Additional Information to Support
An Environmental Impact Assessment

Enviroparks (Hirwaun) Ltd
Hirwaun Industrial Estate
Aberdare

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SUMMARY

This report has been prepared as a result of two objections received during the planning consultation for a proposed development of an Enviroparks site at Hirwaun in Aberdare, South Wales. The two objections each requested that additional information be provided on the potential impacts of the proposed site on sensitive ecological receptors in the vicinity.

The report has been produced in consultation with each of the two bodies raising objections, and with the two relevant local planning authorities, in order that suitable and sufficient information be provided for consideration with the original Environmental Statement submitted with the planning application. Additionally, a screening stage Appropriate Assessment has been produced. This report seeks to:

- Detail the potential impact of aerial emissions on sensitive sites up to 10 km away from the proposed development;
- Provide information on and assess the potential impact of Nitrogen and acid deposition on sensitive ecological receptors;
- Identify the impact of hydrological changes and any potential for land or water contamination, with specific consideration to the Cors Bryn-y-Gaer Site of Special Scientific Interest;

In summary, the report concludes that:

- The **predicted environmental concentration of aerial emissions** from the proposed development, which considers the background air quality concentration as well as the process contribution to air quality, **are not considered to be of significant concern, either to human health or to vegetation**, although not all substances can be screened as insignificant by definition.

- **Although the 1 % threshold of insignificance can be seen to be exceeded for nutrient Nitrogen and acid deposition at Blaen Cynon and for acid deposition at Bryncarnau Grasslands Llwyncoed**, the contribution of the process to such deposition at both sites is considered to be a minor proportion of the total and thus is **not considered to have any significant overall impact.**

- The **data has considered the in-combination effects** of currently identified potential local developments and increases in traffic emissions. Neither of these elements has any significant effect.

- **No additional abatement measures are proposed** for emissions to air from the Enviroparks development.

- The **proposed Enviroparks development at Hirwaun does not intend to alter the hydrology of the area.** Once construction works are complete, during which foundations, excavated areas, below ground rooms and drainage and utility runs will be laid, there will be no on-going impact on the hydrology of the area. **The company does not propose to abstract ground water** for use and will not require excavation to any significant depth. **Therefore there will be no significant impact on ground or surface water features in the area.**

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1 INTRODUCTION

In November 2008, Enviroparks (Hirwaun) Ltd submitted a planning application for the development of an Enviropark facility on the Hirwaun Industrial Estate in South Wales. The application was made to both Rhondda Cynon Taf County Borough Council (RCT) and Brecon Beacons National Park Authority (BBNPA), as the proposed site for the facility straddles the boundary of these two authorities. The proposal has received three Holding Objections in key, specialist areas. This report has been prepared to supply additional information to the Environmental Statement originally submitted, and will be submitted to the Local Authorities for consideration with the planning application.

The three Holding Objections were received from the Countryside Council for Wales, the Environment Agency (Wales) and Welsh Water. This report considers the objections raised by CCW and EAW. Information on the reasons for the Objections are detailed below. Additional information responding to Welsh Water is presented in a separate report.

COUNTRYSIDE COUNCIL FOR WALES (CCW)

The Countryside Council for Wales detailed their concerns in a letter dated 20th January 2009. The main concerns related to the possible adverse impacts of the proposed development on the features of the European designated sites within a 15 km radius of the site. Particular concerns were raised in relation to the potential for air emissions to cause pollution to the Blaen Cynon Special Area of Conservation (SAC), which sits approximately 150 m to the east of the site at its nearest point. Additionally, Coedydd Nedd a Mellte and Cwm Cadlan SACs are within 5 km of the site, and there are two further SACs within a 15 km radius. CCW were also concerned of the potential for impact on sites of national importance in the area.

The second predominant concern of CCW was the potential for hydrological changes at the site, and their potential to impact on the nearby SACs. CCW recommended that an Appropriate Assessment be undertaken to consider the potential impacts of these issues on the local SACs. Information is provided within this report which relates to both the potential impact of aerial emissions, and the potential for hydrological change at the site. The information has been presented with consideration to the examples provided in the Holding Objection made by CCW.

THE ENVIRONMENT AGENCY WALES (EAW)

The Environment Agency Wales raised an Objection (12th February 2009) on the basis that the proposed development would likely have an adverse impact on nature conservation and they considered that insufficient mitigation and compensation measures had been proposed. They also considered that insufficient information had been provided on the potential for land contamination at the site, and the potential impact that this could have on controlled waters.

Due to the similarities of the CCW and EAW concerns, a joint meeting was held between the two consultees and the developer to discuss the provision of further information. At this meeting, the developer agreed to support a screening stage Appropriate Assessment as recommended by CCW, and to provide further specific detail on the potential effects of aerial emissions on the sensitive sites in the local area. It was also noted that the final report of intrusive works was now available and therefore more detailed information on the status of any land contamination and hydrological issues could be provided. CCW confirmed at this meeting, that the 15 km radius originally suggested for the study, could be reduced to a 10 km radius.

2 SUMMARY OF INFORMATION REQUIRED

Three Holding Objections have been received by RCT and BBNPA regarding the proposed Enviroparks development at Hirwaun. This report considers the objections raised by two of the statutory consultees. The developer has met with the consultees to discuss the additional information in support of the application. The information to be provided includes:

- Details of the potential impact of aerial emissions on sensitive sites up to 10 km away from the proposed development;
- Information and assessment of the potential impact of Nitrogen and acid deposition on key ecological receptors;
- The impact of hydrological changes and any potential land or water contamination, with specific consideration to the Cors Bryn-y-Gaer Site of Special Scientific Interest;
- Disturbance of species and loss of habitat, considered as part of the Appropriate Assessment;
- The provision of a screening stage Appropriate Assessment (accompanying, although not included within this report).

This report considers the effects that changes to air quality through the operation of the proposed site, will have on sensitive receptors in the area. It also provides the results of extensive ground and water quality investigations at the site. The data within this report has gone towards informing the Appropriate Assessment which has also been compiled. The Appropriate Assessment is provided as a separate document.

3 AIR QUALITY EFFECTS AT SENSITIVE SITES

Within the original Environmental Statement, Enviroparks provided information on an air dispersion modelling exercise. This modelled two proposed stack heights, and had informed the design of the site through full consideration of the contributions to the Air Quality Objectives and other air quality standards. The model considered both the process contribution (PC), i.e. the contribution which the process would have on the relevant air quality standards as a stand alone source, and the overall predicted environmental concentration (PEC) which considers the impact of the site in combination with other sources of pollution. In this instance, the current background data was taken to provide information on the present effects of other sources, be they natural, industrial or from transportation sources.

The modelling report presented as part of the Environmental Statement included information on the anticipated emissions to atmosphere from the site, meteorological conditions, the local terrain, the effects of site buildings and local surface roughness. Additionally, two separate stack heights were modelled, at 35 m and 40 m above ground level. The subsequent planning application included a 40 m high stack. However what was not apparent from the modelling report is the additional information which has been considered within the exercises. In order to fully inform the design process, modelling had considered not only differing stack heights, but also different stack locations, varying temperatures and velocities of the discharge gases, and the ability of off site buildings to affect plume dispersion. Although these models were run, they were not reported in an effort to ensure the report remained concise, and either because their effect was negligible, and / or because they did not form part of the final design.

Meteorological data was supplied by the Met. Office, and was confirmed as being the most appropriate data for this site. The data was produced by combining meteorological data from St. Athan and Sennybridge met stations. Wind speed and direction data was from Sennybridge, which is located approximately 22 km north of the subject site. The prevailing wind direction recorded at the site over the course of five years of data is W (3 years) to SW (2 years). A screening model suggests that a prevailing wind from the north or north east may give rise to higher pollutant concentrations, however it should be borne in mind that the data from the Met. Office includes actual measured data from a relatively local site. This will include not only data of the prevailing wind direction, but any wind direction detected over the course of a year. Manipulating a data set to give a differing prevailing wind direction, is therefore considered to provide a less robust approach to the modelling, unless firm evidence exists to suggest that the prevailing wind is likely to differ significantly. Additionally, a west or south westerly prevailing wind 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. Modelling from the north may suggest higher concentrations of pollutants, however in the short screening runs undertaken to assess the difference in wind direction, these can be seen to drop off relatively quickly, due in part to the higher concentrations close to the source, but also due to the other effects considered within the model, such as terrain data.

No further information on the results of these screening runs, or the additional scenarios originally modelled for the project are provided here.

The fuel to be fired in the engines is highly processed before reaching the engine house, having passed through the Enviroparks system prior to this point with the sole purpose of creating an optimal fuel for combustion and thus energy production. Data on emissions was provided by the Enviroparks team engineers, and is almost independent of the variability of feedstock because the waste can be managed at every step of the process to create a high quality fuel. The data provided for use within the modelling exercises was considered to represent a worst case scenario for the engines whilst firing. Additionally, the model assumed that operation of all of the engines would be continuous throughout the year, and thus will naturally be an overestimate of emissions to atmosphere for a site which will require some maintenance and shutdown time.

Whilst the contribution of the process is a key element for consideration, it must be remembered that any impact from the site will contribute to current levels of pollution and will not act alone. Therefore it is important to consider the effect of the development in combination with any other impacts in the vicinity of the sensitive receptors. During the preparation of the initial Environmental Statement, an assessment was made of potential developments within the Local Authorities which may have a combined effect with the proposed Enviroparks site. It was deemed that there was nothing either passing through planning, or having received planning permission within sufficient proximity to the site and within the previous five years, that was likely to have any impact. Thus the available background concentrations and the changes to traffic flows in the area were applied as the only in combination effects. At the time of preparing this supplementary report, a further review has been undertaken to ensure that no new planning applications have been registered which may need to be considered in combination with the Enviroparks development. Correspondence was had with BBNPA, RCT and neighbouring Neath Port Talbot Local Authorities, and available information suggested that there were unlikely to be any planning applications or recent permissions which will required consideration. Denis Canney noted that he was “unaware of any significant proposals” since Enviroparks first assessed potential developments in the BBNPA area, and the planning registers of RCT and Onllwyn, Glynneath, Blaengwrach and Glyncorrwg Wards of the Neath Port Talbot Council were reviewed. Some planning applications related to the Hirwaun Industrial Estate or the local area such as Rhigos, however none of the applications observed were likely to form a contribution to the emissions from the Enviroparks site. For example, a planning application submitted in February 2009 for a site on Fifth Avenue was for the creation of a vehicle dismantling site, and another in Rhigos was for a caravan workshop and storage unit. One large industrial development within RCT had been submitted for outline planning, however this is located at the old Coed Ely Colliery site, which is more than 10 km distant from the proposed Enviroparks development, being located in the south of the RCT area. Hence, no in combination impact with the emissions from the Enviroparks site is likely.

Industrial applications in the Neath Port Talbot area were largely concerning open cast or deep mine coal workings. A discussion with Mr Neville Morgan of Neath Port Talbot Council confirmed that these were unlikely to have an effect on a site at any distance. Some monitoring has been undertaken at some such sites, predominantly for particulate levels. Depending on the particle size and density, particulate will generally deposit within a 1 km distance of its source. Additionally, NO_x monitoring has been undertaken at some sites, to assess the impact of high numbers of vehicle movements. Mr Morgan noted that despite some very high concentrations being experienced in the immediate vicinity of vehicle movements around the coal working sites, these drop off at 50 – 80 m distance from the source. Other applications in the Neath Port Talbot area include those for wind farms in the vicinity, however these will not provide any significant in combination effects to the proposed Enviroparks development. Of note however, a screening opinion was requested in December 2008 for a small biomass CHP and a wood pellet manufacturing plant. There was no detail on the application available, however the planning decision (P2009/0015 14/01/2009) was than no screening was required. The land which was operated as Maesgwyn opencast, and is proposed for this site, is located approximately 6 km to the west of the proposed Enviroparks development site. A small biomass CHP unit is unlikely to have any significant in combination effects from its direct operation at such a distance. That said, a biomass plant and wood pellet manufacturing plant will require substantial transportation movements to provide fuel and raw materials. As no full planning application is available to assess the likely requirements of the biomass plant, it has not been possible to consider the potential in-combination effects of this speculative application at this stage. However the effects of pollution from transportation movements tend to remain relatively local to the source, and normal projected traffic increases in the vicinity of the SACs have been considered within this report. Therefore, it is considered that the incorporation of background data, and the application of increased traffic movements provides a suitable assessment of potential in combination effects with the proposed Enviroparks development.

The Countryside Council for Wales has requested information on the potential effects on sensitive receptors within a 10 km radius of the site. As such, further modelling studies have been undertaken, which consider the same input data into the model as previously detailed in the Environmental Statement, but which incorporate all of the sensitive ecological receptors within a 10 km radius of the site. The sites have been input as individual receptors, using the grid references provided for each site by the JNCC (www.jncc.gov.uk) or MAGIC (www.magic.gov.uk) websites.

Two sets of models were run, one considering a 10 km^2 grid, with the site at the approximate centre, and the other considering a 30 km^2 grid with the site located approximately at the centre. These two modelling grids thus enabled receptors within a 5 km radius to be considered, and more extensive sites, up to 15 km away from the proposed development to be considered, although only detail on sites up to 10 km from the proposed development are included here. Both of the models considered the effects of dry deposition and total deposition, and included meteorological data from 2007, the year which had been seen during the earlier study to result in the highest number of maximum concentrations from the five years of data modelled. However only the smaller grid included terrain data, as this was readily available from earlier studies, whereas the terrain tile available was not large enough to model the more extensive 30 km^2 grid.

The models identify both the concentration of pollutant species in air resulting from emission discharges from the site and the levels of deposition which can be anticipated across the modelled grid and at sensitive receptors. These results have been used to provide information on the predicted air quality and to calculate the likely concentrations of nutrient Nitrogen and acid deposition at sites within a 10 km radius. Where process contributions are screened as insignificant, further study at that site has stopped.

Assessment of the deposition of nutrient Nitrogen has been determined by multiplying the deposition concentration of NO_x (as NO_2) by 0.3043 to reduce the Oxides of Nitrogen to nutrient Nitrogen. Assessment of acid deposition is calculated on the APIS website (www.apis.ac.uk) as follows:

Acid Deposition = (S + (NO_X+NH_X)) - NMBC where

S (non-marine sulphur) wet + dry deposition
NO_X (oxidised nitrogen) wet + dry deposition
NH_X (reduced nitrogen) wet + dry deposition
NMBC (non-marine base cations, Ca + Mg) wet deposition

This calculation assumes that all non-marine sulphur and nitrogen deposition is acidifying. In practice, a fraction of the nitrogen deposition may be accumulated by the ecosystem resulting in actual acidification being less than the figure estimated here. Note, no reduced nitrogen, calcium or magnesium is emitted from the process and so these inputs have been ignored in this calculation.

A similar mechanism has been used to calculate acid deposition in this study, although with two key differences:

Although the APIS calculation considers total deposition (dry and wet) in the calculation of acid deposition, the calculations included in this report consider dry deposition rates only. This is because of the relative insolubility of NO_x, and due to information provided by CERC (suppliers of the ADMS model) which confirmed that the wet deposition characteristics recommended by the Environment Agency need only consider significant releases of SO_3 and / or H_2SO_4, neither of which are relevant here. Hence data for wet deposition is not included in the calculation of acid deposition. That said, the APIS calculation also removes the non-marine base cations from the total acid deposition figure, having the effect of reducing the overall level of deposition at the site. As no information is available on the non-marine base cations, these have not been removed from the calculations undertaken.

Tables 1 - 23 present the results from the modelling and calculation exercises, and follow the example tables provided by CCW for reference. Detail on how the results have influenced further study are included as notes to the tables, for ease of reference and understanding.

As a screening tool, the following standard criteria have been applied to the results to assess their significance:

- If the long term process contribution (PC) to ground level concentration or deposition rate is less than 1 % of the assessment level for any pollutant, the impact of that pollutant is likely to be insignificant.

- If the short term process contribution (PC) to ground level concentrations of deposition rates is less than 10 % of the assessment level for any pollutant, the impact of that pollutant is likely to be insignificant.

- If the combination of the long term contribution to ground level concentrations or deposition rates, plus the background (known in combination as the predicted environmental concentration (PEC)) exceeds 70 % of the assessment level for any pollutant, it is unlikely to have an insignificant effect, and therefore requires further, detailed modelling work (as already undertaken in this case).

3.1 What is Insignificance?

The criteria used to determine whether a concentration can be considered to be insignificant consider that:

- As the proposed 1% long term criterion for process contributions is two orders of magnitude below the assessment level which represents the maximum acceptable concentration for the protection of the environment, a substantial safety factor has been built in. Even if the existing ambient quality in an area meant that a benchmark was already at risk due to releases from other sources, a contribution from the process of less that 1% (which is in itself likely to be an overestimate) would be only a small proportion of the total.

- The criterion for screening short-term emissions that are unlikely to lead to significant environmental impacts is proposed as 10% of the relevant short-term benchmark. The assumption is that for short term releases, differences in spatial and temporal conditions mean that the process contributions themselves are more likely to dominate and not the ambient environmental concentrations. If a maximum error factor of 10 is assumed for the estimation of short-term contributions, it suggested that those emissions below 10% of the short term EAL are unlikely to lead to breaches of a short-term benchmark. That said, short term exceedences of gases are unlikely to have a significant effect on ecosystems, as evidenced by the lack of short term objectives for NO_2 or SO_2, when considering the protection of vegetation.

- For long-term releases the risk of breaching an assessment level is usually dominated by the background concentration rather than the process contribution, and hence the need to consider the predicted environmental concentration. Where analysis of ambient environmental quality for air indicates that the background level is already high for a substance released from the installation, there is a risk that the additional contribution from an individual installation may result in a breach of an environmental benchmark. Concentrations may be considered to be high where the predicted environmental concentration is 70% or more of the appropriate environmental benchmark or where an Air Quality Management Plan is in place for a particular substance. This criterion is based on a possible margin of error in monitoring background data in the region of ±50%.

Therefore the criteria for assessing process contributions are considered to represent a point beneath which, the effect of contributions to ground level concentrations will be insignificant. They do not represent the point at which concentrations necessarily become significant, particularly when considering the substantial safety margins which are factored into the insignificance thresholds. ***Conversley, predicted environmental concentrations above 70 % of the assessment level will likely have a significant effect.*** Where the reported process contribution or predicted environmental concentration cannot be screened as insignificant in the following tables, these figures are marked in bold.

Table 1 Designated Sites Within 10 km of the Proposed Enviroparks Facility

Site Reference Number	Name	Designation	Grid Reference (Taken From JNCC / MAGIC Websites And Applied To Model)	Approximate Distance From Site (At Closest Point)	Location In Relation To Site
1	Blaen Cynon	SAC	294600 206600	100 m	East
2	Coed Nedd a Mellte	SAC	291900 209300	1.8 km	West North West
3	Cwm Cadlan	SAC	296100 209800	2.4 km	North East
4	Dyffrynoedd Nedd a Mellte a Moel Penderyn	SSSI	291963 209323	1.5 km	North
5	Cwm Gwrelych and Nant Llynfach Streams	SSSI	290552 205212	3.5 km	South West
6	Craig-y-Llyn	SSSI	291766 203223	3.6 km	South South West
7	Bryn Bwch	SSSI	292056 210947	4.2 km	North North West
8	Caeau Nant-y-Llechau	SSSI	290178 210332	4.8 km	North West
9	Gweunedd Dyffern Nedd	SSSI	291466 211553	4.8 km	North North West
10	Bryncarnau Grasslands Llwyncoed	SSSI	299833 206502	5.5 km	East
11	Blaenrhondda Road Cutting	SSSI	293072 200784	5.5 km	South
12	Blaen Nedd	SSSI	291639 213639	6.1 km	North North West
13	Ogof Ffynnon Ddu Pant Mawr	SSSI	288138 215120	7 km	North North West
14	Caeau Ton-y-Fildre	SSSI	286271 210738	7.9 km	North West
15	Penmoelallt	SSSI	301713 209502	8.1 km	East North East
16	Mynydd Ty-Isaf Rhondda	SSSI	292851 196797	8.3 km	South
17	Plas-y-Gors	SSSI	292106 215519	8.4 km	North North West
18	Daren Fach	SSSI	301914 210477	8.5 km	North East
19	Cwm Glo	SSSI	303248 205630	8.8 km	East
20	Waun Ton-y-Spyddaden	SSSI	286404 212193	8.8 km	North West
21	Gorsllwyn Onllwyn	SSSI	285408 210752	9 km	North West
22	Cwm Taf Fechan Woodlands	SSSI	303945 208684	9.2 km	East North East
23	Nant Llech	SSSI	283867 212245	9.7 km	North North West

Yellow rows are between 0-5 km of the site and orange rows are between 5-10 km of the site.

4 INFORMATION ON SENSITIVE ECOLOGICAL RECEPTORS

Information on each of the sensitive ecological receptors, their key features and reasons for designation follows:

Blaen Cynon SAC

Blaen Cynon is considered to be one of the best areas in the UK for occurrence of the marsh fritillary butterfly. The marsh fritillary butterfly frequents damp meadows and, more rarely, chalk grassland, where its larvae feed on devil's-bit scabious *Succisa pratensis*. It has declined and is now extinct from the eastern half of its former range in the UK (except where it has been reintroduced) and has shown a similar decline throughout Europe. The Blaen Cynon site is part of a wider area used by a metapopulation of marsh fritillary butterfly. Cors Bryn-y-Gaer SSSI and the nearby Woodland Park and Pontpren SSSI will contribute towards supporting the metapopulation of marsh fritillary in the Penderyn/Hirwaun area. These two sites comprise the Blaen Cynon SAC.

The various habitats within the SAC are to be managed for the benefit of this butterfly. Wet grassland covers at least 50% of the total site area. The wet grassland is comprised of acid flush and marshy grassland. Small areas of the site should consist of habitats associated with the wet grassland, including wet heath, bog pools and swamp.

Coedd Nedd a Mellte SAC

Coedd Nedd a Mellte comprises mixed woods on base-rich soils in moist shady conditions associated with ravines or rocky slopes. Ash *Fraxinus excelsior* tends to dominate but wych elm *Ulmus glabra* and lime *Tilia* species are also usually present. In UK examples lime is usually sparse and may be absent from northern woods which otherwise fit this woodland type. These woodlands are rich in plant species and often have a lush ground flora in which ferns, particularly hart's-tongue *Phyllitis scolopendrium*, are common.

The site is also designated for its western acidic oak woodland. The western oak woods in the UK include a range of woodland types, some with much heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus*, others being more grassy. They typically have rich assemblages of Atlantic mosses and liverworts, distinctive birds, lichen communities, and ferns such as hard fern *Blechnum spicant*, lemon-scented fern *Oreopteris limbosperma* and various species of male- and buckler-fern *Dryopteris*. Holly *Ilex aquifolium* is common in the understorey.

Cwm Cadlan SAC

Cwm Cadlan consists of alcium-rich springwater-fed fens. These are wetland areas that are supplied with base-rich ground water. The water level is permanently high. The vegetation of these fens varies but is usually composed of low-growing sedges, rushes, herbs and mosses, which may include black bog-rush *Schoenus nigricans*, dioecious sedge *Carex dioica* and common butterwort *Pinguicula vulgaris*. Many plants that are rare or scarce in the UK occur in base-rich fens.

The site also includes purple moor-grass meadows. These are wet meadows containing a species-rich mixture of grasses (especially purple moor-grass *Molinia caerulea*), sedges, herbs and mosses. These meadows are usually traditionally maintained by grazing.

Dyffrenoedd Nedd a Mellte a Moel Penderyn SSSI

Dyffrynnoedd Nedd a Mellte, a Moel Penderyn is of special interest for its extensive and diverse semi-natural woodland, important populations of several flowering plants and supporting outstanding assemblages of mosses, liverworts and lichens. The site includes a range of geological features, well-exposed in the cliffs and rocky river beds. These include exposures at Moel Penderyn, Craig y Ddinas and Bwa Maen and geomorphological features within parts of the valleys of the Hepste and Mellte are also of special interest.

This site includes the wooded valleys of the rivers Nedd and Mellte, and their tributaries above Pontneddfechan, as they pass through a millstone grit and limestone plateau, and Moel Penderyn, which lies to the east. The plateau lies at about 300 m, the rivers having eroded deep, narrow valleys with gorges, river cliffs, block scree and waterfalls.

Cwm Gwrelych and Nant Llynfach Streams SSSI

The best sequence of Westphalian (Carboniferous) rocks in the South Wales Coalfield. About 500 metres of strata are exposed, representing a more or less complete section through the Westphalian A, Westphalian B and lower Westphalian C.

Craig-y-Llyn SSSI

Two north-east-facing hollows cut by Pleistocene ice or snow in the edge of the Pennant Sandstone Plateau. The high cliffs, ravines and flushes support many montane species including *Sedum rosea*, *Hymenophyllum wilsonii, Lycopodium selago* on the cliffs and the moss *Andrea rupstris* on flat boulders on the plateau. In Llyn Fach occur *Lobelia dortmanna*, *Isoetes lacustrisis* and *Sparganium angustifolium* in its southernmost locality. Analysis of the pollen preserved in Ffos Cenglau has yielded data on the post-glacial sequence of woodland types in South Wales.

Bryn Bwch SSSI

Bryn-Bwch is of special interest for its extensive area of fen-meadow, with associated mire, wet heath and wet woodland communities. The fen-meadow community, which is characterised by the presence of meadow thistle *Cirsium dissectum*, is a scarce and localised vegetation type in England and Wales.

Caeau Nant-y-Llechau SSSI

This is the largest area of traditional unimproved hay meadow known in Brecknock. The collection of gently sloping, south-east facing fields on the upper valley side of the Nedd support a wealth of plant species. Developed on boulder clay overlying millstone grit, flushed in part by springs and drained by a number of well wooded streams, the varying topography is reflected in the diverse flora, with over 110 species of higher plants recorded from the grassland areas.

Gweunedd Dyffern Nedd SSSI

Gweunydd Dyffryn Nedd is of special interest for its extensive areas of damp pasture and wet heath, including a type of fen meadow vegetation that has a restricted distribution in England and Wales. Large areas of this type of vegetation are now rare because of drainage and agricultural changes.

Bryncarnau Grasslands Llwyncoed SSSI

Bryncarnau Grasslands are situated on a west-facing hillside at the head of the Cynon Valley, to the north of Aberdare. They range from 270 to 320m in altitude, and are bounded by small tributaries of the River Cynon which, towards the western end of the site, occupy deeply incised wooded valleys. The soils are derived from boulder clay over Coal Measures. The site represents a particularly good example of a gradation from lowland mesotrophic grassland to pasture of a more upland character. A range of plant communities are present and these include 2 of very high nature conservation value. A number of plants which are rare in the Glamorgans occur here.

Blaenrhondda Road Cutting SSSI

This is the best available section of the flood-plain facies of the Carboniferous Rhondda Beds. It shows, fining upwards, cycles of sandstones and shales, and includes a thin coal, probably the Daren Rhesfyn Seam. Some of the sedimentary channels are of particular interest in that they are side-filled. The variety of flood-plain and backswamp conditions represented in this section are significantly different from the Rhondda Beds as seen in South Wales, where deltaic sandstones usually predominate; this makes the site of great importance for understanding the late Westphalian history of the South Wales Coalfield.

Blaen Nedd SSSI

Blaen Nedd is of special interest for its underground cave system and associated karst (classic limestone landscape) surface features, its oak and ash woodland, neutral grassland, calcareous grassland, limestone pavement, marshy grassland, wet dwarf-shrub heath and associated semi-natural habitats.

The site is situated in the upper valley of the Nedd Fechan, approximately 1km west of the village of Ystradfellte. It consists of a series of contiguous enclosures rising eastwards and north-eastwards from the river towards the lower flanks of Fan Nedd. Altitude ranges from 240-390 m. The geology consists of Dinantian (‘Carboniferous Limestone’) and Namurian (‘Millstone Grit’) strata. Soils are mainly surface-water gleys and brown earths. Where limestone lies close to the surface, shallow lithomorphic soils have developed and in depressions and over grits, peats have formed.

Ogof Ffynnon Ddu Pant Mawr SSSI

Known as the cave of the black spring, Ogof Ffynnon Ddu is Britain's third longest cave as well as being its deepest at 308 m deep.

Caeau Ton-y-Fildre SSSI

This site, comprising two unimproved herb-rich pastures, lies on the north bank of Nant y Bryn.

The westernmost field, dominated by sharp-flowered rush *Juncus acutiflorus*, supports a wide range of species characteristic of damp, flushed peaty pasture, including globeflower *Trollius europaeus*, meadow thistle *Cirsium dissectum*, whorled caraway *Carum verticillatum* and marsh arrowgrass *Triglochin palustris*.

The eastern pasture lies on a steeper slope with wet flushes and springs interspersed between drier grassland. Notable species here include greater butterfly-orchid *Platanthera chlorantha*, saw-wort *Serratula tinctoria*, dyer's greenweed *Genista tinctora* and petty whin *G. anglica*. Small patches of alder *Alnus glutinosa* add diversity to this part of the site, which explains the high species diversity, with over 100 species of flowering plants and ferns having been recorded to date. The area also appears to be attractive to invertebrates, with butterfly species in particular being well represented on this sheltered south-facing slope. These two pastures have been selected as good representative examples of the many species-rich pastures still remaining in this valley in 1981.

Penmoelallt SSSI

A mixed woodland of ash, oak, wych elm and small-leaved lime overlying Carboniferous Limestone. The rare Ley's whitebeam grows on a small escarpment within the wood.

Mynydd Ty-Isaf Rhondda SSSI

The cliffs and crags of the glacial corries at the head of the Rhondda Fawr Valley reach a height of 558 metres and dominate the landscape within the boundary of the Mynydd Ty Isaf Site of Special Scientific Interest. The three cliff systems formed during the erosion of the corries include Tarren Saerbren, Graig Fawr and Graig Fach. The Pennant Sandstone strata exposed in the corrie cliff systems, and also underlying the rest of the Mid Glamorgan uplands, supports a range of vegetation types including *Calluna* dominated heath, *Vaccinium myrtillus* heath, a range of species poor grasslands, bracken-dominated slopes and fern-rich screes and rock outcrops. Recently planted coniferous trees occupy much of Cwm Saerbren and some cliff top land.

The Pennant Sandstone crags are of particular interest as they support a number of arctic-alpine and other plant species of local distribution in Wales. The parsley fern *Cryptogramma crispa* occurs here at what is thought to be one of its most southerly British stations. Other ferns growing on crags within the SSSI include beech fern *Phegopteris connectilis*, mountain fern *Oreopteris limbosperma*, broad buckler fern *Dryopteris dilatata*, lady fern *Athyriurn filix-femina* and brittle bladder fern *Cystopteris fragilis*.

Plas-y-Gors SSSI

This is an example of an unusual type of mire habitat of particular interest for the range of wetland plant communities which has developed on the peat. The site is situated at an altitude of about 395 metres and lies in a shallow, water-filled depression in the Old Red Sandstone on the south-facing slopes of Fan Nedd. It receives water from a number of springs.

Close to the spring heads, flushes dominated by brown-coloured mosses such as *Cratoneuron commutatum*, *Scorpidium scorpioides* and *Drepanocladus revolvens* occur. In pools and seepage areas dioecious sedge *Carex dioica* is found in some abundance, together with the insectivorous plants, round-leaved sundew *Drosera rotundifolia* and common butterwort *Pinguicula vulgaris*. Scattered stems of common reed *Phragmites australis* grow throughout this area and the presence of marsh arrowgrass *Triglochin palustris* and few-flowered spike-rush *Eleocharis quinqueflora* provides additional interest. Between these areas, flushed with nutrients from the springs, are hummocks of acidic peat supporting a different range of plant species. Here heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix* and hare’s-tail cottongrass *Eriophorum vaginatum* are abundant. Amongst the hummocks are peat-bottomed pools with bogbean *Menyanthes trifoliata* and bog pondweed *Potamogeton polygonifolius*.

Daren Fach SSSI

The site consists of an open scrub on low limestone cliffs with screes and woodland on the gentler slopes. The latter are dominated by ash inter-mixed with wych elm together with a well developed understorey of hazel and hawthorn. Field maple is present and a group of small-leaved lime lies at the northern end. The primary interest lies in a concentration of *Sorbus spp*. on the southern end of the Darren Fach crags. This is the type of locality for the rare Ley's Whitebeam *Sorbus leyana*. Several shrubs of *S. leyana* together with a specimen of *S. rupicola* grow in association with ash, yew and holly.

Cwm Glo SSSI

Cwm Glo is of special interest for its wet pastures and species-rich neutral grassland, and for the association of these habitats with others including acid grassland and wet heath.

Waun Ton-y-Spydddaden SSSI

A series of small, unimproved, herb-rich hay meadows lying on a very gentle slope. The site demonstrates well the effects of traditional management on the moorland vegetation to be found on the better soils in this part of Wales.

Gorsllwyn Onllwyn SSSI

This site contains a range of peat-depositing vegetation communities which has developed on a col between the Pyrddin and Dulais valleys. These peatlands are surrounded by an area of acidic grassland. Peat deposition has been sufficiently great in part of the Neath Port Talbot portion of the site to form a dome shaped mass of peat above the general water table of the site. Such a feature is known as a raised mire. There are very few other examples of this formation known in mid and south Wales. Unfortunately, regular burning and grazing of the site has grossly modified its surface vegetation.

Much of this mire drains north into an area dominated by common reed *Phragmites australis*. The spectacular development of clumps of greater tussock-sedge *Carex paniculata*, in many cases over one metre high, amongst the common reed, affords drier sites for the establishment of willow species *Salix spp.*, and willow carr now covers most of the area bordering the main east-flowing drainage stream. A range of woodland species including royal fern *Osmunda regalis* occurs beneath the tree canopy.

Peat has not completely infilled the area. In some parts, the vegetation has grown as floating lawns over water. The more nutrient-rich sites support an extremely diverse flora with up to 28 species recorded in an area of 4 square metres.

Cwm Taf Fechan Woodlands SSSI

Where the partially wooded valley of the Taf Fechan crosses the north crop Carboniferous Limestone, mixed deciduous woodlands cover steep slopes and spoil from quarries with one of the few Glamorgan stations for *Gymnocarpium robertianum*. There are interesting plant communities in flushes around tufa springs and luxuriant growths of bryophytes in the splash zone of the river.

Nant Llech SSSI

The Nant Llech Isaf and the Nant Llech Pellaf combine at Blaen-Llech to form the Nant Llech. In its short dash to join the Afon Tawe near Ynyswen it leaps over the Farewell Rock to provide the highest waterfall in Fforest Fawr Geopark and indeed one of the highest in South Wales. The Henrhyd Falls occur where this band of resistant sandstone is faulted against easily eroded mudstones.

The information above has been used to determine the most appropriate habitat type as listed on the APIS website, in order to identify the critical loads of nutrient Nitrogen and acid deposition for the site. Due to the limited number of habitat types detailed on the APIS website, an element of estimation or best fit has had to be applied to some sites.

Table 2 Process Contribution of Total Oxides of Nitrogen and Sulphur Dioxide at Sensitive Ecological Receptors

	Oxides of Nitrogen as NO_2				Sulphur Dioxide			
Sensitive Site	**Annual Average ug m^{-3}**	**Percentage of Long Term Objective (30 ug m^{-3})**	**Hourly Average (99.79 percentile) ug m^{-3}**	**Percentage of Short Term Objective (200 ug m^{-3})**	**Annual Average ug m^{-3}**	**Percentage of Long Term Objective (20 ug m^{-3})**	**Hourly Average (99.73 percentile) ug m^{-3}**	**Percentage of Short Term Objective (350 ug m^{-3})**
Sites Between 0 and 5 km								
1	4.0328	**13.44**	42.85	**21.42**	0.6460	**3.23**	6.7287	1.92
2	0.1524	0.51	7.72	3.86	0.0245	0.12	1.1361	0.32
3	0.0980	0.33	4.48	2.24	0.0157	0.08	0.6576	0.19
4	0.1534	0.51	7.76	3.88	0.0246	0.12	1.1819	0.34
5	0.3782	**1.26**	27.50	**13.75**	0.0605	0.30	4.2508	1.21
6	0.1869	0.62	33.15	**16.58**	0.0299	0.15	4.1597	1.19
7	0.0775	0.26	3.91	1.96	0.0125	0.06	0.6016	0.17
8	0.0765	0.25	4.10	2.05	0.0123	0.06	0.6228	0.18
9	0.0637	0.21	3.34	1.67	0.0102	0.05	0.5042	0.14
Sites Between 5 and 10 km								
10	0.2902	0.97	5.55	2.77	0.0466	0.23	0.8841	0.25
11	0.0697	0.23	5.45	2.72	0.0112	0.06	0.8469	0.24
12	0.0462	0.15	2.87	1.43	0.0074	0.04	0.4066	0.12
13	0.0335	0.11	2.08	1.04	0.0054	0.03	0.2983	0.09
14	0.0445	0.15	3.15	1.58	0.0071	0.04	0.4837	0.14
15	0.1148	0.38	3.29	1.64	0.0184	0.09	0.5032	0.14
16	0.0391	0.13	3.06	1.53	0.0063	0.03	0.4544	0.13
17	0.0307	0.10	2.23	1.12	0.0049	0.02	0.3120	0.09
18	0.0864	0.29	2.66	1.33	0.0139	0.07	0.4110	0.12
19	0.1773	0.59	3.83	1.91	0.0285	0.14	0.5816	0.17
20	0.0395	0.13	2.97	1.48	0.0063	0.03	0.4430	0.13
21	0.0420	0.14	3.01	1.51	0.0067	0.03	0.4344	0.12
22	0.1087	0.36	2.82	1.41	0.0175	0.09	0.4386	0.13
23	0.0319	0.11	2.28	1.14	0.0051	0.03	0.3458	0.10

Note; The figures presented in Table 2 assume a worst case for NO_2 and SO_2 process concentrations in air, at the specified grid references. That is, all of the emissions of oxides of nitrogen (NO_x) are assumed to be nitrogen dioxide (NO_2), and no effects of deposition, which would have the effect of reducing the concentration of the pollutants in air, have been considered. The same applies for data presented in Tables 3 – 5.

Table 3 Comparison of Results for Total Oxides of Nitrogen Release Versus Modelling with NO_x Chemistry

	Total Oxides of Nitrogen as NO_2				Nitrogen Dioxide Only (NO_x Chemistry)			
Sensitive Site	**Annual Average ug m^{-3}**	**Percentage of Long Term Objective (30 ug m^{-3})**	**Hourly Average (99.79 percentile) ug m^{-3}**	**Percentage of Short Term Objective (200 ug m^{-3})**	**Annual Average ug m^{-3}**	**Percentage of Long Term Objective (30 ug m^{-3})**	**Hourly Average (99.79 percentile) ug m^{-3}**	**Percentage of Short Term Objective (200 ug m^{-3})**
Sites Between 0 and 5 km								
1	4.0328	**13.44**	42.85	**21.42**	2.8230	**9.41**	25.30	**12.65**
5	0.3782	**1.26**	27.50	**13.75**	0.2647	0.88	11.95	5.97
6	0.1869	0.62	33.15	**16.58**	0.1308	0.44	11.36	5.68

Chemistry modelling has been run manually, applying the same methodology as in the original modelling report, which is believed to be the Environment Agency's preferred method. That is:

Long term NO_2 (e.g. annual averaging period) = NO_x * 0.7 + background

Short term NO_2 (e.g. hourly averaging period) = NO_x * 0.35 + (background * 2)

As this type of modelling results in the predicted environmental concentration rather than the process contribution, the background concentration has been removed from the end results, and these are the figures shown. Thus the methodology reduces to:

Long term NO_2 (e.g. annual averaging period) = NO_x * 0.7

Short term NO_2 (e.g. hourly averaging period) = NO_x * 0.35 + background

Note; Since the issue of ADMS Version 4.1, the Environment Agency has confirmed that the ADMS 4.1 Chemistry option is accepted by the Environment Agency for England and Wales. In an email from Ji Ping Shi of the Environment Agency's Air Quality Modelling and Assessment Unit to CERC's Consultancy Manager Sarah Strickland, Ji Ping Shi stated that 'We have a view that the NO_x chemistry scheme outlined in your technical notes is acceptable.' That said, there has been no formal position statement issued.

Table 4 Predicted Environmental Concentration of Total Oxides of Nitrogen as NO_2 at Sensitive Ecological Receptors Modelling with NO_x Chemistry

Sensitive Site	Annual Average ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of Long Term Objective (30 ug m^{-3})	Hourly Average (99.79 percentile) ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of Short Term Objective (200 ug m^{-3})
Sites Between 0 and 5 km								
1	4.0328	11.8	15.83	52.78	42.85	11.8	54.65	27.32
2	0.1524	8	8.15	27.17	7.72	8	15.72	7.86
3	0.0980	8.3	8.40	27.99	4.48	8.3	12.78	6.39
4	0.1534	8	8.15	27.18	7.76	8	15.76	7.88
5	0.3782	8.5	8.88	29.59	27.50	8.5	36.00	18.00
6	0.1869	8.9	9.09	30.29	33.15	8.9	42.05	21.03
7	0.0775	7.8	7.88	26.26	3.91	7.8	11.71	5.86
8	0.0765	7.8	7.88	26.25	4.10	7.8	11.90	5.95
9	0.0637	7.7	7.76	25.88	3.34	7.7	11.04	5.52
Sites Between 5 and 10 km								
10	0.2902	10.3	10.59	35.30	5.55	10.3	15.85	7.92
11	0.0697	9.3	9.37	31.23	5.45	9.3	14.75	7.37
12	0.0462	7.4	7.45	24.82	2.87	7.4	10.27	5.13
13	0.0335	7	7.03	23.45	2.08	7	9.08	4.54
14	0.0445	8	8.04	26.82	3.15	8	11.15	5.58
15	0.1148	9.3	9.41	31.38	3.29	9.3	12.59	6.29
16	0.0391	9.8	9.84	32.80	3.06	9.8	12.86	6.43
17	0.0307	7.2	7.23	24.10	2.23	7.2	9.43	4.72
18	0.0864	9	9.09	30.29	2.66	9	11.66	5.83
19	0.1773	13.3	13.48	44.92	3.83	13.3	17.13	8.56
20	0.0395	7.5	7.54	25.13	2.97	7.5	10.47	5.23
21	0.0420	8.1	8.14	27.14	3.01	8.1	11.11	5.56
22	0.1087	13	13.11	43.70	2.82	13	15.82	7.91
23	0.0319	8.2	8.23	27.44	2.28	8.2	10.48	5.24

Table 5 Predicted Environmental Concentration of Sulphur Dioxide at Sensitive Ecological Receptors

Sensitive Site	Annual Average ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of Long Term Objective (20 ug m^{-3})	Hourly Average (99.73 percentile) ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of Short Term Objective (350 ug m^{-3})
Sites Between 0 and 5 km								
1	0.6460	2	2.65	13.23	6.7287	2	8.73	2.49
2	0.0245	2	2.02	10.12	1.1361	2	3.14	0.90
3	0.0157	1.3	1.32	6.58	0.6576	1.3	1.96	0.56
4	0.0246	2	2.02	10.12	1.1819	2	3.18	0.91
5	0.0605	2	2.06	10.30	4.2508	2	6.25	1.79
6	0.0299	1.4	1.43	7.15	4.1597	1.4	5.56	1.59
7	0.0125	0.9	0.91	4.56	0.6016	0.9	1.50	0.43
8	0.0123	0.9	0.91	4.56	0.6228	0.9	1.52	0.44
9	0.0102	0.9	0.91	4.55	0.5042	0.9	1.40	0.40
Sites Between 5 and 10 km								
10	0.0466	1.3	1.35	6.73	0.8841	1.3	2.18	0.62
11	0.0112	1.4	1.41	7.06	0.8469	1.4	2.25	0.64
12	0.0074	0.9	0.91	4.54	0.4066	0.9	1.31	0.37
13	0.0054	1	1.01	5.03	0.2983	1	1.30	0.37
14	0.0071	1	1.01	5.04	0.4837	1	1.48	0.42
15	0.0184	2.8	2.82	14.09	0.5032	2.8	3.30	0.94
16	0.0063	1.6	1.61	8.03	0.4544	1.6	2.05	0.59
17	0.0049	1.1	1.10	5.52	0.3120	1.1	1.41	0.40
18	0.0139	1	1.01	5.07	0.4110	1	1.41	0.40
19	0.0285	2.8	2.83	14.14	0.5816	2.8	3.38	0.97
20	0.0063	1	1.01	5.03	0.4430	1	1.44	0.41
21	0.0067	1	1.01	5.03	0.4344	1	1.43	0.41
22	0.0175	2.8	2.82	14.09	0.4386	2.8	3.24	0.93
23	0.0051	1.6	1.61	8.03	0.3458	1.6	1.95	0.56

Table 6 Predicted Nitrogen Deposition from Dry Deposition at Special Areas of Conservation

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Blaen Cynon	Marsh Fritillary; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0631	6.05	**60.54**	**30.27**
	Raised Bog	23.8	5-10	0.0631	6.05	**121.07**	**60.54**
	Marshy Grassland; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0631	6.05	**60.54**	**30.27**
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0631	6.05	**60.54**	**30.27**
	Species Rich Unimproved Grassland; Hay Meadow	23.8	20-30	0.0631	6.05	**30.27**	**20.18**
	Wet, acidic grassland (Molina)	23.8	15 – 25	0.0631	6.05	**40.36**	**24.21**
Coed Nedd a Mellte	Old Sessile; Oak Woodland	37.4	10 – 15	0.0025	0.24	**2.38**	**1.59**
	Tilio-Acerion; Ash Woodland	37.4	10 – 15	0.0025	0.24	**2.38**	**1.59**
	Semi Natral Broadleaf; Oak Woodland	37.4	10 – 15	0.0025	0.24	**2.38**	**1.59**
Cwm Cadlan	Molina; Alkaline Fen and Reed Bed (poor fen)	27.9	10 – 20	0.0018	0.17	**1.72**	0.86
	Marshy Acid Grassland	27.9	15-35	0.0018	0.17	**1.14**	0.49
	Alkaline Fen and Reed Bed	27.9	15-25	0.0018	0.17	**1.14**	0.69
	Unimproved Grassland; Hay Meadow	27.9	20-30	0.0018	0.17	0.86	0.57
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	27.9	10-20	0.0018	0.17	**1.72**	0.86

Note; The current background concentration at most sites is already above the lower critical load, and is often also above the higher critical load
The data in the table above demonstrates the deposition results calculated from an initial modelling exercise.

Table 7 Predicted Nitrogen Deposition from Dry Deposition at Site of Special Scientific Interest

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Dyffrynoedd Nedd a Mellte a Moel Penderyn	Oak woodland (decid)	37.4	10 - 15	0.0025	0.24	**2.41**	**1.21**
Cwm Gwrelych and Nant Llynfach Streams	Shingle, rock and cliff	23.8	10-15	0.0030	0.29	**2.90**	**1.45**
Craig-y-Llyn	Shingle, rock and cliff	24.8	10-15	0.0009	0.08	0.85	0.42
Bryn Bwch	Mountain rich fen	19.2	15-25	0.0012	0.12	**1.17**	0.58
Caeau Nant-y-Llechau	Unimproved hay meadow	19.2	20-30	0.0011	0.10	**1.02**	0.51
Gweunedd Dyffern Nedd	Mountain rich fen	19.2	15-25	0.0010	0.09	0.92	0.46
Bryncarnau Grasslands Llwyncoed	Wet, acidic grassland (Molina)	27.9	15-25	0.0036	0.35	**3.47**	**1.74**
Blaenrhondda Road Cutting	Shingle, rock and cliff	24.8	10-15	0.0008	0.07	0.73	0.37
Blaen Nedd	Limestone Pavement	19.2	15-25	0.0006	0.06	0.62	0.31
Ogof Ffynnon Ddu Pant Mawr	Shingle, rock and cliff	20.9	10-15	0.0004	0.04	0.42	0.21
Caeau Ton-y-Fildre	Unimproved hay meadow	19.9	20-30	0.0005	0.05	0.48	0.24
Penmoelallt	Ash Woodland (decid)	44.8	10-15	0.0017	0.17	**1.66**	0.83
Mynydd Ty-Isaf Rhondda	Shingle, rock and cliff	23.2	10-15	0.0004	0.03	0.35	0.17
Plas-y-Gors	Raised/blanket bog	20.9	5-10	0.0004	0.04	0.41	0.20
Daren Fach	Shingle, rock and cliff	22.5	10-15	0.0013	0.13	**1.27**	0.64
Cwm Glo	Wet, acidic grassland (Molina)	28	15-25	0.0018	0.17	**1.71**	0.86
Waun Ton-y-Spyddaden	Unimproved hay meadow	19.9	20-30	0.0004	0.04	0.43	0.21
Gorsllwyn Onllwyn	Wet, acidic grassland (Heath Meadows)	19.9	10-20	0.0005	0.04	0.44	0.22
Cwm Taf Fechan Woodlands	Oak woodland (decid)	44.8	10-15	0.0014	0.14	**1.38**	0.69
Nant Llech	Shingle, rock and cliff	21.1	10-15	0.0003	0.03	0.31	0.16

Note; The current background concentration at most sites is already above the lower critical load, and is often also above the higher critical load
The data in the table above demonstrates the deposition results calculated from an initial modelling exercise.

Table 8 Predicted Nitrogen Deposition From Total Deposition at Special Areas of Conservation

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Blaen Cynon	Marsh Fritillary; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0741	7.11	**71.14**	**35.57**
	Raised Bog	23.8	5-10	0.0741	7.11	**142.28**	**71.14**
	Marshy Grassland; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0741	7.11	**71.14**	**35.57**
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.0741	7.11	**71.14**	**35.57**
	Species Rich Unimproved Grassland; Hay Meadow	23.8	20-30	0.0741	7.11	**35.57**	**23.71**
	Wet, acidic grassland (Molina)	23.8	15 – 25	0.0741	7.11	**47.43**	**28.46**
Coed Nedd a Mellte	Old Sessile; Oak Woodland	37.4	10 – 15	0.0031	0.29	**2.94**	**1.96**
	Tilio-Acerion; Ash Woodland	37.4	10 – 15	0.0031	0.29	**2.94**	**1.96**
	Semi Natral Broadleaf; Oak Woodland	37.4	10 – 15	0.0031	0.29	**2.94**	**1.96**
Cwm Cadlan	Molina; Alkaline Fen and Reed Bed (poor fen)	27.9	10 – 20	0.0021	0.20	**2.03**	**1.02**
	Marshy Acid Grassland	27.9	15-35	0.0021	0.20	**1.36**	0.58
	Alkaline Fen and Reed Bed	27.9	15-25	0.0021	0.20	**1.36**	0.81
	Unimproved Grassland; Hay Meadow	27.9	20-30	0.0021	0.20	**1.02**	0.68
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	27.9	10-20	0.0021	0.20	**2.03**	**1.02**

Note; The current background concentration at most sites is already above the lower critical load, and is often also above the higher critical load
The data in the table above demonstrates the deposition results calculated from an initial modelling exercise.

Table 9 Predicted Nitrogen Deposition From Total Deposition at Sites of Special Scientific Interest

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Dyffrynoedd Nedd a Mellte a Moel Penderyn	Oak woodland (decid)	37.4	10 - 15	0.0031	0.30	**2.99**	**1.49**
Cwm Gwrelych and Nant Llynfach Streams	Shingle, rock and cliff	23.8	10-15	0.0037	0.35	**3.52**	**1.76**
Craig-y-Llyn	Shingle, rock and cliff	24.8	10-15	0.0011	0.10	**1.03**	0.51
Bryn Bwch	Mountain rich fen	19.2	15-25	0.0016	0.15	**1.52**	0.76
Caeau Nant-y-Llechau	Unimproved hay meadow	19.2	20-30	0.0013	0.13	**1.26**	0.63
Gweunedd Dyffern Nedd	Mountain rich fen	19.2	15-25	0.0013	0.12	**1.23**	0.61
Bryncarnau Grasslands Llwyncoed	Wet, acidic grassland (Molina)	27.9	15-25	0.0015	0.14	**1.43**	0.71
Blaenrhondda Road Cutting	Shingle, rock and cliff	24.8	10-15	0.0045	0.43	**4.32**	**2.16**
Blaen Nedd	Limestone Pavement	19.2	15-25	0.0009	0.08	0.84	0.42
Ogof Ffynnon Ddu Pant Mawr	Shingle, rock and cliff	20.9	10-15	0.0008	0.08	0.80	0.40
Caeau Ton-y-Fildre	Unimproved hay meadow	19.9	20-30	0.0006	0.05	0.54	0.27
Penmoelallt	Ash Woodland (decid)	44.8	10-15	0.0006	0.06	0.62	0.31
Mynydd Ty-Isaf Rhondda	Shingle, rock and cliff	23.2	10-15	0.0023	0.22	**2.18**	**1.09**
Plas-y-Gors	Raised/blanket bog	20.9	5-10	0.0004	0.04	0.40	0.20
Daren Fach	Shingle, rock and cliff	22.5	10-15	0.0005	0.05	0.52	0.26
Cwm Glo	Wet, acidic grassland (Molina)	28	15-25	0.0018	0.17	**1.69**	0.85
Waun Ton-y-Spyddaden	Unimproved hay meadow	19.9	20-30	0.0022	0.22	**2.15**	**1.08**
Gorsllwyn Onllwyn	Wet, acidic grassland (Heath Meadows)	19.9	10-20	0.0006	0.05	0.54	0.27
Cwm Taf Fechan Woodlands	Oak woodland (decid)	44.8	10-15	0.0006	0.06	0.56	0.28
Nant Llech	Shingle, rock and cliff	21.1	10-15	0.0019	0.18	**1.79**	0.89

Note; The current background concentration at most sites is already above the lower critical load, and is often also above the higher critical load
The data in the table above demonstrates the deposition results calculated from an initial modelling exercise.

Information on Critical Loads and background concentrations is taken from the UK Air Pollution Information Service (APIS) website. Data on the Nitrogen deposition background is produced using a combination of measurement and modelling techniques. Data is measured across the country and is interpolated with consideration to meteorological conditions. The nearest measurement site to the proposed Enviroparks facility is situated approximately 16 km north, north west, at Crai Reservoir. The background levels reported here represent a 3 year average value (2003 – 2005) and have been mapped at a 5 km resolution.

Tables 6 to 9 assume that all NO_x is deposited as NO_2, and the resultant nitrogen is fully available for uptake by the ecosystems. This will therefore by a gross overestimate of the NO_2 deposition. The suggested NO_2 release from the engines identified for use at the Enviroparks facility equates to 30 % or less of the total NO_x release. Tables 6 to 9 provide the results and calculations from the initial modelling exercise, which did not specify the contribution of NO and NO_2 to overall NO_x.

The results show that when considering the effects of dry deposition of Nitrogen, eleven of the sites within a 10 km radius exceeded the threshold of insignificance when compared against the lower critical load. Four of these also exceeded the threshold of insignificance against the upper critical load. Most however remained below 2 % of the upper and lower critical loads, and all except one, Blaen Cynon remained within 5 % of the critical loads. When considering the effects of total deposition, the effect on fifteen of the sites could not be screened as insignificant when compared to the lower critical load, and seven of these also exceeded the threshold for significance when compared to the upper critical load. Again, only the Nitrogen deposition at Blaen Cynon was considered to equate to more than 5 % of either critical loads, and it can be seen from Tables 8 and 9 that the contribution of wet deposition to the total is much less significant than the contribution of dry deposition.

A report by Professor Duncan Laxen and Dr Ben Marner of Air Quality Consultants[1], confirms that, close to the source, it is 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 identified an assumption of 50 % NO_2 in NO_x release as being a robust approach. Laxen and Marner also identify that Nitric Oxide does not deposit at a significant rate and that, during the course of their study, which considered sites detailed in the Bournemouth, Dorset and Poole Waste Local Plan, in close proximity to SACs, wet deposition could be ignored. Wet deposition was not included in the Laxen and Marner study as it was considered that this would be restricted to wash-out or below cloud scavenging. For this to occur, Laxen and Marner point out that the rain droplets must come into contact with the gas molecules before they hit the ground , and as falling raindrops displace the air around them, they effectively push the gases away. Coupled with the low solubility of nitrogen dioxide and nitric oxide, the effects of wet deposition were considered negligible. Laxen and Marner also applied a deposition velocity of 1.6 mm s^{-1} (0.0016 m s^{-1}) for NO_2, where no specific deposition rate had been incorporated into the original Enviroparks deposition modelling exercise.

Hence the models were re-run in order to incorporate the information obtained from the Laxen and Marner report, and additionally models were set up to combine the discharges from the Enviroparks flues. Subject to some restrictions, flues can be combined where stacks are located in close proximity to one another and this enables the model to take full account of the effects of plume interaction. Tables 10 and 11 present Nitrogen deposition data for the sensitive receptors local to the proposed development, with full consideration of the points detailed above. Table 12 provides results from a similar model for the Blaen Cynon SAC, but considers total deposition (that is wet and dry deposition) as identified by the APIS website (www.apis.ac.uk) as being appropriate for the calculation of nutrient Nitrogen deposition.

Table 10 Predicted Nitrogen Deposition from Dry Deposition at Special Protected Areas Applying the Laxen and Marner[1] Methodologies and Combining Flues

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Blaen Cynon	Marsh Fritillary; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.002017	0.19	**1.94**	0.97
	Raised Bog	23.8	5-10	0.002017	0.19	**3.87**	**1.94**
	Marshy Grassland; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.002017	0.19	**1.94**	0.97
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.002017	0.19	**1.94**	0.97
	Species Rich Unimproved Grassland; Hay Meadow	23.8	20-30	0.002017	0.19	0.97	0.65
	Wet, acidic grassland (Molina)	23.8	15 – 25	0.002017	0.19	**1.29**	0.77
Coed Nedd a Mellte	Old Sessile; Oak Woodland	37.4	10 – 15	0.000104	0.01	0.10	0.07
	Tilio-Acerion; Ash Woodland	37.4	10 – 15	0.000104	0.01	0.10	0.07
	Semi Natral Broadleaf; Oak Woodland	37.4	10 – 15	0.000104	0.01	0.10	0.07
Cwm Cadlan	Molina; Alkaline Fen and Reed Bed (poor fen)	27.9	10 – 20	0.000068	0.01	0.07	0.03
	Marshy Acid Grassland	27.9	15-35	0.000068	0.01	0.04	0.02
	Alkaline Fen and Reed Bed	27.9	15-25	0.000068	0.01	0.04	0.03
	Unimproved Grassland; Hay Meadow	27.9	20-30	0.000068	0.01	0.03	0.02
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	27.9	10-20	0.000068	0.01	0.07	0.03

Table 11 Predicted Nitrogen Deposition from Dry Deposition at Sites of Special Scientific Interest Applying the Laxen and Marner[1] Methodologies and Combining Flues

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Dyffrynoedd Nedd a Mellte a Moel Penderyn	Oak woodland (decid)	37.4	10 - 15	0.000105	0.01	0.10	0.05
Cwm Gwrelych and Nant Llynfach Streams	Shingle, rock and cliff	23.8	10-15	0.000153	0.01	0.15	0.07
Craig-y-Llyn	Shingle, rock and cliff	24.8	10-15	0.000063	0.01	0.06	0.03
Bryn Bwch	Mountain rich fen	19.2	15-25	0.000053	0.01	0.05	0.03
Caeau Nant-y-Llechau	Unimproved hay meadow	19.2	20-30	0.000049	0.00	0.05	0.02
Gweunedd Dyffern Nedd	Mountain rich fen	19.2	15-25	0.000043	0.00	0.04	0.02
Bryncarnau Grasslands Llwyncoed	Wet, acidic grassland (Molina)	27.9	15-25	0.000192	0.02	0.18	0.09
Blaenrhondda Road Cutting	Shingle, rock and cliff	24.8	10-15	0.000043	0.00	0.04	0.02
Blaen Nedd	Limestone Pavement	19.2	15-25	0.000032	0.00	0.03	0.02
Ogof Ffynnon Ddu Pant Mawr	Shingle, rock and cliff	20.9	10-15	0.000023	0.00	0.02	0.01
Caeau Ton-y-Fildre	Unimproved hay meadow	19.9	20-30	0.000028	0.00	0.03	0.01
Penmoelallt	Ash Woodland (decid)	44.8	10-15	0.000081	0.01	0.08	0.04
Mynydd Ty-Isaf Rhondda	Shingle, rock and cliff	23.2	10-15	0.000023	0.00	0.02	0.01
Plas-y-Gors	Raised/blanket bog	20.9	5-10	0.000021	0.00	0.02	0.01
Daren Fach	Shingle, rock and cliff	22.5	10-15	0.000062	0.01	0.06	0.03
Cwm Glo	Wet, acidic grassland (Molina)	28	15-25	0.000110	0.01	0.11	0.05
Waun Ton-y-Spyddaden	Unimproved hay meadow	19.9	20-30	0.000024	0.00	0.02	0.01
Gorsllwyn Onllwyn	Wet, acidic grassland (Heath Meadows)	19.9	10-20	0.000026	0.00	0.03	0.01
Cwm Taf Fechan Woodlands	Oak woodland (decid)	44.8	10-15	0.000074	0.01	0.07	0.04
Nant Llech	Shingle, rock and cliff	21.1	10-15	0.000019	0.00	0.02	0.01

Table 12 Predicted Nitrogen Deposition from Total Deposition at Blaen Cynon Applying the Laxen and Marner[1] Methodologies and Combining Flues

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
Blaen Cynon	Marsh Fritillary; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.006862	0.66	**6.59**	**3.29**
	Raised Bog	23.8	5-10	0.006862	0.66	**13.17**	**6.59**
	Marshy Grassland; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.006862	0.66	**6.59**	**3.29**
	Flush and Spring; Alkaline Fen and Reed Bed (poor fen)	23.8	10-20	0.006862	0.66	**6.59**	**3.29**
	Species Rich Unimproved Grassland; Hay Meadow	23.8	20-30	0.006862	0.66	**3.29**	**2.20**
	Wet, acidic grassland (Molina)	23.8	15 – 25	0.006862	0.66	**4.39**	**2.63**

Note: Although the Laxen and Marner report[1] identify that only dry deposition should be considered for sites close to a source, the total deposition rates have been provided here in line with the Air Pollution Information System (APIS) methodology. Therefore, the modelling took account of we and dry deposition rates, NO_2 as half total NO_x, and also combined the flues.

As the sensitive sites cover a much larger area than the single, central point specified by the grid reference detailed for each, the maximum predicted level of deposition of Nitrogen has also been assessed for the Blaen Cynon site. This is the only site at which the process contribution still cannot be screened as insignificant. The highest rate of deposited Nitrogen for the dry deposition rate is presented in Table 13, and the grid reference is noted as being within the Blaen Cynon site.

The process contribution at this highest point on the modelled grid, represents less than 5 % of the lower critical load of the site, and is the highest recorded deposition rate across the 10 km^2 area assessed by the model. The figure for the total deposition rate is presented in Table 14, and the grid reference is noted as being outside of the Blaen Cynon site. Thus, although the calculated Nitrogen deposition rate at this point represents more than 14 % of the lower critical load, this level of deposition is not predicted to occur within the Blaen Cynon site.

As a grid of 10,000 points (100 x 100 points) was plotted across the modelled 10 km^2 area to assess the concentration and deposition of pollutants, this highest recorded deposition rate will only be experienced at an area 100 m^2 within the 10 km^2 grid, and all other deposition rates across the modelled area will be lower than this. Additionally, as per the Laxen and Marner report[1], the contribution of wet deposition within close proximity to the source is considered negligible. It is therefore considered that although areas of the sensitive receptors will experience higher and lower deposition rates than those identified in Tables 10 to 12 which represent the approximate centre points of the receptors, the dry Nitrogen deposition rate detailed for Blaen Cynon in Table 10 will provide a deposition rate that can be considered reasonably average for the contribution of nutrient Nitrogen to the whole site.

If the National Objective for the protection of vegetation for nitrogen dioxide (30 ug m^{-3}) were experienced at the Blaen Cynon site, the applied deposition rate would result in 4.61 kg N/ha/year being deposited at the site. This represents 30.71 % of the lower critical load (when considering the loading for wet acidic grassland), or 18.43 % of the higher critical load for the same feature. Therefore, the predicted emissions from the proposed Enviroparks site are much less significant at the Blaen Cynon site than the potential impact of the nationally accepted Objective for the protection of vegetation. Levels of nitrogen dioxide in air could reasonably be experienced anywhere in the UK up to the 30 ug m^{-3} level as an annual mean with no question as to the quality of the air when considering the health of humans or vegetation.

Table 13 Maximum Predicted Nitrogen Deposition from Dry Deposition Across the Grid Applying the Laxen and Marner[1] Methodologies and Combining Flues

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
294258 206849	Wet, acidic grassland (Molina)	23.8	15-25	0.0052	0.5	**3.33**	**2.00**

Note: Grid Reference represents an area located on edge / within the SAC boundary, and thus the concentration noted in Table 13 does appear to occur within the SAC.

Table 14 Maximum Predicted Nitrogen Deposition from Total Deposition Across the Grid Applying the Laxen and Marner[1] Methodologies and Combining Flues

Site	Principal Habitat	Current Background kg N/Ha/yr	Critical Load Range kg N/Ha/yr	Predicted NO_2 Deposition ug $N/m^2/s$	Predicted NO_2 Deposition kg N/Ha/yr	Percentage of Lower Critical Load	Percentage of Higher Critical Load
294056 206849	Wet, acidic grassland (Molina)	23.8	15-25	0.022	2.12	**14.12**	**8.47**

Note: Grid Reference represents an area located outside of the SAC boundary, and thus the concentration noted in Table 14 does not occur within the SAC.

Table 15 Predicted Acid Deposition at Sensitive Ecological Receptors

Site	Current Background kg eq/Ha/yr	Critical Load kg eq/Ha/yr	Predicted SO_2 Deposition Kg eq/Ha/yr	Predicted NO_2 Deposition Kg eq/Ha/yr	Total Process Contribution to Deposition kg eq/Ha/yr	PC Percentage of Critical Load	PC + Background Percentage of Critical Load
Dry Deposition Only							
Blaen Cynon	2.2	0.35	0.03807	0.01383	0.05189	**14.83**	**643.40**
Coed Nedd a Mellte	3.25	2.22	0.00190	0.00071	0.00261	0.12	**146.51**
Cwm Cadlan	2.52	4	0.00126	0.00047	0.00172	0.04	63.04
Dyffrynoedd Nedd a Mellte a Moel Penderyn	3.25	2.22	0.00192	0.00072	0.00263	0.12	**146.52**
Cwm Gwrelych and Nant Llynfach Streams	No Data	No Data	0.00251	0.00105	0.00357	N/A	**N/A**
Craig-y-Llyn	2.27	0.78	0.00094	0.00043	0.00138	0.18	**291.20**
Bryn Bwch	1.71	1.5	0.00095	0.00036	0.00131	0.09	**114.09**
Caeau Nant-y-Llechau	1.71	0.35	0.00087	0.00034	0.00121	0.35	**488.92**
Gweunedd Dyffern Nedd	1.71	1.5	0.00077	0.00030	0.00106	0.07	**114.07**
Bryncarnau Grasslands Llwyncoed	2.52	0.35	0.00323	0.00131	0.00455	**1.30**	**721.30**
Blaenrhondda Road Cutting	2.27	0.1	0.00069	0.00029	0.00098	0.98	**2270.98**
Blaen Nedd	1.71	0.35	0.00054	0.00022	0.00076	0.22	**488.79**
Ogof Ffynnon Ddu Pant Mawr	1.89	0.35	0.00039	0.00016	0.00055	0.16	**540.16**
Caeau Ton-y-Fildre	1.8	0.35	0.00044	0.00019	0.00063	0.18	**514.47**
Penmoelallt	3.91	2.36	0.00140	0.00055	0.00196	0.08	**165.76**
Mynydd Ty-Isaf Rhondda	2.12	0.1	0.00035	0.00016	0.00051	0.51	**2120.51**
Plas-y-Gors	1.89	0.35	0.00036	0.00014	0.00050	0.14	**540.14**
Daren Fach	2.01	0.75	0.00107	0.00042	0.00150	0.20	**268.20**
Cwm Glo	2.59	0.35	0.00173	0.00075	0.00248	0.71	**740.71**
Waun Ton-y-Spyddaden	1.8	0.35	0.00040	0.00017	0.00056	0.16	**514.45**
Gorsllwyn Onllwyn	1.8	0.35	0.00041	0.00018	0.00059	0.17	**514.45**
Cwm Taf Fechan Woodlands	3.91	1.44	0.00124	0.00051	0.00175	0.12	**271.65**
Nant Llech	1.93	1.5	0.00030	0.00013	0.00043	0.03	**128.70**

Table 16 Maximum Predicted Dry Acid Deposition at Blaen Cynon

Site	Current Background kg eq/Ha/yr	Critical Load Range kg eq/Ha/yr	Predicted SO_2 Deposition Kg eq/Ha/yr	Predicted NO_2 Deposition Kg eq/Ha/yr	Total Process Contribution to Deposition kg eq/Ha/yr	PC Percentage of Critical Load	PC + Background Percentage of Critical Load
Blaen Cynon	2.2	0.35	0.09962	0.03565	0.13527	**38.65**	**667.22**

Note; Consideration was given to running models to consider total deposition (dry and wet deposition) for SO_2, as SO_2 is more soluble than NO_x, however, information subsequently provided by CERC (suppliers of the ADMS model) confirmed that the deposition characteristics recommended by the Environment Agency need only consider significant releases of SO_3 and / or H_2SO_4 for wet deposition, neither of which are relevant here. Hence data for total deposition of SO_2 is not reported, and the acid deposition figures are based on dry deposition concentrations only. A dry deposition rate of 0.01 m s^{-1} was identified for SO_2. A subsequent figure of 0.012 m s^{-1} has been identified as the Environment Agency's recommended rate, however as the modelling scenario assumed that engines would be constantly fired, which will not be the case in reality, and were considered to emit pollutants at the maximum likely concentrations from all flues, the results above are already presenting a worst case assessment, and hence the figures have not been re-calculated to include this slightly higher proposed deposition rate.

Although the contribution of acid deposition cannot be ruled as insignificant at Blaen Cynon or at the Bryncarnau Grasslands in Llwyncoed when compared to the critical loads, the process contributions are negligible when compared to the background concentrations believed to be present at the sites.

To put the concentration of acid deposition into perspective, the process contribution at the central grid reference for the Blaen Cynon site can be compared to evenly distributing the equivalent volume from 3 soft drink cans (330 ml) of food grade vinegar (3 % acetic acid solution) over a rugby field every week.

If the National Objective for the protection of vegetation for sulphur dioxide (20 ug m^{-3}), coupled with the National Objective for the protection of vegetation for nitrogen dioxide (30 ug m^{-3}) were experienced at the Blaen Cynon site, the applied deposition rate would result in 2.3 keq/ha/year acid deposition at the site. This is slightly higher than the current stated background level (2.2 keq/ha/yr) and would equate to a predicted environmental concentration representing 657.16 % of the critical load for the site. The process contribution for the proposed Enviroparks site is well below this figure, although with the currently available background concentrations, the PEC can be slightly higher in places, representing 667.22 % of the critical load at the highest point. The results at the central grid reference for the site, which can be considered a reasonable average deposition value across the site, equates to a PEC 643.40% of the critical load. Levels of sulphur dioxide and nitrogen dioxide in air could reasonably be experienced anywhere in the UK up to the National Objectives with no question as to the quality of the air when considering the health of humans or vegetation.

Information on critical loads and background concentrations have been taken from the APIS website (www.apis.ac.uk). Data on the acid deposition background is produced using a combination of measurement and modelling techniques. Data is measured across the country and is interpolated with consideration to meteorological conditions. The nearest measurement site to the proposed Enviroparks facility is situated approximately 16 km north, north west, at Crai Reservoir. The background levels reported here represent a 3 year average value (2003 – 2005) and have been mapped at a 5 km resolution. In many cases the critical loads and levels applied do not vary spatially, but are linked to a specific habitat type. This process of using nationally available mapped data and habitat specific values is subject to a series of uncertainties. These include:

- Maps of pollutant concentration and deposition are mostly available at a 5 km grid resolution. For many pollutants there is real sub-grid variability which is not revealed in the 1 km or 5 km averages. The uncertainties are particularly large for the concentrations of primary pollutants e.g. NH_3, NO_X and SO_2.
- The critical loads data for acidity are linked to mapped soils data. The critical load is based on the dominant soil type in a 1 km grid square and may not represent small areas of a square which may be more or less sensitive.
- The habitat specific critical loads and levels data are only available for a limited number of habitat types. In this case the most similar habitat is assigned to the habitat being considered. There are, therefore, uncertainties in both the best estimates of the critical loads and levels and in the assignment of habitats.

Consideration was also given to the potential effects of increased traffic movements on the concentrations of pollutants at the Blaen Cynon site. The Design Manual for Roads and Bridges calculation had been applied within the Transport Assessment of the Environmental Statement, however the contribution to deposition rates of NO_2 have also been calculated here for Cors Bryn-y-Gaer and the Woodland Park and Pontpren site nearest to the road. Cors Bryn-y-Gaer remains the only site at which emissions cannot be screened as insignificant, and Table 17 below demonstrates the difference in the percentage contribution to the critical loads of industrial emissions and industrial and transport emissions. As can be seen, the contribution of predicted traffic emissions to the process contribution is negligible.

Table 17 Percentage Contribution to Critical Loads at Blaen Cynon, With and Without the Increased Traffic of the Development

Percentage Contribution	Nitrogen Deposition at Identified Grid Reference for SAC		Maximum Recorded Nitrogen Deposition		Acid Deposition at Grid Receptor for SAC	Maximum Recorded Acid Deposition
	Lower Critical Load	Higher Critical Load	Lower Critical Load	Higher Critical Load	% of Critical Load	% of Critical Load
Industrial Emissions	1.29	0.77	3.33	2.00	14.83	38.65
Industrial and Traffic Emissions	1.30	0.78	3.34	2.00	14.86	38.68

Table 18 Process Contribution of Particulates, Carbon Monoxide and VOCs at Sensitive Ecological Receptors

	Particulates				Carbon Monoxide		VOCs	
Sensitive Site	**Annual Average ug m^{-3}**	**Percentage of Long Term Objective (40 ug m^{-3})**	**24 Hourly Average (90.41 percentile) ug m^{-3}**	**Percentage of Short Term Objective (50 ug m^{-3})**	**8 Hour Average mg m^{-3}**	**Percentage of Objective (10 mg m^{-3})**	**Annual Average ug m^{-3}**	**Percentage of Long Term Benzene Objective (16.25 ug m^{-3})**
Sites Between 0 and 5 km								
1	0.2674	0.67	0.789	1.58	0.00177	0.0177	0.2531	**1.56**
2	0.0104	0.03	0.037	0.07	0.00007	0.0007	0.0099	0.06
3	0.0067	0.02	0.022	0.04	0.00004	0.0004	0.0064	0.04
4	0.0104	0.03	0.039	0.08	0.00007	0.0007	0.0099	0.06
5	0.0249	0.06	0.078	0.16	0.00017	0.0017	0.0236	0.15
6	0.0123	0.03	0.027	0.05	0.00008	0.0008	0.0116	0.07
7	0.0053	0.01	0.018	0.04	0.00003	0.0003	0.0050	0.03
8	0.0052	0.01	0.017	0.03	0.00003	0.0003	0.0049	0.03
9	0.0043	0.01	0.016	0.03	0.00003	0.0003	0.0041	0.03
Sites Between 5 and 10 km								
10	0.0197	0.05	0.062	0.12	0.00013	0.0013	0.0188	0.12
11	0.0047	0.01	0.011	0.02	0.00003	0.0003	0.0045	0.03
12	0.0031	0.01	0.011	0.02	0.00002	0.0002	0.0030	0.02
13	0.0023	0.01	0.008	0.02	0.00002	0.0002	0.0022	0.01
14	0.0030	0.01	0.012	0.02	0.00002	0.0002	0.0029	0.02
15	0.0078	0.02	0.022	0.04	0.00005	0.0005	0.0075	0.05
16	0.0026	0.01	0.008	0.02	0.00002	0.0002	0.0025	0.02
17	0.0021	0.01	0.008	0.02	0.00001	0.0001	0.0020	0.01
18	0.0059	0.01	0.017	0.03	0.00004	0.0004	0.0056	0.03
19	0.0120	0.03	0.038	0.08	0.00008	0.0008	0.0115	0.07
20	0.0027	0.01	0.009	0.02	0.00002	0.0002	0.0025	0.02
21	0.0028	0.01	0.010	0.02	0.00002	0.0002	0.0027	0.02
22	0.0074	0.02	0.022	0.04	0.00005	0.0005	0.0071	0.04
23	0.0022	0.01	0.009	0.02	0.00001	0.0001	0.0020	0.01

Table 19 Predicted Environmental Concentration of Particulates at Sensitive Ecological Receptors

Sensitive Site	Annual Average ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of Long Term Objective (40 ug m^{-3})	24 Hourly Average (90.41 percentile) ug m^{-3}	Background Conc. ug m^{-3}	PEC ug m^{-3}	Percentage of 24 Hour Objective (50 ug m^{-3})
Sites Between 0 and 5 km								
1	0.2674	15.37	15.63	39.09	0.789	15.37	16.16	32.31
2	0.0104	14.49	14.50	36.24	0.037	14.49	14.52	29.05
3	0.0067	16.99	17.00	42.50	0.022	16.99	17.02	34.03
4	0.0104	14.49	14.50	36.24	0.039	14.49	14.52	29.05
5	0.0249	14.48	14.50	36.25	0.078	14.48	14.55	29.11
6	0.0123	14.42	14.43	36.07	0.027	14.42	14.44	28.89
7	0.0053	14.00	14.00	35.01	0.018	14.00	14.02	28.03
8	0.0052	14.33	14.34	35.84	0.017	14.33	14.35	28.70
9	0.0043	13.91	13.92	34.80	0.016	13.91	13.93	27.86
Sites Between 5 and 10 km								
10	0.0197	14.64	14.66	36.66	0.062	14.64	14.71	29.41
11	0.0047	14.51	14.52	36.29	0.011	14.51	14.52	29.05
12	0.0031	13.79	13.79	34.47	0.011	13.79	13.80	27.59
13	0.0023	13.99	14.00	34.99	0.008	13.99	14.00	28.00
14	0.0030	14.55	14.55	36.38	0.012	14.55	14.56	29.12
15	0.0078	14.40	14.40	36.01	0.022	14.40	14.42	28.84
16	0.0026	14.67	14.67	36.68	0.008	14.67	14.68	29.35
17	0.0021	13.59	13.59	33.98	0.008	13.59	13.60	27.20
18	0.0059	14.40	14.40	36.00	0.017	14.40	14.41	28.83
19	0.0120	14.96	14.97	37.43	0.038	14.96	15.00	29.99
20	0.0027	14.60	14.60	36.50	0.009	14.60	14.61	29.21
21	0.0028	14.77	14.77	36.92	0.010	14.77	14.78	29.55
22	0.0074	15.78	15.79	39.47	0.022	15.78	15.80	31.61
23	0.0022	15.03	15.03	37.57	0.009	15.03	15.03	30.07

Table 20 Predicted Levels of Deposited Dust at Sensitive Ecological Receptors

Sensitive Site	Level of Dry Deposited Dust ($ug/m^2/s$)	Level of Dry Deposited Dust ($mg/m_2/day$)	Critical Load of Deposited Dust ($mg/m^2/day$)	Percentage of Critical Load	Level of Total Deposited Dust ($ug/m^2/s$)	Level of Total Deposited Dust ($mg/m_2/day$)	Critical Load of Deposited Dust ($mg/m^2/day$)	Percentage of Critical Load
Sites Between 0 and 5 km								
1	0.01228	1.0606	1,000	0.01061	0.01305	1.127917	1,000	0.01128
2	0.00053	0.0455	1,000	0.00046	0.00056	0.048706	1,000	0.00049
3	0.00048	0.0414	1,000	0.00041	0.00049	0.042505	1,000	0.00043
4	0.00054	0.0467	1,000	0.00047	0.00058	0.049981	1,000	0.00050
5	0.00051	0.0444	1,000	0.00044	0.00055	0.047915	1,000	0.00048
6	0.00013	0.0115	1,000	0.00011	0.00014	0.012493	1,000	0.00012
7	0.00025	0.0218	1,000	0.00022	0.00027	0.023585	1,000	0.00024
8	0.00019	0.0166	1,000	0.00017	0.00021	0.017936	1,000	0.00018
9	0.00019	0.0163	1,000	0.00016	0.00021	0.017922	1,000	0.00018
Sites Between 5 and 10 km								
10	0.00057	0.0495	1,000	0.00050	0.00063	0.054483	1,000	0.00054
11	0.00010	0.0087	1,000	0.00009	0.00011	0.009277	1,000	0.00009
12	0.00012	0.0100	1,000	0.00010	0.00013	0.010881	1,000	0.00011
13	0.00007	0.0060	1,000	0.00006	0.00008	0.006589	1,000	0.00007
14	0.00007	0.0063	1,000	0.00006	0.00008	0.006916	1,000	0.00007
15	0.00033	0.0287	1,000	0.00029	0.00036	0.031255	1,000	0.00031
16	0.00004	0.0038	1,000	0.00004	0.00005	0.004041	1,000	0.00004
17	0.00007	0.0064	1,000	0.00006	0.00008	0.006891	1,000	0.00007
18	0.00026	0.0225	1,000	0.00022	0.00028	0.024456	1,000	0.00024
19	0.00024	0.0210	1,000	0.00021	0.00027	0.023508	1,000	0.00024
20	0.00007	0.0057	1,000	0.00006	0.00007	0.006238	1,000	0.00006
21	0.00006	0.0055	1,000	0.00006	0.00007	0.006062	1,000	0.00006
22	0.00024	0.0210	1,000	0.00021	0.00027	0.023023	1,000	0.00023
23	0.00004	0.0039	1,000	0.00004	0.00005	0.004322	1,000	0.00004

Note: No information is available regarding the current background concentrations of deposited dust in the area presently. The critical load has been assumed as 1,000 $mg/^2/day$, as per the guidance provided in the Design Manual for Roads and Bridges HA 207/07.[2]

Table 21 Predicted Environmental Concentration of Carbon Monoxide and VOCs at Sensitive Ecological Receptors

	Carbon Monoxide				VOCs			
Sensitive Site	**Annual Average ug m^{-3}**	**Background Conc. ug m^{-3}**	**PEC ug m^{-3}**	**Percentage of Long Term Objective (10 mg m^{-3})**	**Annual Average ug m^{-3}**	**Background Conc. ug m^{-3}**	**PEC ug m^{-3}**	**Percentage of Long Term Benzene Objective (16.25 ug m^{-3})**
Sites Between 0 and 5 km								
1	0.00177	0.00177	0.0035	0.035	0.2531	0.253	0.51	3.11
2	0.00007	0.00014	0.0002	0.002	0.0099	0.020	0.03	0.18
3	0.00004	0.00013	0.0002	0.002	0.0064	0.019	0.03	0.16
4	0.00007	0.00027	0.0003	0.003	0.0099	0.040	0.05	0.31
5	0.00017	0.00085	0.0010	0.010	0.0236	0.118	0.14	0.87
6	0.00008	0.00051	0.0006	0.006	0.0116	0.069	0.08	0.50
7	0.00003	0.00024	0.0003	0.003	0.0050	0.035	0.04	0.25
8	0.00003	0.00027	0.0003	0.003	0.0049	0.040	0.04	0.27
9	0.00003	0.00026	0.0003	0.003	0.0041	0.037	0.04	0.25
Sites Between 5 and 10 km								
10	0.00013	0.00126	0.0014	0.014	0.0188	0.188	0.21	1.27
11	0.00003	0.00036	0.0004	0.004	0.0045	0.049	0.05	0.33
12	0.00002	0.00024	0.0003	0.003	0.0030	0.036	0.04	0.24
13	0.00002	0.00020	0.0002	0.002	0.0022	0.028	0.03	0.19
14	0.00002	0.00027	0.0003	0.003	0.0029	0.040	0.04	0.26
15	0.00005	0.00074	0.0008	0.008	0.0075	0.112	0.12	0.74
16	0.00002	0.00030	0.0003	0.003	0.0025	0.040	0.04	0.26
17	0.00001	0.00023	0.0002	0.002	0.0020	0.034	0.04	0.22
18	0.00004	0.00067	0.0007	0.007	0.0056	0.101	0.11	0.66
19	0.00008	0.00146	0.0015	0.015	0.0115	0.218	0.23	1.41
20	0.00002	0.00035	0.0004	0.004	0.0025	0.051	0.05	0.33
21	0.00002	0.00039	0.0004	0.004	0.0027	0.057	0.06	0.37
22	0.00005	0.00103	0.0011	0.011	0.0071	0.155	0.16	1.00
23	0.00001	0.00032	0.0003	0.003	0.0020	0.047	0.05	0.30

Note: VOCs are compared against the AQO for Benzene, but in reality will comprise more species than Benzene alone, and therefore are not directly comparable in an assessment of significance. It is anticipated that Benzene will comprise approximately 1 % of the total VOCs. Also, the AQO for Benzene reduces to 5 ug m^{-3} on 31st December 2010. Application of this AQO results in a process contribution of VOCs of 5.0615 % of the annual Benzene objective. This would result in a process contribution of Benzene of approximately 0.05 % of the annual objective and is therefore insignificant. The predicted environmental concentration of VOCs at Blaen Cynon represents 10.123 % of the Benzene future annual objective, or an estimated PEC of Benzene of 0.1 %. Therefore the Benzene PEC at Blaen Cynon and each of the other receptors can be considered to be insignificant.

Table 22 Process Contribution of Heavy Metals, Hydrogen Chloride and Hydrogen Fluoride at Sensitive Ecological Receptors

	Mercury		Arsenic*		Cadmium*		Hydrogen Chloride		Hydrogen Fluoride	
Sensitive Site	Annual Average ug m^{-3}	Percentage of Long Term Objective (0.25 ug m^{-3})	Annual Average* ug m^{-3}	Percentage of Long Term Objective (0.006 ug m^{-3})	Annual Average* ug m^{-3}	Percentage of Long Term Objective (0.005 ug m^{-3})	Annual Average ug m^{-3}	Percentage of Long Term Objective (20 ug m^{-3})	Maximum Hourly Concentration ug m^{-3}	Percentage of Short Term Objective (250 ug m^{-3})
Sites Between 0 and 5 km										
1	0.000451	0.1804	0.004509	**8.35**	0.000451	**4.5095**	0.0902	0.4509	0.1554	0.0622
2	0.000018	0.0071	0.000177	0.33	0.000018	0.1770	0.0035	0.0177	0.0253	0.0101
3	0.000011	0.0046	0.000114	0.21	0.000011	0.1139	0.0023	0.0114	0.0201	0.0080
4	0.000018	0.0071	0.000178	0.33	0.000018	0.1781	0.0036	0.0178	0.0247	0.0099
5	0.000042	0.0167	0.000418	0.77	0.000042	0.4179	0.0084	0.0418	0.0663	0.0265
6	0.000020	0.0081	0.000203	0.38	0.000020	0.2029	0.0041	0.0203	0.0950	0.0380
7	0.000009	0.0036	0.000090	0.17	0.000009	0.0899	0.0018	0.0090	0.0193	0.0077
8	0.000009	0.0035	0.000089	0.16	0.000009	0.0887	0.0018	0.0089	0.0188	0.0075
9	0.000007	0.0030	0.000074	0.14	0.000007	0.0738	0.0015	0.0074	0.0173	0.0069
Sites Between 5 and 10 km										
10	0.000034	0.0135	0.000337	0.62	0.000034	0.3371	0.0067	0.0337	0.0208	0.0083
11	0.000008	0.0032	0.000080	0.15	0.000008	0.0802	0.0016	0.0080	0.0245	0.0098
12	0.000005	0.0021	0.000054	0.10	0.000005	0.0537	0.0011	0.0054	0.0121	0.0048
13	0.000004	0.0016	0.000039	0.07	0.000004	0.0391	0.0008	0.0039	0.0083	0.0033
14	0.000005	0.0021	0.000051	0.10	0.000005	0.0513	0.0010	0.0051	0.0142	0.0057
15	0.000013	0.0054	0.000134	0.25	0.000013	0.1340	0.0027	0.0134	0.0127	0.0051
16	0.000004	0.0018	0.000045	0.08	0.000004	0.0450	0.0009	0.0045	0.0171	0.0068
17	0.000004	0.0014	0.000036	0.07	0.000004	0.0357	0.0007	0.0036	0.0106	0.0042
18	0.000010	0.0040	0.000101	0.19	0.000010	0.1009	0.0020	0.0101	0.0119	0.0048
19	0.000021	0.0082	0.000205	0.38	0.000021	0.2054	0.0041	0.0205	0.0140	0.0056
20	0.000005	0.0018	0.000046	0.08	0.000005	0.0456	0.0009	0.0046	0.0166	0.0066
21	0.000005	0.0019	0.000048	0.09	0.000005	0.0485	0.0010	0.0048	0.0158	0.0063
22	0.000013	0.0051	0.000127	0.24	0.000013	0.1269	0.0025	0.0127	0.0117	0.0047
23	0.000004	0.0015	0.000037	0.07	0.000004	0.0367	0.0007	0.0037	0.0106	0.0042

Note: Annual average of Arsenic represents the total emission of Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel and Vanadium. Hence the reported percentage of the objective represents 1/9th the actual percentage of the annual average over the arsenic objective. Similarly, Cadmium and Thallium were modelled together and thus the annual average represents the total emission of both species, whereas the percentage has been divided by two to represent the percentage of the annual average over the arsenic objective.

Table 23 Assessment of Other Modelled Metals Against their Respective Target Values or Environmental Assessment Levels

Species	Total Annual Average at Blaen Cynon ug m^{-3}	Annual Average of Individual Species at Blaen Cynon ug m^{-3}	Target Value / EAL	Percentage of Target Value / EAL
Antimony	0.004509	0.00050	5 ug m^{-3}	0.010
Lead	0.004509	0.00050	0.25 ug m^{-3}	0.200
Chromium	0.004509	0.00050	0.1 ug m^{-3}	0.501
Cobalt	0.004509	0.00050	0.2 ug m^{-3}	0.251
Copper	0.004509	0.00050	10 ug m^{-3}	0.005
Manganese	0.004509	0.00050	1 ug m^{-3}	0.050
Nickel	0.004509	0.00050	0.020 µg m^{-3}	**2.505**
Vanadium	0.004509	0.00050	5 ug m^{-3}	0.010
Thallium	0.000451	0.000225	1 ug m^{-3}	0.02255

Note: Table 23 only considers annual average contributions at Blaen Cynon as this is the only site at which arsenic and cadmium cannot be ruled as insignificant. As these two species have the lowest target values, where these can be ruled as insignificant, all similar modelled species can also be ruled as insignificant.

Table 24 Assessment of Deposition Rates of Metals and Fluoride Against Maximum Deposition Rates for Soils

Species	Deposited Rate at Blaen Cynon mg m^{-2} day	Maximum Deposition Rate mg m^{-2} day	Percentage of MDR
Fluoride	0.011684	2.1	0.56
Arsenic	0.000042	0.02	0.21
Chromium	0.000042	1.5	0.003
Copper	0.000042	0.25	0.02
Lead	0.000042	1.1	0.004
Mercury	0.000037	0.004	0.94
Nickel	0.000042	0.11	0.04

Note: The maximum deposition rate (MDR) is the quantity of pollutant which can be added to the soil daily over 50 years before the selected soil quality criteria is exceeded. MDRs are not available for all species.

5 DISCUSSION OF AIR QUALITY EFFECTS

The data presented in Tables 1 – 24 represent information requested by the Countryside Council for Wales in order to further support the dispersion modelling study submitted with the Environmental Statement for the proposed Enviroparks development at Hirwaun. An initial assessment of the Nitrogen deposition potential assigned critical loads associated with heath meadows and humid swards to the Blaen Cynon SAC. However this report describes each of he principal features of the three SACs which have associated critical loads, and compares the results against each of these. That said, in a recent Air Pollution Assessment of the Blaen Cynon SAC[3], the Environment Agency assessed Nitrogen deposition against the critical loads for molina caerulea meadows, applying this single description as the most appropriate for the whole site. Where the status of other receptors is required to assign a critical load, the best fit description or worst case assessment has been applied.

The data in the tables show that:

There are three Special Areas of Conservations within a 5 km radius of the proposed development site. There are no further SACs between 5 and 10 km, although another two SACs are known to be located between 10 and 15 km distant. There are also twenty separate Sites of Special Scientific Interest within a 10 km radius of the proposed development site.

When Oxides of Nitrogen (NO_x) were modelled together, with no consideration for the potential chemical reaction of the emissions in the atmosphere, the process contribution (PC) could not be considered insignificant at three locations, one SAC (Blaen Cynon), and two SSSIs (Cwm Gwrelych and Nant Llynfach Streams, and Crag-y-Llyn). When applying calculations for the chemistry of the NO_x emission, the PC at the two SSSIs became insignificant, although the PC at Blaen Cynon could still not be screened as insignificant as either a short or a long term average.

The process contribution of Sulphur Dioxide as a long term annual average was also unable to be screened as insignificant at Blaen Cynon, although the short term PC can be considered insignificant.

When considering the deposition of nutrient Nitrogen at the SACs, an initial assessment considered all of the NO_x as NO_2, and did not take into account the potential effects of combining flues which are located in close proximity to one another. This suggested that the process contribution to total deposition at Blaen Cynon could equate to 47.43 % of the lower critical load, or 28.46 % of the upper critical load, when applying the critical loads for molina caerulea meadows. That said, the application of other feature descriptions, particularly raised and blanket bogs, demonstrated that the contribution to critical loads could be higher in some more sensitive locations around the site.

A study undertaken by Laxen and Marner[1] identified that process derived NO_2 could conservatively be modelled at 50 % of the emitted NO_x concentration, and deposition of NO could be ignored, as could wet deposition. Re-running the model to take these factors into account and to combine the flue discharges reduces the percentage contribution of nutrient Nitrogen deposition dramatically, and results in a deposition rate representing 1.29 % of the lower critical load, or 0.77 % of the upper critical load. That said, these figures again represent the critical loads for molina caerulea meadows, and other more sensitive features are seen to receive a higher contribution to their specific critical loads.

When considering the maximum predicted deposition across the larger modelled grid, the maximum recorded concentration resulted in a deposition rate representing 3.33 % of the lower critical load and 2.0 % of the upper critical load. This location was considered to lie within the Blaen Cynon SAC, but would represent an area of no more that 100 m^2, with all other concentrations being below this.

To further investigate the likely contribution of nutrient Nitrogen deposition on each of the sensitive features of the SAC, it would be necessary to have data on the location and extent of each of the features. This would enable a specific grid reference to be applied to each identified feature and would enable a more accurate deposition rate to be calculated for each location, resulting in an assessment of each of the individual areas of the SAC.

Acid deposition has been assessed as a combination of sulphur and nitrogen dry deposition, to provide a molar equivalent of potential acidity resulting from the deposition of these two species. The calculation should remove the concentrations of non-marine base cations, however this has been ignored as no information is available for this study. The calculation assumes that all nitrogen deposition is acidifying, however in practice, a fraction of the nitrogen deposition may be accumulated by the ecosystem resulting in actual acidification being less than the figure estimated here. Hence, the results can be considered to represent an overestimate of the likely acid deposition from the process.

The process contribution to acid deposition at Blaen Cynon could not be considered insignificant, equating to 14.83 % of the critical load. When considering the maximum predicted deposition across the larger modelled grid, the maximum recorded concentration resulted in a deposition rate representing 38.65 % of the critical load. That said, the current stated background for the site is 2.2 kg eq/Ha/year, against a critical load of 0.35 kg eq/Ha/year. The current background acid deposition rate therefore represents almost 630 % of the critical load, and by comparison, the potential process contribution from the proposed Enviroparks site is negligible.

Consideration has been given to the likely contribution of traffic emissions to the nutrient Nitrogen and acid deposition. The increase in emissions was seen to be minimal and the percentage contribution of the critical loads was less than 0.05 % in all cases.

Although the predicted deposition of nutrient Nitrogen and acidifying species from the proposed development onto sensitive receptors in the area represents only a proportion of the critical load for the sites, many of the sites already exceed their higher critical load, and thus any additional contribution will exacerbate these exceedences. That said, where detailed information on the status of Blaen Cynon (which is the nearest and most likely site to be impacted by the operations) has been obtained it suggests that the current status of the feature overall is unfavourable. The principal reasons for this are inappropriate grazing, scrub invasion, inappropriate tree planting and past agricultural improvements in the management units. The likely implication of the potential impact from the proposed site is therefore questionable, as it appears that more significant issues are the cause of the current status of the site, over which the proposed development would have no control. Whilst the predicted process contributions of nutrient Nitrogen and acid deposition cannot be ruled out as being insignificant (i.e. less than 1 % of the critical load), they can be considered to represent a minor contribution to the current deposition rates and status of the site.

Consideration of nutrient Nitrogen and acid deposition had the considerations of Laxen and Marner[1] applied and presented results from flues modelled in combination. Details on all other pollutants, including consideration of levels of deposited dust, applied the original modelling data, which did not combine the flues.

The long term annual average of Volatile Organic Compounds (VOCs), Arsenic, Cadmium and Nickel could not be screened as insignificant at the Blaen Cynon SAC. These pollutants were considered insignificant at all other receptors. The process contribution of total VOCs was compared to the single species air quality objective for Benzene, and is therefore not directly comparable. The PC for VOCs represents 1.5574 % of the current AQO for Benzene and 5.0615 % of the future limit (31st December 2010). As the total VOC emission will comprise a significant number of species, and Benzene will likely make up approximately 1 % of the total, it is reasonable to screen VOCs / Benzene as insignificant.

The process contributions (long and / or short term) of particulates, carbon monoxide, hydrogen chloride, hydrogen fluoride, antimony, lead, chromium, cobalt, copper, manganese, vanadium and thallium, were sufficiently low to screen each of these pollutants as insignificant. Levels of deposited dust are presented in Table 20 and record a maximum of 1.13 $mg/m^2/day$ at Blaen Cynon, when considering total deposition. If the highest concentration recorded across the modelled grid is applied, a dry deposition rate of 4.5 $mg/m^2/day$ and a total deposition rate of 4.7 $mg/m^2/day$ are calculated. Neither of these highest values were seen to occur directly within the Blaen Cynon site, and all of the results are less than 1 % of the level at which particularly sensitive plant species may be affected by dust falling onto them.

Where background concentrations of air quality pollutants were available, none of the predicted environmental concentrations for the pollutants exceeded the 70 % threshold of significance. Therefore, the PEC of NO_x (as NO_2), SO_2, Particulates, CO and VOCs can be considered unlikely to have a significant effect.

6 SITE SPECIFIC INFORMATION ON BLAEN CYNON SAC

The Core Management Plan for the Blaen Cynon SAC has been viewed and notes that the current status of the Cors Bryn-y-Gaer feature overall is unfavourable[4]. The principal reasons for this are considered to be inappropriate grazing, scrub invasion, inappropriate tree planting and past agricultural improvements in the management units. 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 considered to be the single most important issue in the management of this site.

The Core Management Plan also notes that there are no known off-site factors, such as pollution, that are affecting the marsh fritillary butterfly at Blaen Cynon to any significant extent, although there is still much industry in the locality. The two overwhelming issues of grazing and scrub encroachment are considered to obscure any off-site issues, although as management of the site improves off-site factors may become more apparent.

Although the grasslands of Blaen Cynon 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 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[3]. 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[3], however no information has been found as to the location of the differing soil types within the SAC.

As part of an Air Pollution Assessment for Blaen Cynon[3], the Environment Agency has recorded the stated rate of nutrient Nitrogen and acid deposition (amongst others) at the Blaen Cynon site from various websites and databases. Modelling has then been used to calculate the percentage of the minimum critical load, attributable to regulated sources. This source apportionment indicates that for nutrient Nitrogen deposition, the percentage contribution of regulated sources increases with time, likely due to the effects of increased energy consumption, however for acid deposition, the percentage contribution of regulated sources reduces with time, other sources becoming increasingly dominant.

7 CONCLUSION OF THE AIR QUALITY EFFECTS OF THE PROPOSED INSTALLATION

Although not all pollutants emitted to air from the proposed Enviroparks facility at Hirwaun can be considered to have an insignificant effect on the quality of air or potential effects on vegetation in the vicinity of the site, the predicted environmental concentrations of pollutants in air (where calculable) remain below the 70 % threshold of significance, and can therefore be considered unlikely to have a significant effect. Where the process contribution exceeded the insignificance threshold of less than 1 % of the long term assessment level, exceedences of specific substances (e.g. NO_2 as opposed to total NO_x as NO_2) were often below 5 % of the assessment level, and always below 10 % of the assessment level. Therefore although not all pollutants can be considered insignificant, they can still be considered to represent a small contribution to the overall assessment level.

The potential for nutrient Nitrogen and acid deposition has also been assessed. The contribution of these deposits at most sites can be screened as insignificant, however the high background levels result in predicted environmental concentrations of deposits which exceed the critical loads for the sites.

Results of nutrient Nitrogen and acid deposition suggest that deposition at Blaen Cynon cannot be screened as insignificant, however even at the highest predicted concentration, the rate of nutrient Nitrogen deposition was less than 5 % of the lower critical load for the site when considering dry deposition. Although consideration of total deposition increased this to approximately 14 %, the location of this total deposition rate was outside of the Blaen Cynon site, and the actual effects of wet deposition close to source are considered negligible. Thus this result is considered an overestimate.

The potential for acid deposition at the Blaen Cynon site equates to approximately 14 % as an average or 39 % of the critical load at the maximum point. Acid deposition at the Bryncarnau Grasslands could also not be screened as insignificant, although was only marginally above the threshold of insignificance, at 1.3 % of the critical load.

It is considered that as the current background concentrations of both nutrient Nitrogen and acid deposition are above the lower critical loads for the Blaen Cynon site, and the predicted process contribution represents a small proportion of this, the impact from the proposed Enviroparks site cannot be considered significant in relation to the current unfavourable status of the site, which requires better, more balanced grazing management as a priority. This is particularly apparent when considering the contribution of the site to the predicted environmental concentration of acid deposition, where the current background deposition rate is already believed to be approximately 630 % of the critical load. Therefore, although the process contributions cannot be screened as insignificant, they are considered to contribute a minor proportion of the total and thus are not considered to have a significant impact overall.

8 HYDROLOGICAL EFFECTS AT SENSITIVE SITES

The plant communities of Blaen Cynon are dependent on maintenance of the hydrological regime and the continuation of traditional agricultural management. Thus the Countryside Council for Wales had originally raised concerns about the potential for hydrological impacts by the development on the local SAC. Supporting information on the ground and water conditions at the site identified during a major intrusive investigation is presented as Appendix 1. The main conclusions with regard to the potential for impacts to groundwater from changes in the hydrological conditions or the disturbance of contamination at the site can be summarised as follows:

- Concentrations of contaminants which have Soil Guideline Values or Soil Screening Levels did not exceed their respective guideline values, and thus are not considered to pose a risk of contamination to site users or off site receptors.
- It is unlikely that there will be a risk of PAH contamination to site users or off site receptors.
- Soil samples from one trial pit suggested that one small area of the site has evidence of elevated hydrocarbon concentrations. Although the report identified that none of the Soil Screening Levels for aromatic or aliphatic fractions of the carbon bands were exceeded and thus no actual risk was considered to be present, some remediation could be undertaken to ensure the removal of this hydrocarbon contamination, thereby removing any risk to controlled waters. Enviroparks intend to ensure that a suitable removal and remediation strategy is prepared for this small patch of contamination.
- Levels of copper, nickel and zinc encountered in soil samples were not considered high enough to inhibit plant growth.
- Comparison of the groundwater analysis results indicated that the groundwater underlying the site is relatively uncontaminated, with many of the results being below the level of detection. The majority of the contaminants in the analysed groundwater were considered to pose no risk to human health, surface waters, or groundwaters outside of the site. The report identified that in some areas, levels of benzo(a)pyrene and total petroleum hydrocarbons within the groundwater samples exceeded the maximum admissible concentrations for drinking water quality.
- The overall assessment of land and groundwater quality at the site suggested that based on the available evidence, the site may be developed without the need for remediation to remove risks to human health.

After some discussion between Enviroparks and CCW, which highlighted that the only subsurface works to be undertaken at the site consisted of standard foundations, excavations, the provision of subsurface rooms and below surface drainage and utility runs, CCW felt able to lift their requirement for further information on hydrological impacts. Enviroparks can confirm that ground and water disturbance will only occur during construction and will be limited to the site area. Where necessary, surveys will be undertaken to determine the relevant dewatering rate of the work area to ensure that wider areas are not affected, and appropriate piling techniques will be applied. Subsurface works will be temporary, being restricted to the construction period only, and there is no requirement or intention for the site to abstract water from the ground. Therefore, coupled with the information already provided within the Environmental Statement, it can be concluded that the proposed development will not have a significant effect on the hydrology of the site for ground or surface water features.

9 CONCLUSION AND PROPOSED PROTECTION AND MITIGATION MEASURES

This report has attempted to provide suitable and sufficient supporting information to an Environmental Statement submitted with a planning application for an Enviroparks facility proposed for the Hirwaun Industrial Estate in South Wales. The detail included within this report has been compiled with full reference to the requirements of the Breacon Beacons National Park Authority, the Rhondda Cynon Taf County Borough Council and the consultees concerned. In conclusion:

- The predicted environmental concentration of aerial emissions from the proposed development, which considers the background air quality concentration as well as the process contribution to air quality levels, are not considered to be of significant concern, either to human health or to vegetation, although not all substances can be screened as insignificant by definition.

- Although the 1 % threshold of insignificance can be seen to be exceeded for nutrient Nitrogen and acid deposition at Blaen Cynon and for acid deposition at Bryncarnau Grasslands Llwyncoed, the contribution of the process to such deposition at both sites is considered to be a minor proportion of the total and thus is not considered to have any significant overall impact.

- The data has considered the in combination effects of currently identified potential local developments and increases in traffic emissions. Neither of these elements has any significant effect.

- No additional abatement measures are proposed for emissions to air from the Enviroparks development.

- The proposed Enviroparks development at Hirwaun does not intend to alter the hydrology of the area. Once construction works are complete, during which foundations, excavated areas, below ground rooms and drainage and utility runs will be laid, there will be no on-going impact on the hydrology of the area. The company does not propose to abstract ground water for use and will not require excavation to any significant depth. Therefore there will be no significant impact on ground or surface water features in the area.

10 REFERENCES

1. An Assessment of Possible Air Quality Impacts on Vegetation from Processes Set Out in the Bournemouth, Dorset and Poole Waste Local Plan. Prof. Duncan Laxen and Dr. Ben Marner; Air Quality Consultants Ltd. April 2005.

2. Design Manual for Roads and Bridges HA 207/07; Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques – Appendix F Assessment of Designated Sites. May 2007.

3. Draft Air Pollution Assessment for Blaen Cynon. Provided by the Environment Agency Wales in April 2009.

4. Core Management Plan Including Conservation Objectives for Blaen Cynon Special Area of Conservation (SAC). Version 1; 28th February 2008. Countryside Council for Wales.

11 APPENDICIES

APPENDIX 1	Hirwaun Industrial Estate Development; Interpretive Report on Site Investigation. Soil Mechanics Report Number H8076; January 2009