result of increased nutrient nitrogen and acid deposition resulting in potential increased successional changes within the habitats the SAC which support marsh fritillary.

The 2020 assessment has confirmed that whilst the proposed Enviroparks development still has the potential to indirectly impact on the SAC as a result of dust deposition during construction and operation and increased acid deposition during operation, indirect impacts as a result of nutrient nitrogen deposition can now be screened as 'insignificant'.

9.2.1 Dust Management Plan

In 2017, Natural Resources Wales identified that the following planning condition should be imposed to ensure that suitable mitigation measures would be put in place to control potential effects on the SAC from dust generated by the Enviroparks scheme:

Planning Condition - A condition can be imposed on any permission granted that a Dust Management Plan (covering both the construction and operational phases) be submitted and agreed with the LPA's prior to any development commencing.

Condition 5 of the RCTCBC Decision Notice for the 2017 application (reference 17/0249/10), dated 1st February 2019, and Condition 5 of the BBNPA Decision Notice for the 2017 application (reference 17/14587/FUL), dated 6th March 2019, states:

> "*Prior to the first use of the development, a Dust Management Plan shall be submitted to and agreed in writing with the Local Planning Authority. This shall cover dust management during the operational phase of the development and shall be implemented as approved."*

With this planning condition in place, and the subsequent controls outlined in the Dust Management Plan implemented, it can be concluded that there would not be any residual adverse effects on Blaen Cynon SAC from dust generation.

Subject to this planning condition being carried forward and applied to the 2020 application, there is no change to the conclusion that there would not be any residual adverse effects on Blaen Cynon SAC from dust generation.

9.2.2 Additional Technologies

The additional modelling work completed in September 2017 showed that with the implementation of additional technologies, emissions from the Enviroparks scheme could be controlled to levels at which impacts are considered to be 'insignificant' when the process contributions are considered alone, with the exception of acid deposition at Blaen Cynon SAC which was slightly above the lower critical load (process contribution of 1.74% of the lower critical load). As such, in order to screen out any significant adverse effects on Blaen Cynon SAC from process contributions, the 2017 report concluded that it would be important to implement the identified technologies (or any others which ensure that process contributions can be screened as insignificant), as part of the development. The 2017 assessment confirmed that technologies were available which would reduce the emissions to an insignificant level for most pollutants, and it was stated that the competent authority could be confident of the availability of a technological solution, and that details of the technologies could be approved at Permitting Stage, when assessed by Natural Resources Wales.

In 2017, the following details regarding a suitable planning condition were provided:

Planning Condition - A condition can be imposed on any permission granted that emissions from the scheme would be controlled via the Natural Resources Wales Permitting Process, and that a permit will not be granted unless it can be shown that the process contributions from the scheme would be at levels considered to be insignificant using the screening criteria available at the time of the Permit application.

Condition 6 of the RCTCBC Decision Notice for the 2017 application (reference 17/0249/10), dated 1st February 2019, and Condition 6 of the BBNPA Decision Notice for the 2017 application (reference 17/14587/FUL), dated 6th March 2019, states:

> *"Prior to operation of the development hereby approved, a scheme detailing technologies to reduce emissions to the levels identified in the Atmospheric Dispersion Modelling report dated September 2017 shall be submitted to the Local Planning Authority. The scheme shall be implemented as approved unless otherwise agreed in writing with the Local Planning Authority."*

Subject to this planning condition being carried forward and applied to the 2020 application, which has been informed by updated Atmospheric Dispersion Modelling, it is concluded that that process contributions of emissions from the Enviroparks scheme can be controlled to levels at which impacts are considered to be 'insignificant'.

9.2.3 Section 106 Agreement for Conservation Management

The 2017 assessment confirmed that in-combination effects from the proposed Enviroparks development and other projects and plans could not be screened out in relation to acid deposition at Blaen Cynon SAC, based on the same IAQM (2016) and Environment Agency screening criteria as applied to the scheme alone (there are no published screening criteria for in-combination effects) and NRW have confirmed (Baynon, 2017, *Pers. Comm.*) that they "*do not have a standard approach to considering high background levels or the issue of in combination effects*" (see Section 6.5.2). The 2017 assessment also confirmed that the in-combination effects on nutrient nitrogen were only just above 1% (at 1.29%) and if the IAQM (2016) Position Statement was considered, this figure would be rounded-down to 1%, thus showing that the levels remained insignificant.

The 2020 assessment has confirmed that indirect impacts as a result of nutrient nitrogen deposition can be screened as 'insignificant'.

However, as detailed in Section 6.5.2.2, although the acid deposition can be screened as 'insignificant' at the closest point of Blaen Cynon SAC to the Enviroparks development, Owen, (2020, *Pers. Comm.*) has confirmed that modelling across a wider area has demonstrated that the long-term process contribution is greater than 1% of the lower critical load at other points across the SAC. The highest contribution of acid deposition within the wider area would equate to approximately 2.9 % of the critical load, although it should be noted that this level of acid deposition does not occur within the Blaen Cynon SAC and is approximately 235 m away from the nearest point of this receptor. As such, the contributions of acid across the SAC in its entirety will be less than this, but cannot be screened as insignificant.

Owen, (2020, *Pers. Comm.*) has stated that:

> *"…whilst the calculated contributions to acid deposition cannot necessarily be screened as insignificant across the entire Blaen Cynon site, they amount to a tiny fraction of the total loadings currently experienced by the site and, coupled with the mitigation measures that Enviroparks have already committed to, are not expected to have any measurable or significant effect on the status of the Blaen Cynon site, or any of the other SACs or SSSIs in the vicinity of the Enviroparks site."*

With respect to cumulative impacts, Owen, (2020, *Pers. Comm.*) states that:

> *"When considering the contributions of…acid deposition to the three local SACs in combination with the cumulative effects of other local third-party emissions…Acid deposition does marginally exceed the 1 % insignificance threshold at Blaen Cynon however, equating to approximately 1.03 % at the modelled receptor point."*

As the main contributing factor to the levels of nutrient nitrogen and acid deposition are the elevated background levels of nitrogen and acid within the local area, consideration has been given to ensuring that the proposed Enviroparks development does not result in a further reduction of the quality of the habitats associated with the SAC qualifying criteria, the marsh fritillary butterfly, and the mechanisms which might be available to achieve this.

Since the 2020 assessment has confirmed that the acid deposition levels at some points within Blaen Cynon SAC (although not the closest point to the Enviroparks development) could not be screened as insignificant, the following details, provided in 2017, remain relevant.

As part of the assessment works for the 2008 planning application, an agreement was made with the local planning authorities, Countryside Council for Wales (now Natural Resources Wales, NRW) and Butterfly Conservation to provide funding for a Biodiversity Scheme which focussed on identifying opportunities for expanding the areas of habitat available to marsh fritillary butterfly within a 5km radius of the Enviroparks development site. Enviroparks (Wales) Limited duly made a financial contribution of £205,031 to conservation group Butterfly Conservation for the management of local grassland habitats. This budget has not been expended and, having regard to the distinction between environmental compensation and mitigation explained below, it is proposed that the uses of this fund could be redefined to serve the requirements of the current development proposal and this HRA.

The Biodiversity Scheme was designed as part of a mitigation, compensation and enhancement package associated with the development and was designed to provide an expansion to the areas of optimal habitat available for use by marsh fritillary butterflies within the project area. The scheme was set up to include three phases of work:

- Scheme Development Phase (Years 1-5): This phase would include liaison with local landowners within a 5km radius of the Enviroparks site, identifying opportunities for land to include within the Biodiversity Scheme, and producing a costed Habitat Management Plan for the study area detailing proposed habitat management works.
- Implementation Phase (Years 6-10): This phase would include implementation of the Habitat Management Plan with 3-year land management agreements to provide enhanced marsh fritillary habitat with local landowners
- Monitoring Phase (Years 11-15): This phase would assess the impact of the works using standard monitoring protocols for marshy grassland and key features. The monitoring works would provide data for feedback to landowners and opportunities for implementing additional works.

The requirements of the Biodiversity Scheme were set out in the Section 106 agreement associated with the 2010 Enviroparks planning permission. Schedules 11 and 12 from the Section 106 agreement are included in Appendix 4.

Section 6.5.2.2 has identified that the proposed development, alone and in-combination with other projects, could result in increased acid deposition at certain points within Blaen Cynon SAC at a level at which its effects cannot be screened as insignificant (although it is reiterated that there are no published screening criteria for in-combination effects, and the main contributing factor is the already elevated background levels). Whilst the deposition is not considered to directly affect the marsh fritillary butterfly, it could affect the habitats on which this species relies and specifically the larval food plant of the butterfly, Devil's-bit scabious *Succisa pratensis*. It is clear from the research works that have been completed that the effects of nitrogen increases on Devil's-bit scabious *Succisa pratensis* are only marginally understood, however, studies have shown that in general, nitrogen deposition can result in an increase in nitrophilous species within a habitat, thus resulting in habitat change through loss of species that favour nutrient-poor conditions. With respect to acid deposition, a similar effect can be experienced (as acid deposition is largely comprised of nitrogen deposition) within those habitats that cannot buffer the acid through their base-status. It is understood from consultation with NRW that there is currently no monitoring data from Blaen Cynon SAC available which would identify whether the elevated background levels were actually having an adverse effect on the habitats and the marsh fritillary populations.

During the telcon with Natural Resources Wales in August 2017, it was the opinion of NRW that off-site mitigation options could be considered with respect to ensuring the integrity of the population of marsh fritillary for which Blaen Cynon SAC is designated is maintained. A site visit to the Enviroparks development site took place in September 2017 between EWL and NRW.

As part of the 2017 application, it was proposed that the Section 106 agreement for the scheme would be revised through a Deed of Variation and as such the following principles would be adopted as part of a revised Biodiversity Scheme:

1. That a minimum area of 0.5 Hectares in the north-western quadrant of the site and along the northern boundary would be allocated as a marsh fritillary mitigation area. This area is outside of the red-line of the current application area, but inside the ownership of EWL. It will therefore be possible to secure provision of this area through a Section 106 agreement.
2. As a requirement of the Section 106, a detailed mitigation plan would be produced which would include the following information:

   - A plan showing the mitigation area;
   - A detailed assessment of the suitability of the area to create marsh fritillary habitat (marshy grassland and fen);
   - Details of any land preparation works (e.g. vegetation removal / re-profiling etc) required;
   - A vegetation establishment plan to create suitable marshy grassland / fen habitat with Devil's-bit scabious plants established as seedlings;
   - A management plan for the area to maximise the habitat for marsh fritillary (it is proposed that this management requirement would extend throughout the life of the Enviroparks scheme, and potentially beyond if it was shown that the in-combination effects from acid deposition remained); and,
   - A monitoring plan to assess the site's establishment, the growth of Devil's-bit scabious within the area, and use of the site by marsh fritillary butterfly.

3. The mitigation area will be established prior to the commencement of operation of the Enviroparks site. There is a 2-year lead-in time before the site would be operational.

The September 2017 modelling work (Envisage, 2017) included 5 points within the Enviroparks site to assess whether there would be on-going air quality and air pollution at levels which could not be screened as insignificant within any mitigation areas. It was understood that this monitoring showed that the proposed mitigation areas would only be subject to deposition at levels which could be considered insignificant.

In 2017, it was stated that subject to the identified additional technologies being implemented, and the Section 106 agreement being varied to take the above mitigation proposals into account, then it should be possible to conclude that the scheme will have 'No Likely Significant Effect' on Blaen Cynon SAC, in-combination with the other projects outlined in Chapter 4.

In addition to the Section 106 agreement, Condition 13 of the RCTCBC Decision Notice for the 2017 application (reference 17/0249/10), dated 1st February 2019, and Condition 13 of the BBNPA Decision Notice for the 2017 application (reference 17/14587/FUL), dated 6th March 2019, state:

> *"Prior to the commencement of development, a revised landscaping plan shall be submitted to and approved in writing by the Local Planning Authority. The plan shall be based upon the details shown on drawing AJA.2341-02 Issue 03 but shall also include provision of habitat and landscaping for marsh fritillary butterflies."*

Condition 14 of the Decision Notices states:

> *"A landscape management plan, including management responsibilities and maintenance schedules for all landscaped areas shall be submitted to and approved in writing by the local planning authority prior to the first receipt of waste at the site. The landscape management plan shall be carried out as approved."*

Finally, Condition 28 of the Decision Notices is as follows:

> *"No development shall take place until an amended Wildlife Protection Plan has been submitted to and agreed in writing with the Local Planning Authority. The Plan shall include:*
> > *a) details of the Reptile Mitigation Strategy*
> > *b) the provision of habitat and appropriate management for at least 0.5 hectares of land for marsh fritillary butterfly*
> > *c) timetables for implementation and long-term management*
>
> *The Plan shall be implemented as approved."*

Subject to these planning conditions being carried forward and applied to the 2020 application, which has been informed by updated Atmospheric Dispersion Modelling, it is concluded that the scheme will have 'No Likely Significant Effect' on Blaen Cynon SAC, in-combination with the other projects outlined in Chapter 4.

9.3 Coedydd Nedd a Mellte SAC

The 2017 modelling data showed that based on the implementation of additional technologies, use of the IED limits emissions data, and conversion of 70% NOx to NO_2 (i.e. as Nitric Oxide does not deposit to any significant extent, the deposition of total NOx has been reduced by 30 % to represent deposition from NO_2 only), at the closest point of the SAC to the Enviroparks development, the process contributions from the scheme could be considered insignificant, both alone and in-combination with other projects and plans outlined in Chapter 4.

The updated 2020 modelling data, which accounts for an increase in height of the emissions stack, has confirmed that at the closest point of the SAC to the Enviroparks development, the process contributions from the scheme could be screened as insignificant.

As such, it will be important to implement the identified technologies (or any others which ensure that process contributions can be screened as insignificant), as part of the development. As it has now been shown that technologies are available which will reduce the emissions to an insignificant level, the competent authority can be confident that a technological solution is available, and that details of the technologies can be approved at Permitting Stage, which is assessed by Natural Resources Wales.

In 2017, the following details regarding a suitable planning condition were provided:

Planning Condition - A condition can be imposed on any permission granted that emissions from the scheme would be controlled via the Natural Resources Wales Permitting Process, and that a permit will not be granted unless it can be shown that the process contributions from the scheme would be at levels considered to be insignificant using the screening criteria available at the time of the Permit application.

Condition 6 of the RCTCBC Decision Notice for the 2017 application (reference 17/0249/10), dated 1st February 2019, and Condition 6 of the BBNPA Decision Notice for the 2017 application (reference 17/14587/FUL), dated 6th March 2019, states:

> *"Prior to operation of the development hereby approved, a scheme detailing technologies to reduce emissions to the levels identified in the Atmospheric Dispersion Modelling report dated September 2017 shall be submitted to the Local Planning Authority. The scheme shall be implemented as approved unless otherwise agreed in writing with the Local Planning Authority."*

Subject to this planning condition being carried forward and applied to the 2020 application, which has been informed by updated Atmospheric Dispersion Modelling, it is concluded that that process contributions of emissions from the Enviroparks scheme can be controlled to levels at which impacts are considered to be 'insignificant'.

9.4 Cwm Cadlan SAC

The 2017 modelling data showed that based on the implementation of additional technologies, use of the IED limits emissions data, and conversion of 70% NOx to NO_2 (i.e. as Nitric Oxide does not deposit to any significant extent, the deposition of total NOx has been reduced by 30 % to represent deposition from NO_2 only),, any effects could be screened as insignificant, across Cwm Cadlan SAC as a result of the Enviroparks scheme, both alone and in-combination with other projects.

The updated 2020 modelling data, which accounts for an increase in height of the emissions stack, has confirmed that at the closest point of the SAC to the Enviroparks development, the process contributions from the scheme could be screened as insignificant.

However, it will be imperative to implement the identified technologies (or any others which ensure that process contributions can be screened as insignificant), as part of the development. As it has now been shown that technologies are available which will reduce the emissions to an insignificant level, the competent authority can be confident that a technological solution is available, and that details of the technologies can be approved at Permitting Stage, which is assessed by Natural Resources Wales.

In 2017, the following details regarding a suitable planning condition were provided:
Planning Condition - A condition can be imposed on any permission granted that emissions from the scheme would be controlled via the Natural Resources Wales Permitting Process, and that a permit will not be granted unless it can be shown that the process contributions from the scheme would be at levels considered to be insignificant using the screening criteria available at the time of the Permit application.

Condition 6 of the RCTCBC Decision Notice for the 2017 application (reference 17/0249/10), dated 1st February 2019, and Condition 6 of the BBNPA Decision Notice for the 2017 application (reference 17/14587/FUL), dated 6th March 2019, states:

> *"Prior to operation of the development hereby approved, a scheme detailing technologies to reduce emissions to the levels identified in the Atmospheric Dispersion Modelling report dated September 2017 shall be submitted to the Local Planning Authority. The scheme shall be implemented as approved unless otherwise agreed in writing with the Local Planning Authority."*

Subject to this planning condition being carried forward and applied to the 2020 application, which has been informed by updated Atmospheric Dispersion Modelling, it is concluded that that process contributions of emissions from the Enviroparks scheme can be controlled to levels at which impacts are considered to be 'insignificant'.

10. CONCLUSIONS

In accordance with best practice guidance, a screening exercise has been undertaken to assess whether the proposed development is likely to result in Likely Significant Effects to the integrity of the Natura 2000 sites within proximity to the proposed development, comprising Blaen Cynon SAC, Coedydd Nedd a Mellte SAC and Cwm Cadlan SAC.

The proposed Enviroparks scheme was granted planning permission in 2010, and a number of changes have been made to the scheme subsequently. A new planning application was submitted in 2017 to reflect proposed changes to the scheme, and updated assessment work was completed to support this. This shadow Habitats Regulation Assessment: Stage 1 Screening report was first produced in April/May 2017 to consider the potential effects that the changes to the scheme will have in relation to Natura 2000 sites which are within 10km of the proposed development. The RevB version of the report, produced in September 2017, provided an updated assessment further to consultation with Natural Resources Wales in August and September 2017, further work by the project team regarding technologies available, and additional air quality modelling work, completed in September 2017.

The 2009 shadow Habitats Regulations Assessment report (RT-MME-104641) which was produced concluded that with the mitigation proposed at the time in place, the Enviroparks scheme would have no Likely Significant Effect on any of the Natura 2000 sites. A Biodiversity Scheme was agreed with Countryside Council for Wales and Rhondda Cynon Taf County Borough Council (RCTCBC) and Brecon Beacons National Park Authority (BBNPA), and secured through a Section 106 agreement as part of a mitigation, compensation and enhancement package. It is understood that whilst Enviroparks have provided the agreed financial contribution associated with the Biodiversity Scheme, no works have been carried out on the Biodiversity Scheme by Butterfly Conservation.

The conservation objectives for each of the Natura 2000 sites considered in this report are associated with preserving the favourable conservation status of qualifying habitats and species. In 2008, CCW published Core Management Plans for all of the sites considered in this report, which describe known areas of vulnerability for these sites. These areas of vulnerability are all factors which could reduce the ability of the sites to meet their conservation objectives, therefore this assessment is focused on the ability of the proposed development to contribute to known areas of vulnerability. Since the original sHRA report was completed in 2009, new Natura 2000 – Standard Data Forms have been issued (in 2015) which also identify ‘threats’ to the specific Natura 2000 site. The assessment of the potential impacts of the development proposal have therefore been considered in accordance with these new data.

The Screening Report includes consideration of the in-combination effects of a number of committed projects within the local area, which have the potential to also have air quality impacts.

With respect to Blaen Cynon SAC, the 2017 and 2020 assessments have shown that there are potentially effects from dust pollution of the SAC (given its proximity to the Enviroparks site) during construction. However, these potential effects can be controlled through development and implementation of a Dust Management Plan.

The air quality modelling completed in 2017 showed that, assuming that additional mitigating technologies would be implemented as part of the plant’s design, the effects of the scheme when considered alone would be considered insignificant for the following air quality / air pollutants: nitrogen deposition, ammonia, nitrogen oxides, sulphur dioxide, metal, VOCs, and PAH. Levels of acid deposition at Blaen Cynon SAC were modelled to be at a level which could not be screened out, although they were low (1.79%).

The updated air quality modelling completed in 2020 confirmed that the process contributions of all air pollutants, when the scheme is considered in isolation, now screen as insignificant, at the closest point within the SACs to the Enviroparks development. However, the updated 2020 modelling of acid deposition across a wider area has demonstrated that the long-term process contribution, when the scheme is considered in isolation, is greater than 1% of the lower critical load at several points across the Blaen Cynon SAC, which cannot be screened as insignificant.

The 2017 assessment confirmed that when the scheme is considered in-combination with other projects and plans, levels at the closest point within Blaen Cynon SAC of nutrient nitrogen and acid deposition would be at a level which could not be considered insignificant (if the same screening criteria for process contributions were applied to the in-combination effects as no screening criteria was available for assessing in-combination effects). However, it was noted that the nitrogen deposition levels were only just above 1% of the critical load (at 1.29%) and as such it was considered unlikely that there would be a significant adverse effect on the integrity of the SAC from this in-combination deposition.

The updated air quality modelling completed in 2020 confirmed that when the scheme is considered in-combination with other projects and plans, although levels at the closest point within Blaen Cynon SAC of acid deposition would be at a level which could be screened as insignificant (if the same screening criteria for process contributions were applied to the in-combination effects as no screening criteria is currently available for assessing in-combination effects), levels at several points across the wider area cannot be screened as insignificant.

The main contributing factor for the elevated levels of nitrogen and acid deposition at the site are actually from background levels which are already above the lower critical loads identified by APIS for Blaen Cynon SAC. It is understood that no monitoring data is currently available to support a theory that increased background nitrogen and acid deposition at the site is having an adverse effect on the site's habitats and the marsh fritillary butterfly that the site is designated for.

The levels of nitrogen deposition and acid deposition at Blaen Cynon SAC which were presented in the 2009 sHRA are not directly comparable to the data presented in this report. This is due to the fact that the data in this report is from a grid reference closest to the Enviroparks development (as requested by Natural Resources Wales), rather than a central grid reference within the SAC (which was used in the 2009 assessment). The critical loads and critical levels have also been updated since 2009 by APIS and as such the current data is based on current guidance. However, that aside, it is clear from the data that the levels of predicted nitrogen deposition for the current scheme are showing a lower deposition rate than in the 2009 assessment. The acid deposition levels are relatively similar for the 2009 and the current modelled data. For the 2008 application, a Biodiversity Scheme was agreed with Countryside Council for Wales, RCT and BBNPA, and secured through a Section 106 agreement. This scheme was designed to provide compensatory marshy grassland habitat for marsh fritillary use within a 5km radius of the Enviroparks scheme as mitigation, compensation and enhancement for loss of habitat from the proposed development site and also any adverse effects on marsh fritillary populations within Blaen Cynon.

Guidelines have therefore been provided with respect to altering the Biodiversity Scheme, already agreed and contributed to, although not yet implemented, to ensure that it can be considered to provide improvements to the conservation of the marsh fritillary butterfly, SAC qualifying species by providing additional on-site mitigation in the form of creation of areas of marsh fritillary habitat within the Enviroparks site.

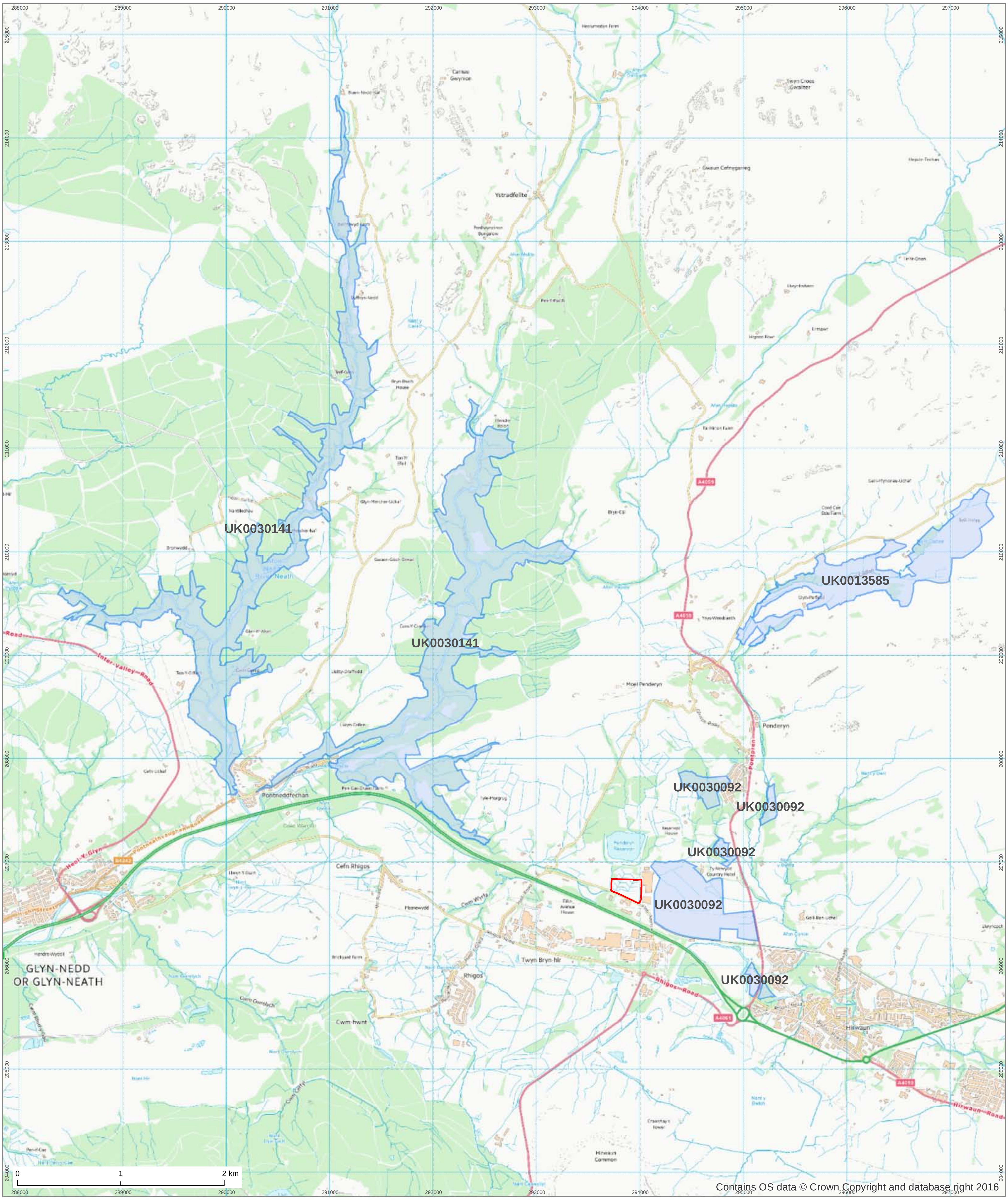
For Coedydd Nedd a Mellte SAC, it was concluded in 2017, and has been confirmed in 2020, that all of the potential effects on this SAC can be screened out assuming that the revised scheme is implemented as proposed. This requirement was secured via a planning condition provided in the 2019 Decision Notices from RCTCBC and BBNPA. It is recommended that this requirement is carried forward and applied to the 2020 application.

For Cwm Cadlan SAC, it was concluded in 2017, and has been confirmed in 2020, that all of the potential effects on this SAC can be screened out assuming that the revised scheme is implemented as proposed. This requirement was secured via a planning condition provided in the 2019 Decision Notices from RCTCBC and BBNPA. It is recommended that this requirement is carried forward and applied to the 2020 application.

Consideration has also been given in this Screening and Stage 2 Appropriate Assessment Report to the potential in-combination effects from the proposed development when considered with local energy generation projects and the Local Development Plans for Rhondda Cynon Taff County Borough Council and Brecon Beacons National Park Authority which could have an impact on the three SACs discussed in this report.

11. DRAWINGS

Middlemarch Environmental Ltd Drawing C124755-01 – Location of Natura 2000 Sites in Relation to Application Site



Legend

Site boundary

SAC Site

Key to site names:

UK 0030092 - Blaen Cynon SAC
UK 0030141 - Coedydd Nedd a Nellte SAC
UK 0013585 - Cwm Cadlan SAC

N

Project: Hirwaun Enviroparks	
Drawing: Special Areas of Conservation	
Client: Envisage	
Drawing Number: C124755-01	Revision: 00
Scale @ A3: 1:35,000	Date: April 2017
Approved By: KR	Drawn By: SKS

MIDDLEMARCH ENVIRONMENTAL

Triumph House, Birmingham Road, Allesley, Coventry CV5 9AZ
T:01676 525880 F:01676 521400
E:admin@middlemarch-environmental.com

C124755-01

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APPENDICES

APPENDIX 1

Countryside Council for Wales Drawing - Blaen Cynon SAC Management Units

Countryside Council for Wales Drawing - Blaen Cynon SAC Marsh Fritillary Butterfly Habitat Map

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales

Unedau Rheoli
Management Units

Blaen Cynon

Map 1 / 1 Côd Safle y GE **EC Site Code** UK0030092

Ardal Cadwraeth Arbennig (ACA)
Special Area of Conservation (SAC)

1 Ffiniau'r unedau a chyfeirnodau
Boundary of unit and Ref number

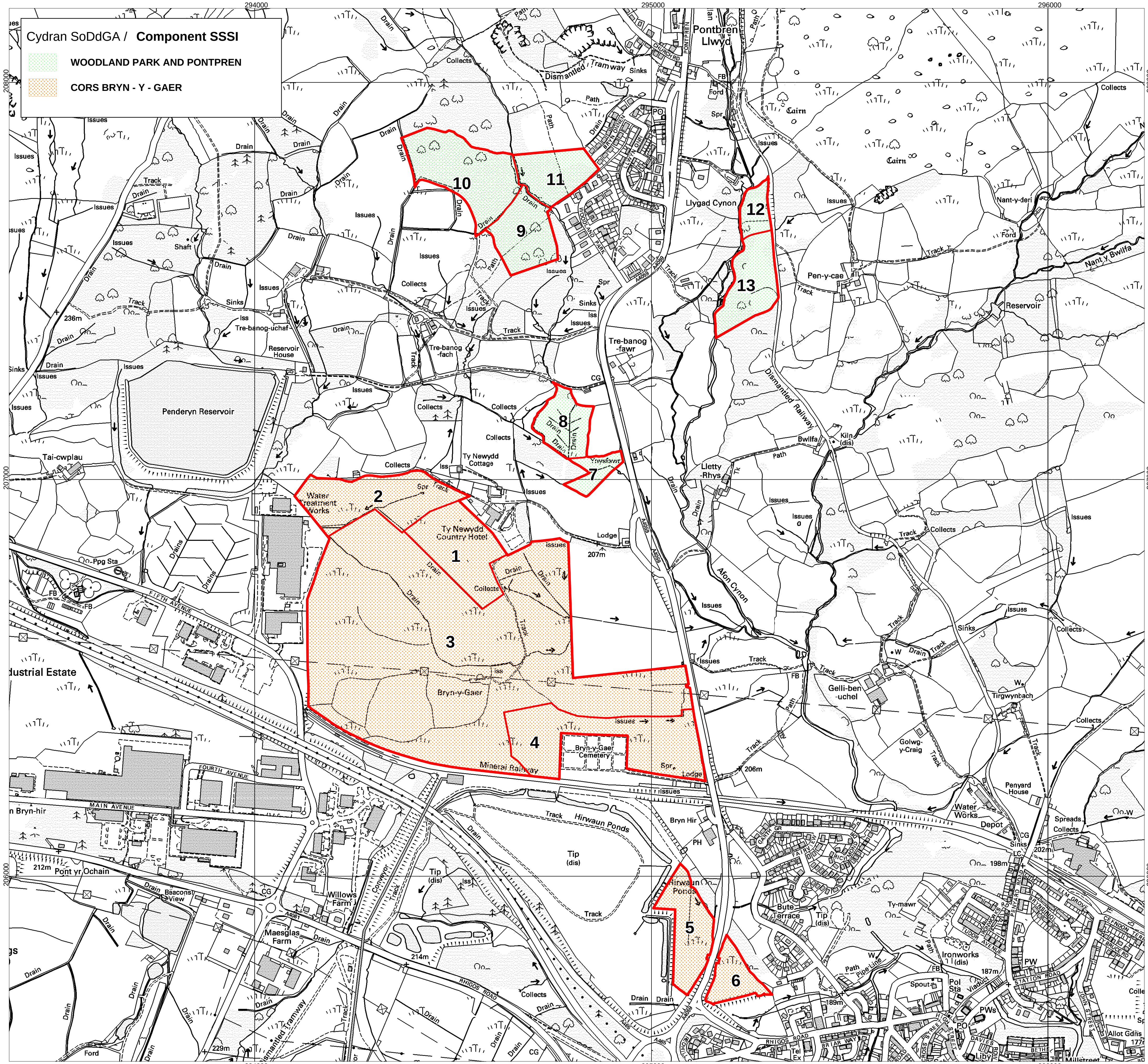
Tafluniad map: Y Grid Cenedlaethol Prydeinig
Projection: British National Grid

G/N

Graddfa
Scale **1:10,000** **15\03\2008**

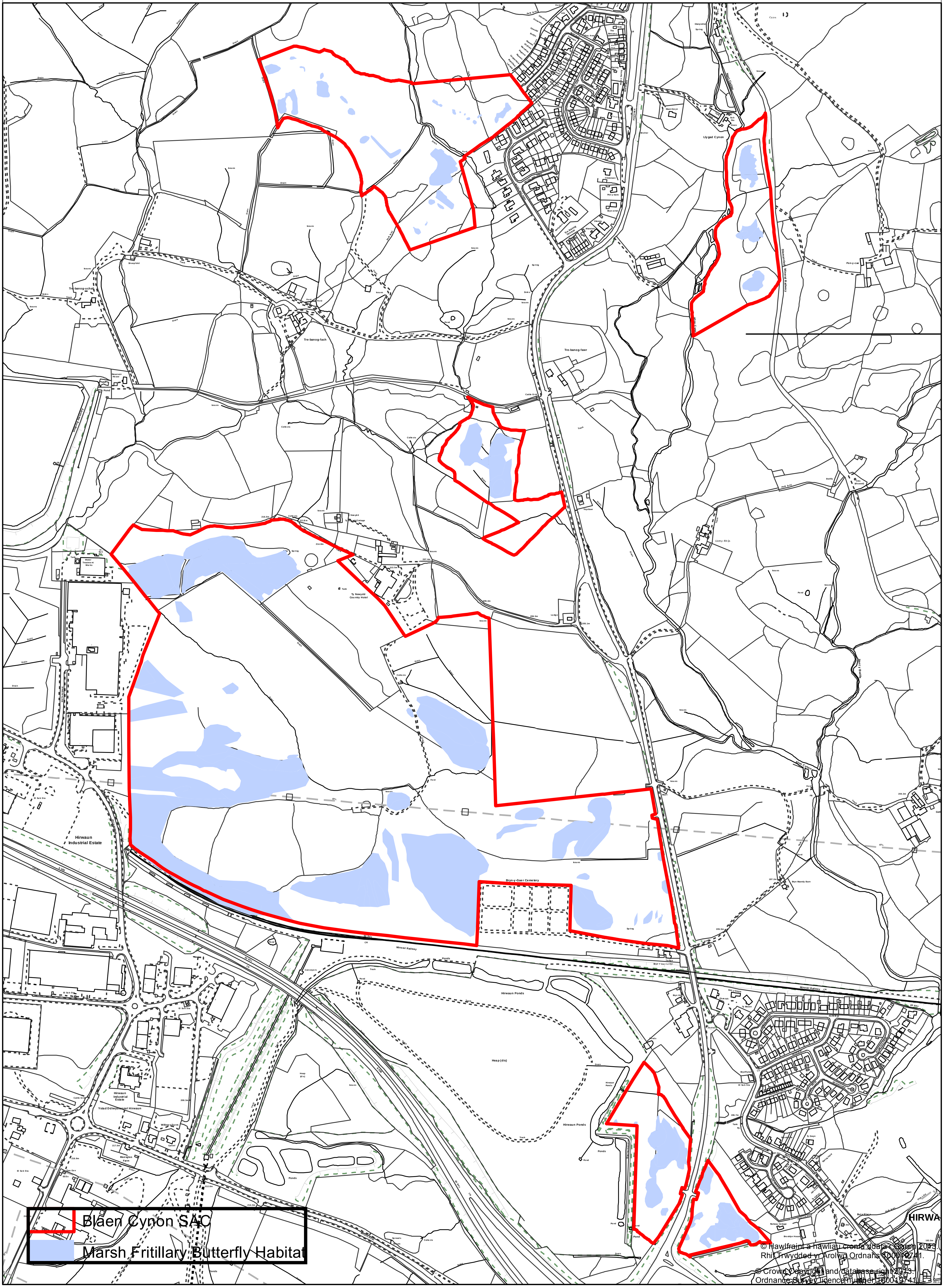
Noder:Data wedi ei gipio ar raddfa 1:2,500, rhoddwyd ar raddfa 1:10,000
Mae mapiau graddfa-fawr swyddogol ar gael gan CCGC.

Note: Data captured at 1:2,500 scale, placed on 1:10,000 scale
A definitive large scale map is available on request from CCW.



Cyfoeth Naturiol Cymru
Natural Resources Wales

Blaen Cynon Special Area of Conservation (Marsh Fritillary Butterfly Habitat Map)



APPENDIX 2

Countryside Council for Wales Drawing - Coedydd Nedd a Mellte SAC Management Units Master-map

Countryside Council for Wales Drawing - Coedydd Nedd a Mellte SAC NCV Phase II Woodland Habitat

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales

Lleoliad mapiau uned rheoli ar raddfa fawr.
Location of large scale management units maps.

Coedydd Nedd a Mellte

Map 1 / 1

Côd Safle y GE **EC Site Code** **UK0030141**

Ardal Cadwraeth Arbennig (ACA)
Special Area of Conservation (SAC)

Safle o Ddiddordeb Gwyddonol Arbennig (SoDdGA)
Site of Special Scientific Interest (SSSI)

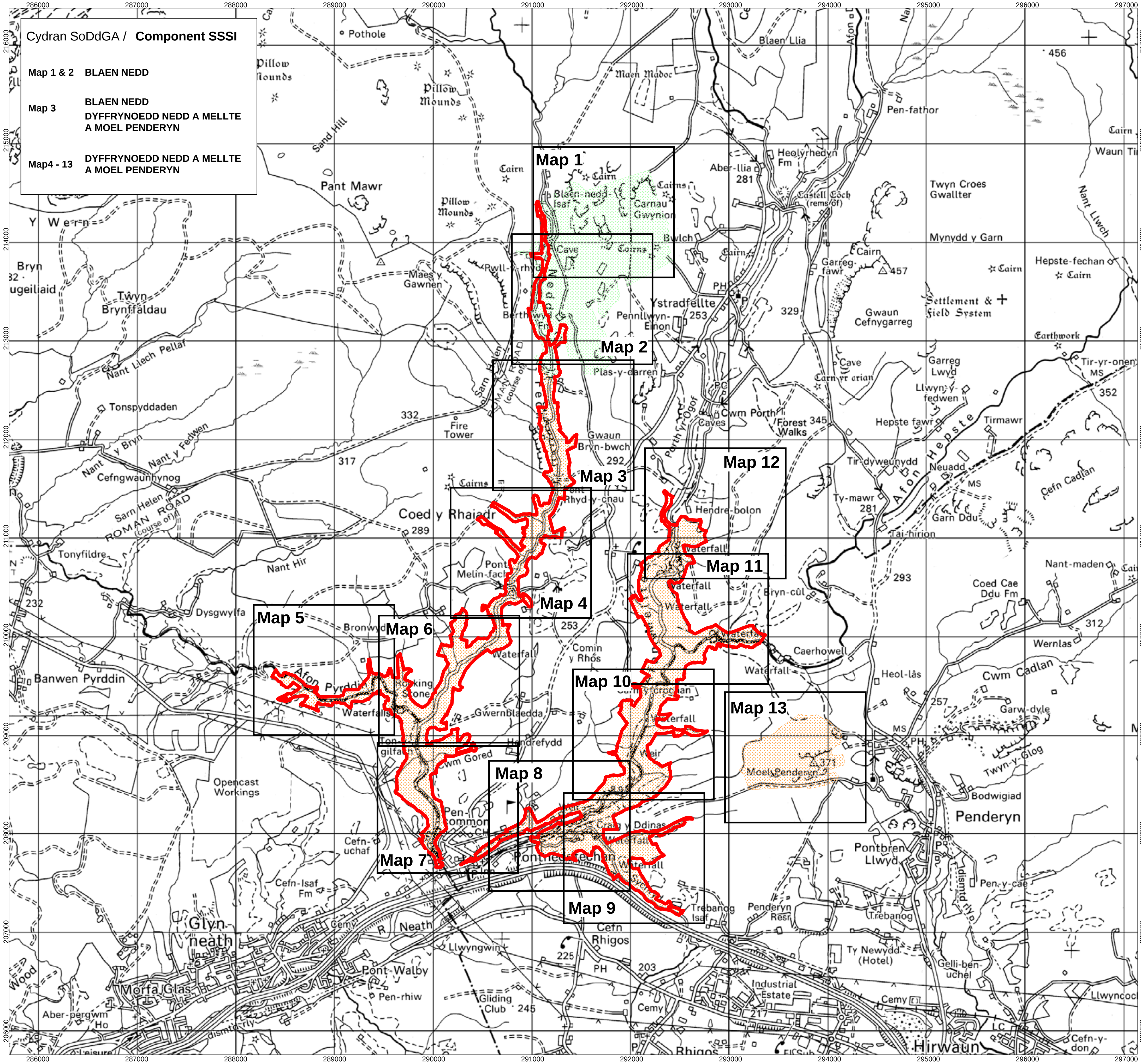
Blaen Nedd

Dyffrynoedd Nedd a Mellte a Moel Penderyn

Tafluniad map: Y Grid Cenedlaethol Prydeinig
Projection: British National Grid

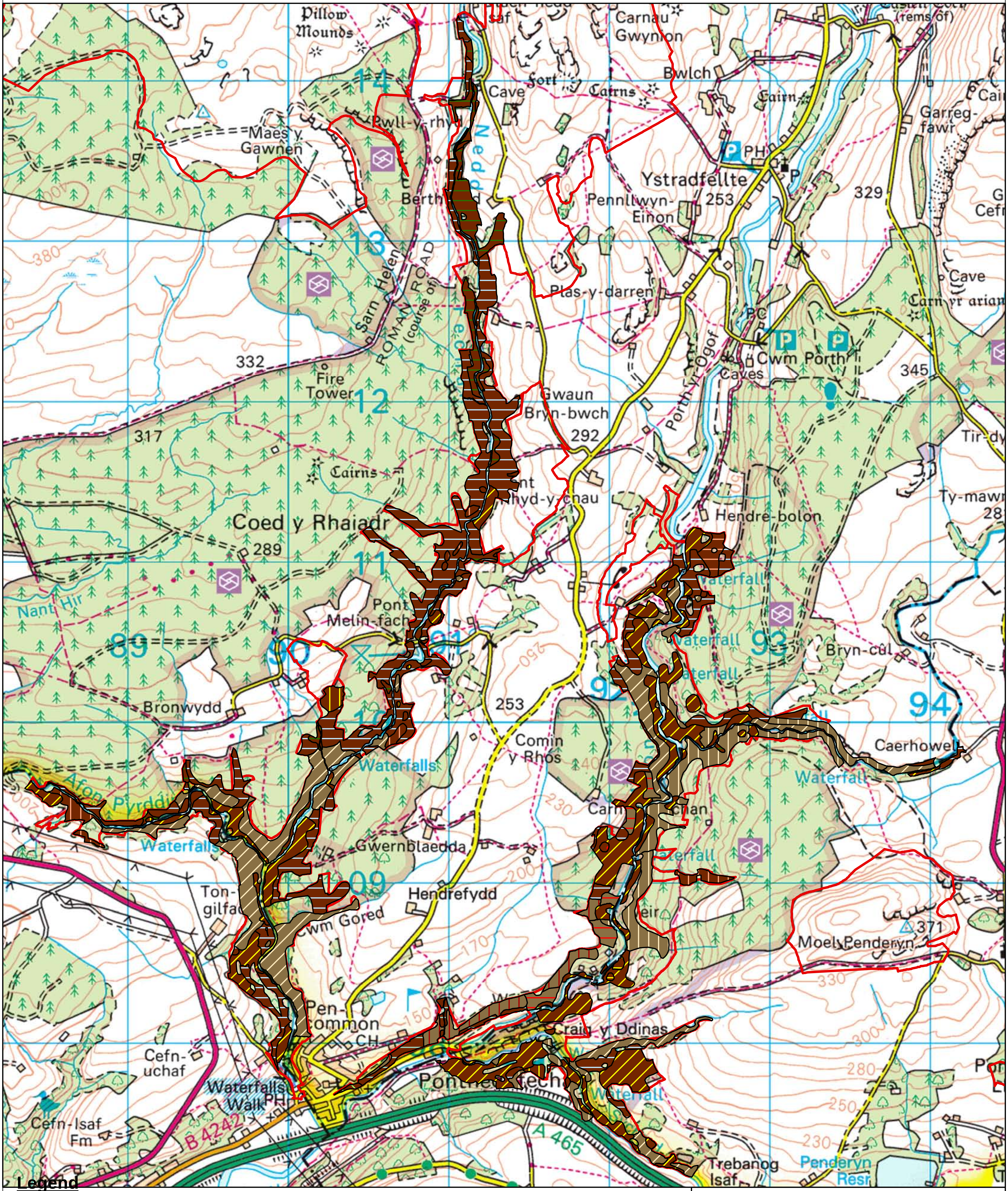
G/N

Graddfa
Scale **1:40,000** **15/03/2008**



Cyfoeth Naturiol Cymru
Natural Resources Wales

NVC phase II woodland Habitat



Legend

PH2_Woodland_Vegetation

NVC_CODE

- W1
- W4a
- W4b
- W7a
- W7b
- W7c
- W8a
- W8d
- W9a
- W10a
- W11a
- W15a
- W16b
- W17b
- W17c

0 0.1 0.2 0.4 0.6 0.8 Kilometers

N

APPENDIX 3

Countryside Council for Wales Drawing – Cwm Cadlan SAC Management Units

Countryside Council for Wales Drawing – Cwm Cadlan SAC - Annex 1 Habitats (2016 SAC monitoring data)

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales

Unedau Rheoli
Management Units

Cwm Cadlan

Map 1 / 1

Côd Safle y GE **EC Site Code** UK0013585

Ardal Cadwraeth Arbennig (ACA)
Special Area of Conservation (SAC)

1 Ffiniau'r unedau a chyfeirnodau
Boundary of unit and Ref number

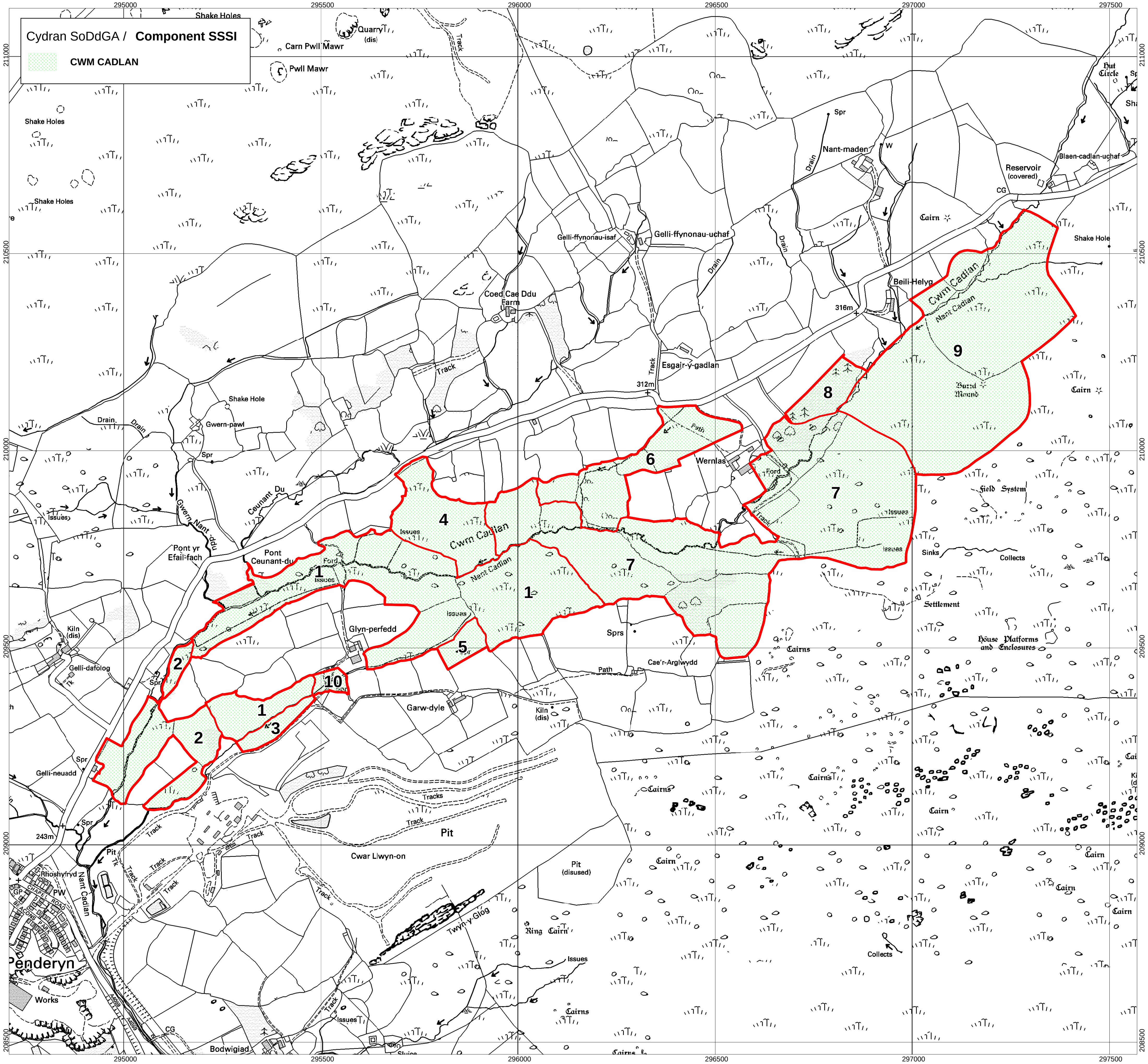
Tafluniad map: Y Grid Cenedlaethol Prydeinig
Projection: British National Grid

G/N

Graddfa **Scale** **1:10,000** **25/02/2008**

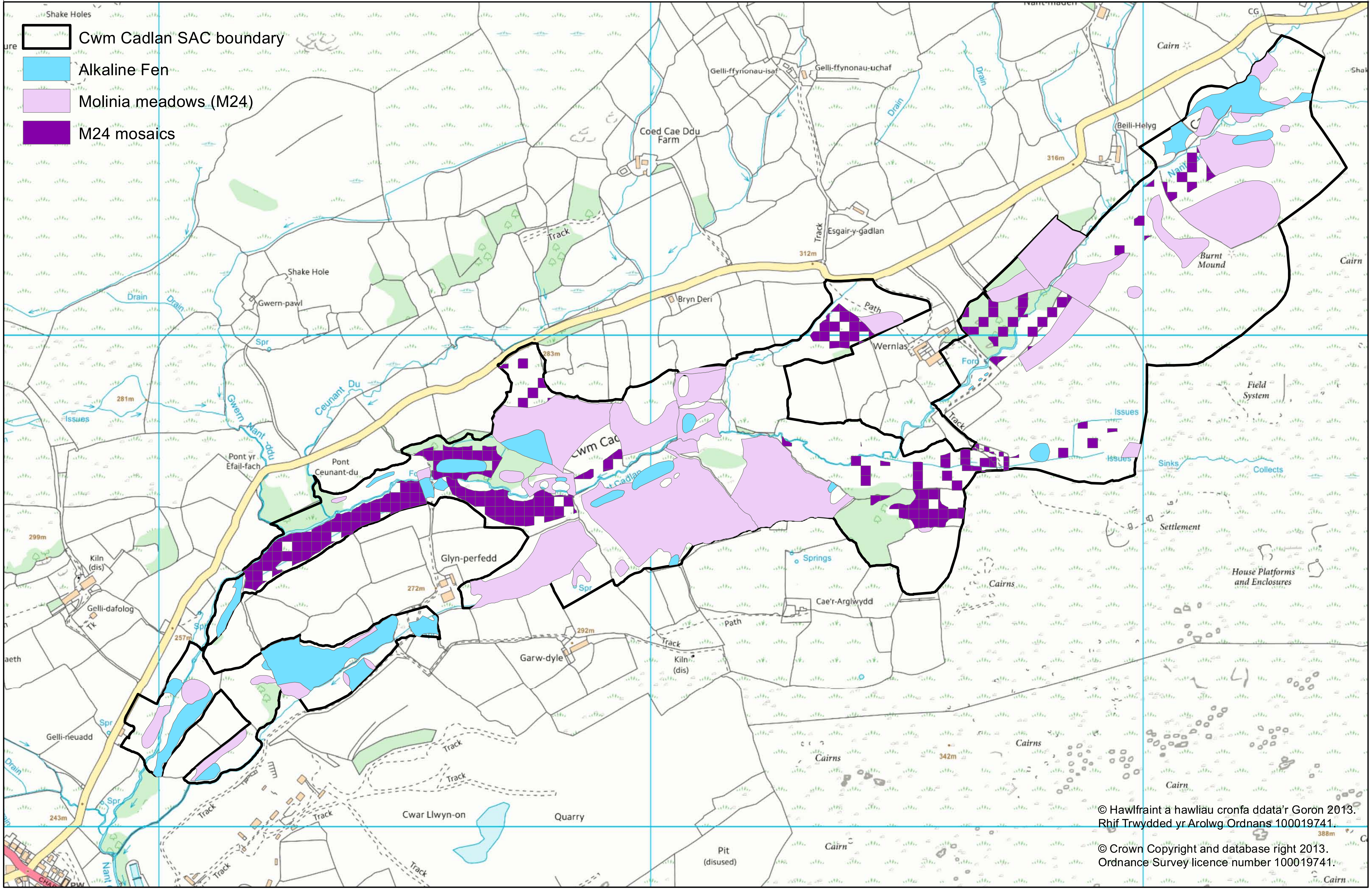
Noder:Data wedi ei gipio ar raddfa 1:2,500, rhoddwyd ar raddfa 1:10,000.
Mae mapiau graddfa-fawr swyddogol ar gael gan CCGC.

Note: Data captured at 1:2,500 scale and placed on 1:10,000 scale.
A definitive large scale map is available on request from CCW.



Cyfoeth Naturiol Cymru
Natural Resources Wales

Cwm Cadlan Special Area of Conservation (SAC) Annex 1 Habitats (2016 SAC monitoring data)



APPENDIX 4

2009 Section 106 Agreement – Part 3, Schedules 11 and 12

ELEVENTH SCHEDULE

Butterfly Conservation's Covenants

Butterfly Conservation agrees with the LPAs and the Developer:

1. that on receipt, to pay any sum forming part of the Biodiversity Contribution into a Restricted Fund to ensure the transparent tracking of Biodiversity Contribution income, expenditure and any interest accrued;
2. to use the Biodiversity Contribution for the implementation of the Biodiversity Scheme;
3. that it shall within twelve months of receiving payment of the Biodiversity Contribution form an Advisory Group to include representatives of the LPAs and to which the Countryside Council for Wales, Environment Agency Wales and the Developer shall be invited to send representatives;
4. that it shall within thirty-six months of receiving payment of the Biodiversity Contribution provide the Advisory Group with a written Habitat Management Plan;
5. that it shall produce a written annual report to the members of the Advisory Group detailing the outcomes of the Biodiversity Contribution to date under this Deed;
6. to repay to the Authority such amount of the Biodiversity Contribution which has not been expended in accordance with the provisions of this Deed within fifteen years of the date of receipt by Butterfly Conservation of the payment of the Biodiversity Contribution together with any unspent interest as accrued thereon to the date of such repayment.

TWELFTH SCHEDULE
Biodiversity Scheme

1. The Biodiversity Scheme will:

1.1 operate to a Habitat Management Plan within a five kilometre radius of the centre of the Site unless otherwise agreed through the Advisory Group.

1.2 seek to secure the habitat management of a minimum area of fourteen hectares within a period of five years. The remaining area to be secured within a further period of five years, providing a project timeframe of fifteen years;

1.3 focus on off-Site management of sub optimal marshy grassland to ensure it is sympathetically managed and all its interest features are then maintained in favourable condition for the duration of landowner agreements.

2. The Biodiversity Scheme has three distinct phases (which may overlap):

2.1 **Scheme Development Phase:**

2.1.1 A scoping exercise would identify landowners within five kilometres of the Site with suitable marshy grassland.

2.1.2 Where landowners express an interest in participating in the Biodiversity Scheme, site walkovers will be undertaken and an inventory of the land management infrastructure requirements (e.g. fencing, gates, stiles, etc) will be made.

2.1.3 A Habitat Management Plan will be written detailing the proposed works and phasing them according to budget.

2.2 **Implementation Phase:**

2.2.1 The Habitat Management Plan will be implemented with a standard land management agreement for a three year period signed with the landowner.

2.2.2 Where the landowner has the necessary skills, the Biodiversity Scheme will provide materials and the landowner will undertake the works (e.g. fencing). Where the landowner is not capable of undertaking works the scheme would arrange for local contractors to undertake necessary works using existing Butterfly Conservation contractor tendering protocols.

2.3 **Monitoring Phase:**

2.3.1 The impact of the works will be assessed using standard monitoring protocols for marshy grassland habitat and key features.

2.3.2 Monitoring will inform feedback to landowners and additional works will be implemented where required.