11th May 2007
Ref: 1377

Mr Roger Bennion,
Planning Department,
Flintshire County Council,
County Hall
MOLD
CH7 6NF

Dear Roger,

PARRY'S QUARRY ENVIRONMENTAL STATEMENT ADDENDA AND RESPONSES TO CONSULTATIONS

We are pleased to provide, as requested, six copies of the documentation related to the above.

The documentation includes the following;

1.0 Summary of proposed working conditions and operations
2.0 Management plan for the control and prevention of bird strikes
3.0 Best practicable environmental option (BPEO) assessment
4.0 Noise and air quality implications of proposed Costa Coffee and Subway developments
5.0 Environmental statement addendum on ecology response to CCW comments dated 27.03.07
6.0 Rebuttal to Brock plc letter dated 20.12.06 and clarification of other traffic and highway issues
7.0 Rebuttal to Brock plc letter relating to landscape and visual impact issues
8.0 Addendum concerning hydrogeology issues
9.0 Predictive odour assessment and odour management plan
10.0 Health impact assessment

Please note that predictive odour assessment is currently being undertaken and we expect this to be complete by the 21st May 2007.

We trust you find the information satisfactory.

[redacted]

Giles Bishop,
Technical Director, AMEC Earth and Environmental.

Copy: G Robbins- Robin Jones and Sons Ltd

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PARRYS QUARRY PROPOSED LANDFILL SITE

SUMMARY OF PROPOSED WORKING CONDITIONS AND OPERATIONS

(Facts and Figures of Site Construction, Operation and Closure)

Working Hours

- 8.30am – 5pm. Monday to Saturday. The site will be closed on Sundays and Statutory Holidays. Equipment may operate at the site up to 1 hour before and no later than 2 hours after the hours of operation to complete the required maintenance and cover soil placement activities.

Disposal and Cover of Waste

- The size of the active disposal area will be limited to no greater than 900m2 at any one time.
- At the end of each day a minimum of 0.15 metres of daily soil cover will be placed on all exposed waste.
- Certain areas of the landfill will remain inactive over a period of time after which waste placement will resume until final contours are reached. Areas of landfill which remain inactive for more than 90 days will be completed with interim cover material which will consist of a 0.3 metre layer of soil, preferably fine grained if available, placed over the waste and graded to promote surface water run off.
- Final cover will consist of a minimum 1.0 metre layer of low permeable soil (clay), constructed to a maximum compacted/remoulded hydraulic conductivity of 1 x 10-8 m/sec, overlain by 0.15 metres of vegetated topsoil.

Void Volumes

- Available Landfill Volume 2,616,425 (Waste and Daily Cover Soil, m^3)
- The estimated available landfill tonnage is 1,569,855 tonnes, assuming the void volume given above and a conservative estimate for emplaced waste/daily cover soil density of 600kg/m^3.
- The above equates to an annual waste input rate of 104,657 tonnes assuming a lifetime for landfilling of 15 years or 78,493 tonnes per annum for a project lifetime of 20 years.
- If a higher degree of waste compaction is achieved an in situ/daily cover soil density of 900kg/m^3 may be possible which would equate to an estimated landfill tonnage of 2,354,783 tonnes and an annual input of 156,986 tonnes/year for a 15 year project lifetime or 117,739 tonnes/year for a 20 year project lifetime.

Cell Development

- The base of the landfill is proposed to be at an elevation of approximately 82m AOD.
- The flanks of the cell will be constructed with a sidewall grade of 2:1
- Filling within Cell 1 shall continue until wastes reach the elevation of the existing ground level - i.e to a minimum elevation of approximately 105m AOD at the northern tip of Cell 1, to a maximum of 112m AOD at the southwest corner of the cell. This shall be the interim stage of filling within the cell until such time as the remaining three cells have been progressed to the same stage.
- The maximum height of the completed landfill will be approximately 129m AOD with slopes of 20:1 near the crest and 4:1 on the flanks of the landfill.

- The maximum height of the landfill will not exceed that proposed and relates to the pre-settlement condition.
- The groundwater level (AMEC 2006) at the south central portion of the landfill area is approximately 92m AOD. The proposed landfill base in approximately 82m AOD. To avoid problems with emplacing and maintaining the engineered landfill basal liner it will be necessary to dewater the site to an elevation at or just below the base.

Basal Lining System

- The sub-base of the landfill will consist of a minimum 0.5 metre thick low permeability soil (typically clay) with a compacted/remoulded hydraulic conductivity of $\leq 1x10^{-9}$ m/s (Landfill Regulations, 2002)
- The basal lining system will be graded in a herringbone pattern. The grade will fall from the centre of the landfill outward to the sidewalls at 2% in distinct peaks/valleys as showing in Drawing 2.
- The basal lining system will consist of a geomembrane liner, typically made from high density polyethene (HDPE) material for chemical compatibility with MSW leachate, overlain by a non woven geotextile material (EA 2004).
- The geomembrane liner design will have a minimum thickness of 1.5m (60 mils) and a minimum hydraulic conductivity on the order of $\leq 1x10^{-13}$ to $1x10^{-15}$ m/s.
- The low permeability final cover will be covered by a minimum of 150mm of suitable soil which allows the proposed final restoration end use to be achieved.

Leachate Management

- The proposed leachate collection system will consist of a continuous drainage blanket, lateral collection pipes, perimeter header pipes, cleanouts, leachate pump stations and a leachate forcemain to the sanitary sewer.
- The lateral collection pipes will be perforated HDPE pipe, 300mm in diameter.
- The header pipes will be 300mm diameter perforated HDPE pipes.
- Cleanout pipes will consist of 300mm solid HDPE pipe.
- The header pipe on the east side of the landfill will drain to the Leachate Pump Station No.1 at grades ranging from 0.5% to 1.5%. On the west side of the landfill, the header pipe will drain to Leachate Pump Station No. 2 at grades ranging from 0.4% to 2.4%.

Landfill Gas (LFG) Management

- Assuming the proposed waste generation scenarios, a LFG generation potential of 250m3 of CH_4 per tonne of waste, and a methane generation rate of 0.04/year, the estimated annual LFG generation tonnage is 104,657 tonnes for a site life of 15 years, and 78,493 tonnes for a site life of 20 years using the conservative in-place gross waste density of 600kg/m3.
- Landfill gas generated from decomposing biodegradable wastes will be collected via a series of horizontal and lateral trenches.
- The horizontal trenches consist of a segmented perforated HDPE pipe in gravel bedding.
- The pipe segments use a 300mm solid HDPE pipe and a 200mm perforated HDPE pipe with the segments overlapping.
- The trenches will be placed 10 metres vertically and 40 metres horizontally to achieve an optimal zone of influence over the entire waste mass, therefore achieving 85% collection efficiency.

- A 4 to 6 metre waste depth will be maintained over the expected capture zone of the trench prior to initiating LFG extraction to prevent air intrusion into the system.
- The pipe material selection for the wells may be 100 to 150mm PVC or HDPE.
- Extraction wells will be installed between the horizontal trenches within the 127m AOD contour area at 40 metre spacing
- The gas trenches will be connected to a peripheral landfill gas header pipe of 450mm diameter and constructed of HDPE.
- If a trigger value of 100m^3/hr is assumed, LFG collection should be initiated approximately 1 year following site opening. This may be difficult to achieve, hence all facilities should be built for the expected peak rate of approximately 1,900m^3/hr. If this trigger is assumed, LFG extraction must continue for over 100 years as indicated on the LFG generation curves.
- Assuming a trigger of 0.75MW to initiate utilization, 3.6 to 5 years is required for enough waste to accumulate to generate the required LFG.

Surface Water Management (SWM) System

- The contributing surface water drainage area from the proposed landfill site covers a total area of approximately 10.11ha. The area is discretised into two free flowing subcatchment areas, the top of the land fill cap which is relatively flat (20:1) and the sloping areas of the cap having 4:1 sideslopes.
- Overall drainage will be directed towards the existing northwest SWM pond. Stormwater from the pond will continue to be pumped out via the existing 100mm diameter overland pipe at a discharge rate not exceeding the present discharge consent of 1,200m^3/day (14 L/s) to the existing 300mm diameter storm sewer located north west of the site.
- Hydrological modelling revealed the following;
- 1:100 year hydrograph volume entering into the pond is 3,674m^3
- The surplus storage volume available in the pond is 1,872m^3 and:
- The above points suggest the pond could be reduced by 5.5m, still leaving 3,796m^3 storage capacity.
- The existing SWM pond has the following characteristics;
- Bottom elevation = 82.5m AOD
- Maximum top elevation = 92.0m AOD
- Total maximum depth = 9.5m AOD
- Maximum storage capacity = 5,546m^3

Lorry Movements

- It is predicted that the Parry's site will generate some 95 HGV movements per day from the landfill operations and quarrying operations, which will continue as at present, will generate some 20 HGV movements per day, i.e. in combination there will be approximately 12 HGVs per hour or 1 every 5 minutes.

Proposed End Use of Site

- After closure of the landfill, the proposed end use of public green space will comprise mixed plantings of native British tree and shrub species and wildflower meadow (AMEC 2006). The proposed proportion of woodland, shrub and meadow plantings will be 20% woodland around the lower slopes of the peripheries of the site, with approximately 20% mixed shrub planting and 60% wildflower meadow.

- It is likely that the post-closure monitoring and the aftercare period will extend to a minimum of 20 years.

PARRY'S QUARRY
ALLTAMI
MANAGEMENT PLAN FOR THE
CONTROL AND PREVENTION OF BIRD STRIKES

Submitted to:
Flintshire County Council

Submitted by:

AMEC Earth & Environmental UK
Unit 1, Long Barn, Pistyll Farm,
Nercwys, Mold, Flintshire, CH7 4EW

May 2007

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1.0 INTRODUCTION

1.1 Purpose of the document

A planning application has been submitted to Flintshire County Council for the development and operation of a Non-Hazardous Household Commercial and Industrial waste landfill site at Parry's Quarry, Alltami near Mold. The application included an Environmental Statement and an Impact Assessment.

Following submission of the planning application, Flintshire County Council received a consultation response from Airbus (letter dated 11th December 2006) which requested that an assessment of the potential for the landfill to attract birds, and therefore to impact upon aircraft using the Airbus airfield at Broughton, be carried out.

This document sets out the management proposals designed to mitigate against the risk of birdstrikes and outlines the measures taken to prevent or minimise the attraction of birds to the site.

1.2 Birdstrikes

Birdstrikes is a term given to incidents involving aircraft and birds which, when drawn into the jet engines of aircraft, can cause engine failure or fire on board the aircraft, thus causing accidents and delays.

Landfill sites can attract large flocks of birds, especially gulls, therefore the presence of a landfill site in close proximity to an aerodrome can pose a significant risk to aircraft in the vicintity of the site

1.3 Site location

Parry's Quarry is located at NGR SJ 2755 6652, approximately 7.3 km North West of the Airbus airfield at Broughton, Flintshire. Figure 1 illustrates the location of the proposed development site in relation to the airfield and delineates the 13 km radius of the airfield reference point, which is taken to be the centre of the main run way.

1.4 Risk assessment

Appendix A contains a qualitative risk assessment, addressing the risk of increased bird strikes and how risk mitigation measures will reduce the risks to acceptable levels. The risk assessment makes the following assumptions:

- That without mitigation, there will be an increase in populations of birds within a 13 km radius of the airfield reference point as a result of the landfill development.
- Corvids and Starlings will present no significant contribution to risk, as the landfill site is located over 7 km from the airfield reference point. The concentration of Corvids

and Starlings around landfill sites is more local and less pronounced and will only contribute to birdstrike risk if the landfill is in very close proximity to the airport.

- Gulls, when not feeding, will spend much of the day within a 6 km radius of the landfill
- Gulls commonly soar up to 450 metres in altitude in clear weather
- Birds may commute between the landfill and their roost, which may involve crossing the airfield approach and take off flight lines.

In preparing the risk assessment, reference is made to Civil Aviation Authority (CAA) guidance document CAP 772 Birdstrike Risk Management for Aerodromes and recent published research projects carried out in the UK.

2.0 MANDATORY RISK CONTROL MEASURES

2.1 Control of waste types

Birds are attracted to biodegradable waste as it provides a source of food. Therefore, controlling the waste types accepted at the site is the best method of minimising bird attraction and mitigating against bird strikes.

The site is intended to be an 'open gate' landfill with the proposed waste types including non-hazardous Household, Commercial and Industrial waste. Such wastes will inevitably contain food sources for birds. However, certain management controls can be exercised, which if implemented effectively, will reduce the quantity and availability of food sources within the wastes.

In accordance with the Landfill Regulations 2000 (as amended), from 01 October 2007, all non-hazardous waste will require pre-treatment before it can be landfilled. As such, the site operator will impose through contractual arrangements with waste producers, a requirement for non-hazardous waste containing food sources to be treated in such a way as to reduce the quantity and availability of such material present in the waste.

The following measures will be implemented.

Commercial & Industrial waste

Bakeries, hotels, restaurants or food manufacturers will be required to separate food waste into closed containers or sealed bags, separate from general waste items. This will allow the food waste to either be excluded from the incoming waste stream or allow for special disposal arrangements to be made at the site.

Household and municipal waste

In the event that the site is used for the disposal of waste from household sources, schemes will be introduced to manage such waste. These may include introducing a community composting scheme, providing special food waste collection bags and providing alternative disposal facilities for the wastes. Such proposals could be implemented and funded through a landfill tax credit scheme managed by the operator.

2.2 Control of phasing and emplacement of waste

Birds generally forage on the surface of freshly deposited uncovered waste. Therefore, reducing the surface area of uncovered waste is an effective method of minimising the attractiveness of a site to birds, as the availability of food source is reduced and the chance of disturbance is increased. The surface area of uncovered waste will be controlled via careful planning of the phasing and emplacement of waste within the landfill, as described below:

Phasing

The deposit and emplacement of waste will be undertaken in a controlled manner as to reduce as far as practically possible, the size of the working face. The landfill will be completed in a series of four separate cells (phases). This method of infilling provides the operator with effective control over the risks posed by the waste.

Emplacement

Birds may also forage as waste is discharged from the rear of waste collection vehicles and spread over the surface of the landfill.

Waste emplacement techniques will be implemented to reduce the ability of birds to forage and will include:

- immediate / deep burial of waste containing food sources with other non hazardous wastes
- restricting the acceptance of biodegradable wastes to the morning period (as far as practicable), thus allowing immediate / deep burial.

In any event, the discharge and emplacement of all waste will be undertaken under the cover of an exclusion net (as described below).

2.3 Exclusion netting

Exclusion netting will be erected over the working face of the landfill. The exclusion net will be large enough to accommodate compactor vehicles, tippers and wagons and sufficiently robust to prevent gulls from entering the working face area. Once a working face area has been completed and covered, it will be dismantled and erected over subsequent areas of landfill.

Daily inspections of the exclusion netting will be undertaken in order detect and effect repair of any defects. Any holes or defects in the netting will be repaired immediately.

Exclusion netting will also be extended to cover potential loafing and roosting areas, in particular, the surface water settlement pond.

2.4 Daily and intermediate cover

Daily cover

Recent research has demonstrated that the use of daily cover does not necessarily prevent foraging by birds on freshly tipped areas of waste. However, it can prove effective in preventing access by rodents and flies which can expose areas of waste. In accordance with statutory guidelines, suitable cover material will be applied to the working face of the landfill to a depth of at least 150 mm as stated in the design statement which accompanied the planning application. Suitable cover material may include demolition waste, soils, paper pulp or off spec compost. As daily cover is not usually applied until late in the working day, its effectiveness is somewhat limited. However, arrangements will be made to apply daily cover as soon as possible.

Intermediate cover

Unfinished areas of landfill which still require some waste emplacement to achieve restoration levels will be covered with a suitable intermediate (interim) cover of at least 300 mm as specified in the design statement which accompanied the planning application. Intermediate cover may be applied to restored areas prior to the spreading of restoration soils, particularly when restoration soils will not be applied until some time following waste emplacement.

2.5 Minimal storage times

The storage of non-hazardous waste on site prior to disposal will be avoided where possible, thus reducing the availability of waste for foraging. Only in emergencies or during peak demands, will waste be stored temporarily in managed stockpiles prior to spreading and compaction. In such cases, the following procedures will apply:

- Temporary stockpiles of waste will always be located under the exclusion net (as described above).
- Where possible, stockpiles will be kept to a minimum and will be emplaced as soon as practically possible.
- If emplacement is not possible (e.g. as a result of mechanical plant break down), stockpiles will be temporarily covered with sheeting, netting or daily cover material.

2.6 Controlling loafing sites

Areas of landfill which have been vegetated, engineered or restored may be attractive as loafing areas for gulls. Vegetation on such areas will be managed in such a way as to prevent loafing at the site. This may involve regular grass cutting.

In the event that birds begin to nest or roost within these areas, action may be taken to humanely control the population. Such action may include removal of eggs, disturbing nesting areas or covering with proprietary netting.

2.7 Control of debris on roads

To help minimise bird attraction to the site, good site management practices will be employed in order to keep the site access roads and surrounding environs clear of litter and debris which could attract birds. In particular, waste delivery vehicles will be obliged to ensure waste is secured by netting or sheets and all local access roads will be kept clean and clear of litter and debris which could fall from delivery vehicles.

2.8 Vehicle cleaning

Vehicles depositing waste at the site will be required to pass through a wheel wash before leaving the site. The wheel wash will be effective in removing loose debris from the vehicles which would otherwise be tracked out of the site onto the access roads.

Cleaning of waste containers and vehicles will be undertaken under the cover of the exclusion net in order prevent access to the waste residues by birds.

2.9 Site security

Maintaining site security has the indirect effect of minimising the presence of birds at the site. Acts of vandalism such as damaging the exclusion netting or disturbing the waste mass can present an opportunity for birds to gain access to food sources within the waste.

The primary method of preventing unauthorised access to the site will be to provide a security fencing of a suitable standard, together with locked gates and additional measures such as CCTV or night time patrols.

As part of the site operations, daily inspections will be undertaken to ensure that security is maintained and that unauthorised entry into the site is prevented. In the event that damage to site security fencing or the exclusion netting is detected, action will be taken to repair the defects as soon as possible.

3.0 ADDITIONAL RISK CONTROL MEASURES

3.1 General

The measures described above will reduce the availability of access to food items within the waste. The following measures will be implemented in the event that the presence of birds at the site becomes a potential nuisance or pose an increased risk to aircraft. No one technique is expected to prove 100% effective in controlling the birds in isolation, therefore techniques will be initially be employed on a trial basis to determine the most effective control method. Techniques may be used in combination.

3.2 Falconry

An experienced bird keeper may be employed to deploy birds of prey such as Falcon or Hawk which will deter gulls and other smaller birds. Recent research has shown that the presence of birds of prey is known to be effective in reducing the attractiveness of a site to foraging birds.

3.3 Dispersal and scaring

Flocks of birds can be dispersed using a range of techniques such as:

- Firing blank pistols towards flocks.
- Using sound generators to mimic distress calls and other sounds to disturb the birds.
- Firing pyrotechnic charges.

The use of dispersal techniques will be fully investigated prior to commissioning, as some techniques may pose a Health & Safety risk or can escalate the potential for nuisances caused by the landfill operations (e.g. noise).

3.4 Reducing site operations

In the event that large flocks of birds become attracted to the site and measures to disperse the flock fail, the discharge and emplacement of waste may be temporarily suspended until the flock is dispersed.

Should flocks pose a serious and regular risk to nearby aircraft, consideration will be given to reducing waste input rates and restricting waste types.

In the event of reported bird strikes and complaints regarding birds, the site operations may altogether cease until the situation can be brought under control.

3.5 Operational management

Site operations will be managed in such a way as to minimise as far as possible the impacts of the landfill on human health, wildlife and environment.

Site operations will be managed by a management system which will include comprehensive procedures relating to the control of birds. As a minimum, the management system will include:

- Roles and responsibilities
- Policies and procedures
- Training and development
- Environmental management
- Health & Safety
- Record keeping and data management

4.0 MONITORING

4.1 Monitoring for the presence of birds

As part of the site operations, an inspection program will be implemented which will include regular monitoring for the presence and risk of hazards associated with birds. The monitoring program will include monitoring for the presence of:

- Food waste outside of the exclusion netting.
- Damage to the netting.
- Inappropriate waste discharge and emplacement techniques.
- Flocks of birds inside the netting.
- Flocks of birds roosting on or adjacent to the site.

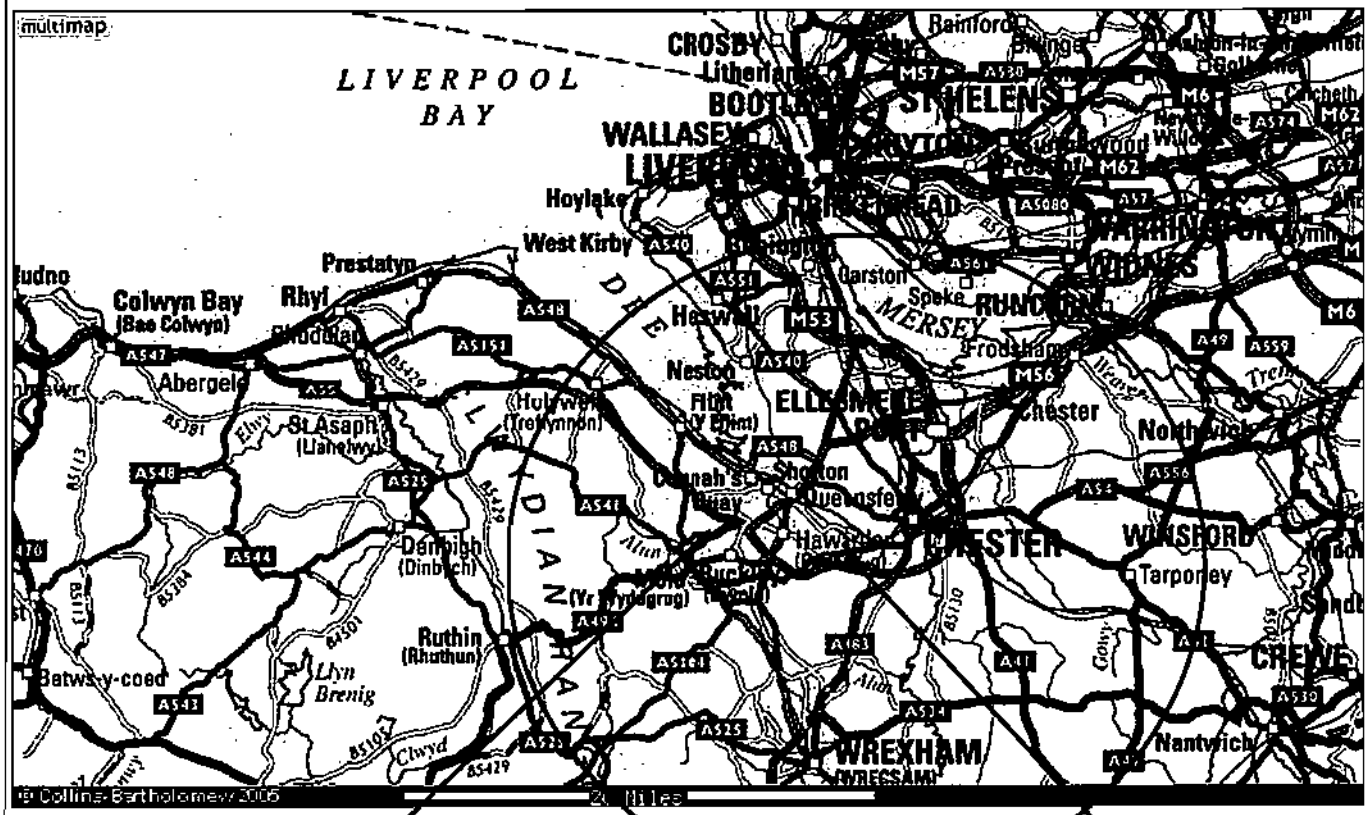
4.2 Records

Records of monitoring and inspection will be maintained as part of the site management system and may include detailed records of all incidents relating to birds, including:

- Bird species present.
- Time and date of presence of flocks.
- Actions taken to control flocks.
- Estimated numbers and behavior of birds and flocks.

5.0 REFERENCES

CAP 772 Birdstrike Risk Management for Aerodromes, March 2007



Parry's Quarry

Hawarden Airfield

13 mile radius

Job No.	5788001377
Project	Parry's Quarry Landfill Site
Title	Location Plan
Client	Robin Jones & Sons Ltd
Drawn by	R.K
Date	11.05.07
Scale	1:500,000

APPENDIX 1

APPENDIX 1
RISK ASSESSMENT – BIRD STRIKE

A1.1 Introduction

A tabulated risk assessment has been produced to asses the likelihood of increased risk of bird strike as a result of the landfill development. The assessment details a number of potential hazard sources arising from the acceptance and handling of the waste which, if unmitigated, could increase the population of birds within 13 km of the airport reference point.

By rating both the probabilities of these hazards occurring, and their consequences upon exposure to the receptor (aircraft), the degree of risk is expressed in a qualitative manner. A number of mitigation measures are identified (both technical and operational) that will reduce the subsequent mitigated risk to a medium magnitude.

Following monitoring during operation, a range of further risk control measures can be implemented, which will further reduce the risk to a very low or negligible level.

A1.2 Definitions

Hazard
A factor which, in certain circumstances would lead to harm. The hazard, in this assessment is defined as birds which may be attracted to the landfill and whose population may therefore increase within 13 km radius of the airport reference point. As described in section 1, the hazard has been identified as the increased presence of gulls. Gulls may be soaring above and near to the landfill or crossing the flightlines of aircraft. Corvids and Starlings are not considered to be significant in this assessment, due to the distance between the site and Broughton airfield.

Hazard source
In this assessment, it is the factor which can increase the presence of birds within the 13 km radius of the airport reference point.

Receptor
Factor which will be at risk as a result of expose to the hazard. In this case, the receptor will always be aircraft using the Broughton airfield. Aircraft may be in a direct flightline to the runway for landing, on a take off route, or circulating the airport prior to landing.

Likelihood of occurrence
The likelihood of increased bird populations within the 13 km radius of the airport reference point, as a result of the landfill operations, without mitigation measures to control or deter birds. The likelihood of occurrence is expressed as:

- Low (L) unlikely to happen
- Medium (M) may happen
- High (H) likely to happen

Consequence

As a result of increased bird populations, the risk of bird strike increases. The consequences of bird strike are engine failure or other damage to aircraft, which can potentially lead to an accident and in severe cases, fatalities. Consequence is expressed as:

- Low (L) negligible occurrence of birds interfering with aircraft operations
- Medium (M) possible birdstrike
- High (H) birdstrike, possibly resulting in catastrophic accident

Risk

A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of occurrence. The general L – M – H ratings listed in the risk assessment tables below are for use as a guide only based on:

Probability	Consequence	Risk
L	L	L
L	M	L
M	L	L
M	M	M
L	H	M
H	L	M
H	H	H
M	H	H
H	M	H

Primary risk mitigation

Measures which will be implemented to prevent increased bird populations.

Secondary risk mitigation

Further measures to deter and control bird populations may be implemented depending on monitoring during operations.

Hazard	Receptor	Likelihood of occurrence	Consequence	Risk	Mandatory risk control measures	Revised Risk	Additional risk control measure
l emplaced	Aircraft: On approach	M	H	H	Phasing of landfill construction Emplacement of waste as soon as it is discharged Covering waste with daily cover, intermediate cover and eventual capping	M	Bird dispersal and falconry Monitoring presence of birds and i patterns Exclusion of problematic waste typ
ces within	Taking off Circulating airport prior to landing	M	H	H	Pre-treatment of waste prior to landfilling Source segregation of waste to exclude food Special handling and emplacement of food waste Provision of alternative collection and disposal facilities for food waste	M	Temporary suspension of waste in contain significant food items for b
charge from		M	H	H	Controlled discharge of waste: close to point of disposal and under cover of the exclusion net	M	
rage		M	H	H	No on site storage of waste prior to emplacement, except in times of emergency	M	
eading and n		M	H	H	All waste spreading and compaction to be undertaken under the cover of the exclusion net. Immediate spreading and M compaction of waste, once discharged from the RCVs.	M	
m cleaning		M	H	H	Cleaning of RCV holds prior to leaving the site under the cover of the exclusion nets.	M	Active bird control and dispersal te
loafing pond)		M	H	H	Erection of exclusion net over surface water settlement ponds. Active management of vegetated areas e.g. regular grass cutting.	M	Active bird control and dispersal te
access ads)		L	H	M	Waste delivered by RCVs to be contained, sheeted or netted to prevent wind blown debris and litter accumulating along the access routes. Cleaning of RCV wheels prior to leaving the site. Cleaning access routes and roads used by RCVs.	L	N/A

k control:

f site activities, presence and behaviour of birds. Such results will be used to determine the need for the secondary risk mitigation identified above.

n, the initial risk of increased bird populations and the associated increased risk of bird strike is considered to be high. A series of primary mitigation measures, will be implemented which will re ating. If birds are found to be attracted to the site, a series of control measures will be implemented effectively to further reduce the risk magnitude to low.

BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT FOR PROPOSED LANDFILL SITE AT PARRY'S QUARRY NEAR ALLTAMI, FLINTSHIRE

Ref: 5788001377

Report Author	Liz Hocking
Signed	[redacted]
Date	14.5.07
Report Checker	Giles Bishop
Signed	[redacted]
Date	08.05.07
Report Issued to:	Robin Jones

Submitted to:
Robin Jones

Submitted by:
AMEC Earth & Environmental UK

May 2007

amec

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1.0 BACKGROUND AND INTRODUCTION

1.1 Background

This Best Practicable Environmental Option (BPEO) assessment has been produced at the request of the Planning Department at Flintshire Council (FCC) following the submission of a planning application for a proposed landfill at Parry's Quarry, Alltami, Flintshire. The assessment has been requested in order to consider the use of landfill and landfill provision in relation to other waste management options within Flintshire.

A BPEO assessment allows the balancing of costs, logistics and environmental aspects of activities (Welsh Assembly Government, 2001).

The key principles adopted by the European Union (EU), UK government and Welsh Assembly Government (WAG) to be considered in the assessment of the provision and allocation of new waste management facilities and in determining BPEO are:

- Sustainability;
- Proximity i.e. disposal of waste as close to the place of production as possible;
- Regional Self Sufficiency in the management of waste; and
- Waste Hierarchy.

This assessment presents current options for waste management within Flintshire and identifies current and future projections for the diversion of waste from treatment facilities through the expansion of existing recycling schemes. The options and strategies of neighbouring authorities are briefly outlined. The key principles in the assessment of BPEO assessments for new waste facilities are outlined and the Parry's Quarry landfill proposals are assessed qualitatively in relation to these.

1.2 Relevant Literature and Publications

The main documents referenced in the production of this assessment are as follows:

- Planning Policy Wales- Technical Advice Note (TAN) (Wales) 21- Waste. The TAN provide guidance advice regarding the planning system and sustainable waste management.
- Flintshire County Council. (2005). Waste Management Strategy- Draft for Consultation.
- Welsh Assembly Government (WAG). (2002). Wise About Waste: The National Waste Strategy for Wales. The document is the National Waste Strategy for Wales replacing the Waste Strategy 2000 (England and Wales). It provides a strategy of the management for waste over a 10 year period within Wales.

- North Wales Regional Waste Plan 2003-2013. The plan provides a sustainable land use planning framework for the region for a 10 year period.

1.3 Summary of Proposals

The proposed project comprises the provision of a landfill site to be used for the input of Municipal Solid Waste (MSW) and non hazardous industrial and commercial waste.

Municipal Solid Waste typically comprises household waste, street sweepings and litter, park and garden wastes non- hazardous trade wastes and waste from institutions such as schools collected by, or on behalf of, a Local Authority (LA) (DEFRA, 2004). The exact composition of MSW varies between authorities but typically comprises 80 to 90% household waste. Full details of the wastes to be accepted at the site are outlined within the Waste Acceptance Criteria (WAC).

The proposed site is located at Parry's Quarry, centred on National Grid Reference (SJ 2755 6652) off the A494, Mold Road. The site covers an area of approximately 16.3 hectares.

The landfill site will provide total void space of approximately 2,600,000m^3. Depending on the degree of compaction achieved within the site the available void space equates to annual waste input rates of 104,657 to 156,986 tonnes or 78,492 to 117,729 tonnes based on a lifetime of landfilling of 15 or 20 years respectively.

The site is currently an operational quarry and includes an inert Waste Transfer Station which accepts waste such as broken out concrete, bricks and general site and demolition waste. The waste is sorted on site, any deleterious materials are removed and the resulting material is then screened and crushed to provide recycled hardcore. It is intended that the transfer station will remain following the redevelopment of the site as a landfill site and provides a mechanism via which inert wastes of the type described above can be diverted from landfill.

2.0 WASTE MANAGEMENT IN FLINTSHIRE

2.1 Current Waste Management

A study was undertaken by Enviros Consulting Ltd in support of the planning application and the ES. Their study was reported in a document entitled *"Waste Arisings to Support Planning Application for Parry's Quarry"* comprising the current local and regional markets for MSW. Further information regarding waste management within Flintshire has also been obtained from the FCC Waste Strategy

and from the Municipal Waste Management Report for Wales 2004-05 produced by the National Assembly for Wales (2006).

The Enviros study indicates that in 2004/2005 total MSW arisings were 100,070 of which 81,774 tonnes (81.73%) were sent to landfill for disposal and the remaining 18,296 tonnes (18.28%) were recycled.

Information from the Municipal Waste Management Report for Wales indicates that of the waste recycled and composted within Flintshire during 2004/2005, almost half resulted from kerbside collection, with almost 40% from bring bank and civic amenity sites and the remainder from household recycling and composting.

Information included within the Flintshire Waste Strategy indicates the following schemes and options available for recycling and composting:

- Kerbside paper collection;
- Dry recyclates kerbside collection;
- Organic garden waste kerbside collection;
- Bring bank sites for deposit of household items including paper glass, plastics, cans, textiles, shoes, books, oils, oil filters and metals; and
- Centralised green waste composting facility at Greenfield.

The Waste Strategy indicates the following household coverage for the recycling collection schemes:

- Paper collection- 60, 480 households;
- Dry recyclates- 94% of households; and
- Organics collection (green garden waste)- 42% of households.

In order to meet the targets for recycling of MSW included within the National Waste Strategy for Wales, FCC need to increase the current rate of recycling of MSW to 25% in 2006/7 and 40% in 2009/2010. A summary of trends in waste generation since 1999/2000 presented within the FCC Waste Strategy indicates that the volume of recycling has increase as follows:

- Household recycling from 5,430 tonnes in 1999/2000 to 10,845 tonnes in 2004/05; and
- Green waste recycling from 2,934 tonnes in 2002/3 to 7,272 tonnes in 2004/5 over the period 2002/03 to 2004/05.

The Landfill Trading Allowance Scheme (LATS) sets limits on the amount of biodegradable municipal waste (BMW) defined as paper, food and garden waste - that disposal authorities can landfill. At present FCC needs to divert 10,000 tonnes of BMW from landfill to comply with its LATS allocation, however this needs to increase 30,000 tonnes by 2009/ 2010 to meet the LATS allowance of 36,482 tonnes set for

2009/10. This indicates that a significant increase in composting, recycling and the use of other waste management options is required for BMW in order to meet the LATS allowance.

The FCC Waste Strategy indicates that the position at the time of the publication of the strategy was to increase the coverage of paper and dry recyclates collection schemes to cover all households in the area by 2006/7 and of the green waste collection to 80% of households over the same period. In addition, two new recycling sites were planned for Sandycroft and Greenfield. The Strategy also indicates that a small Municipal Reclamation Facility (MRF) would be developed and used for the separation of waste from recycling parks, community waste and trade waste.

It is understood that the AD Waste site at Brookhill can accept waste until mid 2008. The Enviros study indicates that FCC are seeking tenders for an integrated waste management facility comprising either Mechanical Biological Treatment (MBT) (for Refuse Derived Fuel (RDF)) or gasification pyrolosis. From discussions with representatives from FCC it is understood that other options may be being considered include the provision of an Mechanical Heat Treatment (MHT) plant.

2.1 Future Waste Management Options

The North Wales Regional Waste Plan, which is essentially the guiding document regarding waste management within the region, considers a total of six options for managing waste as follows:

1) Increased recycling and composting, use of MBT and landfilling of residues;
2) Increased recycling and composting, energy from waste treatment and landfilling of residues;
3) Increased recycling and composting, some waste sent to energy from waste treatment and some landfilled;
4) Increased recycling and composting and all remaining waste sent to landfill;
5) Increased re-use, recycling and composting, some waste subject to energy from waste treatment and remainder landfilled; and
6) Maximise re-use, recycling and composting with remaining waste subject to MBT and residuals landfilled.
7) HYBRID option- Combination of options 2 and 6- High levels of recycling and composting with MBT and energy from waste

An assessment including a BPEO and Life Cycle Assessment (LCA) was undertaken to consider the various options. The results of the assessment indicated that Option 6 had the highest (most favourable) score followed by the Hybrid option then Option 2. The strategy indicates that FCC would take forward Option 6.

3.0 WASTE MANAGEMENT IN NEIGHBOURING AUTHORITIES

Information regarding current and proposed future waste management options has been obtained for the Local Authorities neighbouring the Flintshire boundary; Wrexham County Borough Council (CBC), Denbighshire, the Wirral (Merseyside Waste Partnership) and Chester City (Cheshire County Council). Information from the Enviros study has been utilised and the following documents have been reviewed:

- The Merseyside Waste Partnership. (2005). Joint Municipal Waste Partnership;
- Wrexham Municipal Waste Strategy;
- Denbighshire Municipal Waste Management Strategy- 2005; and
- Cheshire.

Merseyside/ Wirral

The strategy indicates that of the 800,000 tonnes of waste produced within the region 700,000 tonnes are currently sent to landfill (i.e. approximately 87.5% of waste is landfilled).

The strategy indicates that the first priority regarding waste management in the area must be to reduce the amount of biodegradable municipal waste being sent to landfill. It is anticipated that this will be achieved by increasing kerbside collections of recyclable materials and public awareness regarding recycling schemes, increases in the collection of garden waste, increasing the number of bring sites available, and developing strategies for waste minimisation and re-use within Merseyside.

The strategy identifies the need for an options appraisal of the various types of residual waste management. At the time of the publication of the strategy, no preferred treatment options had been identified. However, the most likely options to be used within the region were identified as MBT, anaerobic digestion, energy from waste and autoclaving.

Existing facilities that will be built to help reduce reliance on landfill include an Integrated Waste Management facility (IWM) at Bidston Moss including a MRF, waste transfer station (WTS), In Vessel Composting Facility (IVC) and Household Waste Recycling Centre (HWRC).

Waste from the Wirral area is currently split between two landfill sites in the north west; Lord St Helens and Lyme Wood in Haydock (Enviros, 2006).

Wrexham

The strategy indicates that at present approximately 90% of the waste produced within Wrexham is sent to landfill for disposal. The strategy identifies a number of priorities regarding municipal waste including the composting of organic waste, collection of recyclable materials and the management of residual waste. Various options for the treatment of residual waste are considered within the strategy such as the use of MBT, RDF, anaerobic digestion, energy from waste and landfill.

The strategy further states that the Council is in the process of procuring a long term contract for the provision of a fully integrated waste management facility. Further information on the Wrexham BC website indicates that the original application has now been revised and the incineration element has been substituted for the use of pyrolosis and gasification. It is our understanding that the facility will initially accept household and some catering waste and will including an IVC and MRF. The facility will be relatively small in terms of capacity and will be used for the sorting and treatment of waste collected within Wrexham.

The landfill sites currently used for the disposal of waste include Penybont, AD Waste at Brookhill and Tudor Griffiths in Ellesmere (Enviros, 2006).

Denbighshire

A large proportion of residual waste within Denbighshire is currently sent for disposal to landfill with sites at Llandulas, Chirk and Gowy currently used for waste collected from different parts of the county. The strategy outlines various requirements regarding waste management within the county such as:

- Waste minimisation;
- Enhancing existing kerbside collection schemes and civic amenity provision and bring sites; and
- Identification of appropriate waste handling and treatment infrastructure for residual waste.

The strategy follows the BPEO and SWMO defined by the North Wales Regional Waste Management Strategy (i.e. the use of an MBT for residual waste) and discusses the need to consider the development of sub-regional composting facilities and further develop MRF facilities.

The strategy notes that there will continue to be a need for the disposal of some residual wastes to landfill over the next few years.

Cheshire

Information available indicates that at present approximately three quarters of Cheshire's waste is currently sent to landfill sites for disposal with sites used identified as Arpley, Gowy, Danes Moss and Maw Green.

The Household Waste Strategy indicates that the best options for waste management include waste minimisation, recycling and composting with an energy from waste facility and the landfilling of residuals.

The Enviros (2006) study states that Cheshire is currently in the process of procuring a waste treatment facility, with the preferred option being an MBT facility.

4.0 BPEO ASSESSMENT

4.1 Background and Summary

The BPEO assessment has been undertaken considering the four key principles used in assessing new waste facilities i.e.:

- Sustainability;
- Proximity i.e. disposal of waste as close to the place of production as possible;
- Regional Self Sufficiency in the management of waste; and
- Waste Hierarchy.

These principles are included and outlined within the NW Regional Waste Plan and the TAN 21 and are discussed in the following paragraphs.

Sustainability

The NW Regional Waste Plan indicates that *"a commitment to promoting sustainable development is at the heart of the decision making process"*. Section 121 of the Government of Wales Act 1998 provides a requirement for the promotion of sustainable development. The framework for sustainable development is outlined within a series of documents produced by the WAG, the first of which *"Learning to Live Differently"* was published in 2000. Since the publication of the sustainable development strategy in Wales and the UK Strategy published in 1999, a new UK Sustainable Development Strategy was published by DEFRA in 2005, along with the UK's shared framework for sustainable development *"One Future- different paths"* published in 2005. The strategy includes five guiding principles which have been agreed by the UK government and the WAG. The principles are as follows:

- Living within environmental limits;
- Ensuring a strong, healthy and just society;

- Achieving a sustainable economy;
- Promoting good governance; and
- Using sound science responsibly.

In addition to the shared principles, priority areas for immediate action are outlined and can be summarised as follows:

- Sustainable consumption and production- Considering products throughout their entire lifecycle.
- Climate change and energy- Requires changes in the way energy is generated and used and in other activities that release greenhouse gases
- Natural Resource Protection and Environmental Enhancement- better understanding of environmental limits, environmental enhancement and recovery of the environment where it is most degraded in order to ensure a decent environment for all
- Sustainable Communities- Creation of sustainable communities embodying the principles of sustainable development at the local level.

Key issues identified within TAN 21 in relation to sustainability include considering the efficient and prudent use of natural resources; reducing atmospheric emissions, minimising local air quality impacts, protecting habitats and species and minimising transport impacts.

The FCC waste strategy indicates that the Council has set a number of objectives to satisfy environmental and socioeconomic requirements in accordance with the BPEO including:

Environmental:

- To ensure prudent use of land and other resources;
- To reduce greenhouse gas emissions;
- To minimise air quality impacts;
- To conserve landscapes and townscapes;
- To protect local amenity; and
- To minimise adverse effects on water quality.

Socio economic:

- To minimise local transport impacts
- To provide employment opportunities
- To provide opportunities for public involvement and education

Proximity

The proximity principle relates to the management of waste (i.e. treatment and disposal) as close to its source of origin as possible to reduce the environmental, social and economic costs associated with the transportation of waste.

The proximity principle and waste hierarchy are linked in that the BPEO for a particular waste stream might be close to the bottom of the hierarchy, as the environmental impacts associated with transportation of the waste to a facility that is higher on the hierarchy outweigh the benefits associated with the use of the option.

Regional Self Sufficiency

Regional self sufficiency requires that waste is managed within the region or within a 'reasonable distance' of its point of generation. The TAN 21 and NW Regional Waste Plan both state that this places requirements upon Local Authorities regarding the provision of waste management facilities within their regions for future forecast waste levels.

Waste Hierarchy

The waste hierarchy is considered within both TAN 21 and the NW Regional Waste Strategy as one of the main considerations in the assessment of waste management options.

The hierarchy essentially specifies an order of preference for dealing with wastes, with options towards the top being more desirable than those at the bottom as follows:

Table 4.1- Waste Hierarchy

Most favoured option	↑	Reduction
		Reuse
		Recover, through recycling and composting
		Recover, through energy from waste
Least favoured option	↓	Dispose via landfill or incineration without energy recovery

The waste hierarchy is described as *"offering an order which can be used when considering waste management options"* (DETR, 2000). The top of the hierarchy is the need to reduce the volume of waste produced. The reuse of waste material produced is next on the list. The DETR (2000), further note that the BPEO for particular waste streams is likely to comprise a combination of options.

4.2 Sustainability

Sustainability encompasses a number of objectives including environmental, social and economic principles. Environmental principles require the minimisation of impacts on air quality and water resources, making prudent use of land and other resources, conserving landscapes and protecting local amenity.

The landfill site has been designed in accordance with current standards and legislative requirements including the provision of a fully engineered liner and capping system, leachate and gas collection, control and management, and gas utilisation. The design of the site will minimise any potential environmental impact upon either water resources or air quality. Further environmental protection will be afforded throughout the operational and post completion phases of the site through the implementation of operational controls and monitoring and maintenance programmes.

A Site of Special Scientific Interest (SSSI), which also forms part of a larger SAC is located close to southern boundary of the site. Ecological surveys undertaken as part of the Environmental Statement indicate that the ecological value of a majority of the site is low as a result of disturbance and degradation from quarrying activities. Measures will be taken throughout all phases of the landfilling operations to ensure that the site activities do not have an adverse impact on any ecological interest including both flora and fauna. Furthermore, restoration of the site following the completion of landfill activities including extensive woodland planting, the provision of areas of grassland and wild flower meadows will result in an area with a significantly enhanced ecological value in comparison with the current situation.

Landfill activities at the site represents good reuse of the existing void resulting from previous quarrying activities, thus representing prudent use of existing land and resources.

The site is well located with respect to access being served by both the A494 and the A55, providing good links for transportation and minimising the need for significant journeys through built up and residential areas. The site location would minimise the travel time for waste disposal, thus minimising local transport impacts. The traffic and access assessment undertaken as part of the ES indicates that the impacts of the scheme on the local road network are considered to be insignificant.

In addition, the existing waste transfer station at the site can be used to divert a significant proportion of the construction and industrial waste received at the site from landfill, through sorting and crushing to provide recycled engineering materials (such as engineering fill). This will reduce the need to transport such waste to a separate facility prior to the landfill site.

Following completion of landfilling activities, the restored site will provide opportunities for education and public involvement through the habitat creation and the potential to open up the site for public access and the creation of a footpath network on the site.

4.3 Proximity Principle and Regional Self Sufficiency

The proximity principle and regional self sufficiency are interlinked in that they require the management of waste as close to its point of generation as possible and the management of waste within the region or within a reasonable distance of its point of generation.

In order to meet the requirements of LATS and the recycling targets set within the national Waste Strategy for Wales, the volume of waste currently being sent for disposal at landfill sites is likely to reduce. However, regardless of the strategies and other waste management options implemented within the region, a need for landfill capacity will remain for commercial and industrial waste, MSW which cannot be recycled or managed via other methods and residual waste arising from other treatment methods.

All MSW not recycled within Flintshire is currently landfilled at the AD Waste site at Brookhill. It is understood that capacity at the site will be exhausted some time within 2007/2008. There will remain a requirement for landfill space within Flintshire for MSW, commercial and industrial waste following the closure of the Brookhill site.

There is a clear need for a new landfill facility within Flintshire in the near future. The provision of the landfill facilities at Parry's Quarry would provide for the continuation of landfill void space within the authority boundary. The specific location of the site accords with the proximity principle being close to the major centres of population in Queensferry, Mold and Flint. The site void space fulfils the self sufficiency principles being adequate to meet Flintshire's needs.

4.4 Waste Hierarchy

The use of landfill with energy recovery (i.e. gas utilisation) lies close to the bottom of the waste hierarchy. However, irrespective of the position of landfill on the waste hierarchy, there remains a need for landfill void space for the disposal of residuals from other waste management options. This is acknowledged within the North Wales Regional Waste Plan which states that landfill has a role to play as part of a combination of waste management facilities.

The waste management option adopted by FCC based on the BPEO undertaken for the NW Regional Waste Plan includes maximising re-use, recycling and composting with remaining waste subject to MBT and residuals landfilled.

It is evident that although the landfilling of waste lies close to the bottom of the hierarchy, it is not a management option that would be used in isolation. By necessity, the proportion of waste recycled and diverted to other treatment methods

will be required in order for FCC to meet the requirements of LATS and the recycling targets.
In our opinion the scale of the proposed landfilling operation at Parry's Quarry is suitable to site alongside and compliment other waste management options.

5.0 CONCLUSIONS

The management of MSW within Flintshire currently comprises a combination of recycling through kerbside collection and amenity sites, with the landfilling of all other wastes at the AD Waste site at Brookhill.

In line with the requirements of LATS and in order to meet recycling targets, the volume of waste sent to landfill sites is likely to decline within Flintshire. However, regardless of future waste management options, a need for the landfilling of waste not recycled or residuals from other waste management options will be required within the area.

The four main principles of a BPEO assessment regarding waste facilities include sustainability, proximity, self sufficiency and the waste hierarchy.

Landfill sites with energy recovery fall close to the bottom of the waste hierarchy. However, the landfill site will be constructed in accordance with current best practice including the provision of an engineered liner and capping system, leachate and gas collection and management systems and gas utilisation, all of which minimise the potential environmental impacts associated with the site. Furthermore, reuse of the former quarry site as a landfill facility represents sustainable use of the land and offers the potential for ecological enhancement and public access following the completion of the landfill activities.

The existing waste transfer station provides an opportunity to divert a significant of the industrial and commercial waste to be sent to the facility away from landfill for reuse as engineering materials (e.g. recycled aggregate).

There is a clear need to landfill void space within the region, and provision of the landfill site will reduce the distance travelled between the point of generation and management of waste in accordance with the proximity and self sufficiency principles.

6.0 REFERENCES

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Addendum

Noise and Air Quality Implications of Proposed Costa Coffee and Subway

This addendum takes into consideration the possible noise and air quality implications of the proposed Costa Coffee and Subway restaurant, which are likely to be located adjacent to the Holiday Inn Hotel, to the north-east of Parry's Quarry. These assessments are supplement to the Noise and Vibration and Air Quality Assessment previously submitted within the Environmental Statement for Parry's Quarry.

1.0 NOISE AND VIBRATION

1.1 Introduction

This addendum report should be read in conjunction with the previously submitted Noise and Vibration Chapter contained within the Environmental Statement for Parry's Quarry.

The previous noise and vibration assessment considered and described the existing baseline noise within the vicinity of the proposed landfill. Sensitive receptors that could potentially be affected by increased noise levels and vibration due to the construction and operation of the proposed landfill were identified. At the time the noise-sensitive receptors closest to the site were identified as follows:

- Parrys Cottages
- Council offices off Pinfold Lane
- Ewloe House
- Holiday Inn Hotel

The impacts of the development on these receptors were evaluated for both the construction and operational phase and noise mitigation was proposed, where necessary.

This addendum considers the location of the proposed Costa Coffee and Subway restaurant, with respect to the proposed landfill and the subsequent potential for noise disturbance to workers and visitors. Predicted noise levels at Costa Coffee and Subway due to both the construction and operational phase of the proposed landfill have been calculated and assessed in line with the assessment methodology used within the previous noise and vibration assessment.

1.2 Noise Assessment Methodology

1.2.1 Guidance and Legislation

The noise and vibration assessment has been conducted with reference to the following British Standards, National and International Guidance.

Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste

Annex I of the Landfill Directive states that "Measures shall be taken to minimise nuisances and hazards arising from the landfill through noise and traffic".

Welsh Office – *Technical Advice Note (TAN) (Wales) 11 (1997)*

TAN11 provides guidance on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development.

Annex B indicates that the main sources of noise from landfill waste disposal sites are generally from vehicle movements, tipping operations and site plant. With this in mind it

recommends that appropriate mitigation or planning/licensing conditions should therefore relate to hours of working, the number and/or capacity of vehicles using the site and their points of ingress and egress and the provision of acoustic screening and/or noise limits.

TAN11 refers to BS5228 for information on predicting noise levels from landfill sites.

Welsh Assembly Government – *Minerals Technical Advice Note (Wales) 1: Aggregates (2004)*

This document does not make direct reference to landfill operations. However, given the similarity between the operation of surface mineral workings and landfills, with respect to noise and vibration, the guidance and noise limits contained within MTAN1 should be taken into account.

MTAN1 refers to the Minerals Planning Guidance Note 11 for advice on monitoring and assessment of noise levels. Note that MPG11 has now been revised and re-issued as Minerals Planning Statement 2 Annex 2 (see below).

MTAN1 indicates that the aggregates industry should aim to keep noise emissions at a level that reflects the highest possible environmental standards, taking all reasonable steps to achieve a quieter working environment, through the use of BATNEEC (the best available technique not entailing excessive cost).

Paragraph 88 in MTAN1 states that "*noise limits should relate to the background noise levels, subject to a maximum daytime noise limit of 55 dB(A) where background noise levels exceed 45 dB(A). 55 dB(A) is the lower limit of the daytime noise levels where serious annoyance is caused. Where background noise is less than 45 dB(A), noise limits should be defined as background noise levels plus 10dB(A). Night-time working limits should not exceed 42 dB(A) at noise sensitive properties. Daytime working is defined as 0700-1900 hours and night-time as 1900-0700 hours. Noise limits should be set in terms of $L_{Aeq,T}$ over a 1-hour measuring period. L_{Aeq} is the noise index used to describe the "average" level of noise that varies with time (T) and should be measured "free field" that is, at least 3.5 metres away from a façade to prevent reflections of noise by any façade that faces the noise source. During temporary and short-term operations higher levels may be reasonable but should not exceed 67 dB(A) for periods of up to 8 weeks in a year at specific noise-sensitive properties*".

MPS 2: 2005 – *Controlling and Mitigating the Environmental Effects of Mineral Extraction in England – Annex 2: Noise*

MPS 2 Annex 2 offers guidance for both surface mineral extraction and surface operations associated with underground mineral extraction, including waste disposal and recycling operations.

The Annex does not make direct reference to other waste disposal or recycling operations. However, it states that *"these share many operational features with surface mineral operations, waste management operators and waste planning authorities should take account of this Annex alongside Planning Policy Guidance Note 10 (PPG10) Planning and Waste Management".*

The Annex complements the general guidance in PPG24 and other controls under environmental legislation by:

- identifying the significant effects of noise from surface mineral operations;
- identifying examples of good practice in the control and mitigation of noise emissions;
- stating how the planning system can keep noise emissions within environmentally acceptable limits without imposing unreasonable burdens on mineral operators.

The key planning principle stated within Annex 2 is that noise should, as far as possible, be controlled mitigated or removed.

British Standard (BS) 5228: 1997 – *Noise and Vibration Control on Construction and Open Sites*

BS5228-1: 1997 offers guidance on assessing the impact of noise and vibration due to activities on construction and open sites. In addition, it provides recommendations for basic methods of noise and vibration control where significant noise and/or vibration levels are anticipated.

Environment Agency: *Internal Guidance for the Regulation of Noise at Waste Management Facilities* (July 2002)

This guidance applies to landfill site and waste management facilities which fall under PPC regulations and/or are licensed under the Waste Management Licensing Regulations. For IPPC sites, reference should be made to the Horizontal Guidance for Noise (see below).

The guidance covers the control of noise, appropriate noise limits and the overlap with the other regulatory authorises.

IPPC Horizontal Guidance for Noise H3 Part 1 – *Regulation and Permitting* (Version 3 2004)

This document outlines the main considerations relating to the regulation and permitting of noise.

IPPC Horizontal Noise Guidance H3 Part 2 – *Noise Assessment and Control* (Version 3 2004)

Part 2: Noise Assessment and Control is aimed equally at regulators and operators. It describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies.

British Standard (BS) 4142: 1997 – *Methods for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*

BS4142: 1997 provides guidance on assessing the significance of a noise source. It describes a method, whereby measured or predicted noise levels from a noise source(s)

are compared to existing background noise conditions in order to determine the likelihood of complaints from residents within the vicinity of the source. The title of the document implies that the guidance is strictly for industrial developments; however the assessment methodology it recommends is also often used for a wider range of noise sources.

The likelihood of complaints is assessed by subtracting the background noise level ($L_{A90,T}$) from the rating level ($L_{Aeq,T}$). The rating level is based upon the specific noise level, and includes a correction of +5 dB if the noise source features any tonal or impulse noise. BS4142 states that a difference of +10dB or more between the predicted/measured (with development) and background (without development) noise levels is likely to result in complaints. A difference of around +5dB is of marginal significance, with a difference of -10dB being a positive indication that complaints are unlikely.

British Standard (BS) 8233: 1999 – *Sound Insulation and Noise Reduction for Buildings*

BS8233: 1999 provides recommended indoor ambient noise levels for commercial premises. The recommended levels can be seen in Table 1.1 below.

Table 1.1: BS8233:1999, Relevant Internal Ambient Noise Levels in Unoccupied Spaces.

Criterion	Typical Situations	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable conditions for study and work requiring concentration	Cellular office Meeting room, executive office	40 35	50 40
Reasonable acoustic privacy in shared spaces	Open plan office	45-50	Design range
Reasonable speech or telephone communications	Cafeteria	50	55

The design criteria for hotel bedrooms are similar to those for dwellings.

BS8233 also recommends that where windows are opened to allow ventilation, attenuation in the order of 10-15 dB can be anticipated. Assuming a worst-case attenuation of 10dB, this would equate to a satisfactory external level of between 45-60 dB for commercial premises.

In situations where windows are not required for ventilation i.e. mechanical ventilation is provided, noise attenuation level of 25-30 dB can be anticipated. This equates to a satisfactory external ambient level of between 60-75 dB $L_{Aeq,t}$.

1.2.2 Assessment approach

Impact assessments associated with the proposed development have been undertaken in relation to both the construction and operational phases using quantitative and qualitative methods. Noise and vibration sources associated with the construction phase

and site preparation will be temporary and will include the operation of plant and machinery engaged in earthworks, and other site preparation activities.

During the operational phase the dominant noise sources will be associated with unloading of waste materials, noise from the waste compactor, traffic movements on the site and on the local road network and the use of gas a flare and engines. These impacts are considered more long-term, although the magnitude of any impact is likely to change over time in line with the uses of the landfill and adjacent quarry and completion of the different phases.

Noise impacts associated with the construction and operation of the landfill have been assessed using indicative noise levels for representative mobile plant presented in the "Updated noise database for prediction of noise on construction and open sites" released by DEFRA in July 2005. Noise predictions for the construction and operational phase of the proposed landfill have been undertaken with reference to BS5228 Part 1:1997 "Noise and vibration control on construction and open sites".

The predicted noise levels for the construction phase have been compared to the existing ambient noise levels ($L_{Aeq,T}$) at the proposed Costa Coffee and Subway and assessed in accordance with the criteria presented in Table 1.2 below and recommendations stated within MTAN1.

The following criteria (Table 1.2) have been developed for assessing the magnitude of impact due to the development at nearby noise-sensitive receptors. This is based on the guideline levels stated in BS4142 and recommendations within MTAN1.

Table 1.2 – Criteria Adopted for Interpreting Magnitude of Impact at Sensitive Receptor Locations

Magnitude of Impact	**Noise level difference between predicted noise level ($L_{Aeq,T}$) and baseline level ($L_{A90,T}$)***
No impact	Less than -5 dB
Negligible/Insignificant impact	Between -5 and equal to baseline noise levels
Minor impact	Between 0 and +5 dB
Moderate impact	Between +5 and +10 dB
Major impact	Greater than +10 dB

* Note that for the purpose of the construction impact assessment the predicted noise levels have been compared to the ambient noise levels at each receptor ($L_{Aeq,T}$)

Note that residential receptors and the hotel close to the site are assumed to have a high sensitivity, with visitors and workers at the council offices and proposed Costa Coffee development having a medium sensitivity.

1.3 Baseline Noise Conditions

Information relating to a proposed Costa Coffee and Subway restaurant adjacent to the Holiday Inn Hotel, located to the north-east of Parry's Quarry, has been provided by Flintshire County Council. It is understood that the Costa Coffee and Subway previously obtained planning consent for the development and have recently applied for planning consent again due to a revision in the plans.

As part of the previous noise and vibration assessment, noise monitoring was undertaken at 4 No. locations. These locations correspond to noise-sensitive receptors located within the vicinity of the proposed landfill.

One of the monitoring locations (ML1) was located on the grass verge adjacent to the OK Dinner and Holiday Inn Hotel at the A55 services. For the purpose of this assessment the noise levels experienced at monitoring location 1 are considered to be representative of the existing noise environment within the vicinity of the proposed Costa Coffee and Subway development.

Noise monitoring was carried out on the 16th, 17th and 21st August 2006. Given that there is the potential for the gas flare and engines to be used during the night it was considered appropriate to undertake monitoring over a 24 hour period during a typical weekday. However, it is assumed that the Costa Coffee and Subway will not be opened during the night.

The results of the monitoring at ML1 are summarised in Table 1.3 below.

Table 1.3 – Baseline Noise Monitoring Data

Monitoring Location	Start Time	Duration (mins:secs)	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB	$L_{Amax,F}$ dB
ML1	08.51	20.00	58.7	56.2	69.1
	11.28	20.00	58.3	56.0	70.0
	14.43	20.00	55.9	53.5	67.1
	15.50	20.00	56.0	53.4	78.2
	20.39	20.00	56.0	52.8	65.7
	01.26	20.00	46.5	40.5	65.3
	01.46	20.00	48.9	41.6	70.8

NB - Night-time measurements are shaded

The existing noise environment at the site generally comprises noise from plant and machinery associated with quarrying activities taking place at the site, noise from activities and heavy good vehicles movements taking place at the adjacent Scania site and traffic noise from the A55 and A494.

The dominant noise source throughout the noise survey at ML1 (adjacent to the Holiday Inn and OK Diner) was traffic noise from the A55. Noise from traffic within the services was also audible at this location. Noise from quarrying activities at the site was audible between 08.51 and 09.11 on the 16th August. In addition, noise from Pinfold Lane Quarry, operated by Brock Plc, was audible at this location between 14.43 and 16.10 on the 21st August. Additional noise sources at this location includes, talking from visitors and workers at the hotel and diner and bird song.

The previous noise and vibration assessment noted that the baseline survey was carried out during the holiday period. As such, there is the potential for increased traffic noise from the A55. As a result, it was agreed with Flintshire County Council that the daytime noise levels from the previous monitoring survey (carried out on the 29th September 2004) would be utilised, along with the new data, to derive an average daytime noise level for each monitoring location for use within the assessment (see Table 1.4 below).

Table 1.4 – Average Noise Levels based on AMEC's's Monitoring Data

Monitoring Location	Period	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB	$L_{Amax,F}$ dB
ML1	Day	61	58	78
	Night	48	41	69

NB - Night-time measurements are shaded

The noise levels experienced within the vicinity of the proposed Costa Coffee and Subway development are within the levels considered reasonable for speech communications, assuming that windows are open in BS8233: 1999.

1.4 Assessment of Potential Noise Impacts

The proposed landfill may have an impact upon the existing local noise environment during both the construction and operational phase. There is the potential for site preparation work to be undertaken simultaneously with operating activities. As a result, the combined impact of all noise sources which could be undertaken at the site time has also been assessed.

All impacts predicted within this assessment are considered to be localised and direct. However, unfavourable meteorological conditions, such as wind gradients and temperature inversions could transfer noise further away from the site making any potential impacts more widespread.

1.4.1 Construction Phase

For the purpose of this assessment the construction phase is taken as site preparation works required prior to the commencement of landfilling activities in each cell. It is anticipated that the site preparation phase will require a period of approximately 12 months in total. Although work is likely to be concentrated between March/April and September/October.

The initial site preparation works at the site will include the construction of the haul road along the southern and eastern section of the landfill and preparation of the cell 1. The preparation works of subsequent cells (3-4) and the extension of the haul road along the western boundary of the landfill is likely to be undertaken simultaneously with landfilling activities at the site.

The detailed programme of works for the site preparation had not been finalised prior to the preparation of this report. However, a number of assumptions have been made relating to the site preparation works required and the type of plant which may be utilised on site. These assumptions are based on observations on site and experience from similar sites. This has allowed the potential impact on nearby noise-sensitive receptors to be estimated. Note that it is assumed that no construction and site preparation works will be undertaken during the night.

It is anticipated that, where possible, plant and machinery already present on site will be utilised to carryout site preparation works. This will minimise the amount of additional noise sources present on site during the construction phase.

It is assumed that there will be an additional tracked excavator, dozer and dump truck present on site to assist with the redistribution of materials and levelling for the haul road. For the purpose of this assessment a worst-case scenario has been assumed with all three items of plant operational simultaneously at the closest distance to the noise-sensitive receptors.

Following this initial preparation work, the haul road will be covered with asphalt to ensure that the road can be kept clean and in good condition during the life of the landfill. The predicted calculations for road surfacing activities assume that there will be an asphalt spreader, chip spreader, road roller and tipper lorry present on site at this time.

In addition to the construction of the haul road the water from within the quarry void will need to be drained. It is assumed that at least 2 No. diesel fuelled water pumps will be utilised to drain the lagoons. It is likely that the pumps and associated storage equipment will be located within the quarry void and hence will be screened to a degree from the existing quarry faces. The site development plan indicates that the lagoon located in the southern section of the site is likely to be drained the cell preparation works for cell 2, with part of the northern lagoon being drained during the preparation works for cell 4.

It is assumed that there will be up to two additional tracked excavators, dozer, roller and dump truck present on site to assist with the cell preparation works. For the purpose of this assessment a worst-case scenario has been assumed with all five items of plant operational simultaneously at the closest distance to the noise-sensitive receptors. Note that this work will be undertaken within the existing quarry void (approximately 25-30m below the existing ground level) and hence noise will be attenuated by the quarry face. However, there is the potential for some noise to reverberate from the opposing quarry faces, which could potentially reflect sound to towards the noise-sensitive receptors.

For the purpose of this report the distance between the source and receiver has been taken as the closest distance between the receptor and the location of the construction activity. Given that the construction plant is likely to move around the site, depending on the area under construction at that time, this represents the worst-case scenario. Note that the predicted noise levels assume that these activities will take place over the majority of the working day and hence a time correction of -1.2dB has been applied to the noise predictions (in accordance with BS5228: 1997).

In accordance with BS5228: 1997 a -5dB barrier correction has been applied where the noise source is along the line of sight with the noise-sensitive receptors or partially screened by either topography or barriers. Where the noise source is considered likely to be completely screened by these features a -10 dB barrier correction has been applied. Note that the BS5228 barrier corrections represent a straightforward approach and high topographical features or specially designed and positioned noise barriers could provide greater attenuation. Where noise sources are not screened by topography

or by man made features, attenuation from ground cover has been taken into account using the formula presented within CRTN.

BS4142 states that a +5 dB correction factor should be applied when the noise source contains distinguishing features, distinct impulses or is irregular enough to attract attention. Given the potential for single frequency reversing alarms to be used on the dump truck and tracked excavator during the site preparation works (haul road and cell preparation works) a tonal correction has been added to the predicted level at the receptor.

The predicted noise levels at the proposed Costa Coffee and Subway have been calculated and are presented in Tables 1.5 and 1.6 below.

The results indicate that activities associated with the construction of the haul road (Phase 2) and pumping out of the quarry voids (both southern and northern lagoons) are unlikely to have an adverse impact on visitors and workers at the Costa Coffee and Subway development.

There is the possibility of a minor adverse impact during the cell preparation works for Cells 1 and 2. The results have also indicated that the construction of the haul road (Phase 1), immediately adjacent to the proposed Costa Coffee and Subway development is likely to have the greatest impact, with the potential for a major adverse impact during the earthworks and moderate adverse impact during the road surfacing activities.

Note that, with the exception of the construction of the haul road (Phase 1), all predicted noise levels are below the MTAN1 threshold for temporary and short-term operations ($L_{Aeq,T}$ 67 dB(A)).

Table 1.5 - Predicted noise level ($L_{Aeq,1hr}$ dB) from construction activities

Receptor	Haul Road Construction – southern and eastern section		Haul Road Construction – western section		Cell Preparation		Drainage of Lagoons	
	Site preparation	Road Surfacing	Site preparation	Road Surfacing	Cell 1	Cells 2-4*	Southern	Northern
Costa Coffee and Subway	75.0	70.5	55.0	45.4	64.2	61.2	35.5	35.2

* Taken as closest cell to receptor

Table 1.6 - Noise level difference between the predicted noise level ($L_{Aeq,1hr}$ dBA) due to construction activities and existing daytime ambient noise level ($L_{Aeq,T}$ dBA) at the proposed Costa Coffee development

Receptor	Average ambient noise level ($L_{Aeq,t}$)	Haul Road Construction – southern and eastern		Haul Road Construction – western		Cell Preparation		Drainage of Lagoons	
		Site preparation	Road Surfacing	Site preparation	Road Surfacing	Cell 1	Cells 2-4*	Southern	Northern
Costa Coffee and Subway	61.0	+14.0	+9.5	-6.0	-15.6	+3.2	+0.2	-25.5	-25.8

1.4.2 Operational Phase

The operation of the proposed landfill will include the following potential noise sources:

- lorry movements along the haulage road and unloading events;
- redistribution and compaction of waste;
- operation of the emergency gas flare and engines; and
- traffic on the local road network;

Note that these noise sources will be in addition to the noise emissions already experienced from quarrying activities, which are due to continue on the site.

a) Lorry movements and unloading events

Predicted noise levels at the closest residential properties to the site have been calculated with reference to the methodology stated within BS5228: 1997. This provides a pragmatic approach for predicting the noise level ($L_{Aeq,T}$) at a receptor due to noise from mobile plant using a regular well defined route, such as a haulage route. The procedure takes into account the distance between the receiver and the centre of the haul road, the number of vehicles per hour, average speed and angle of view. Traffic flow data provided by Veryards Opus Ltd indicates that there will be 290 additional vehicles a day at the site entrance as a result of the proposed landfill. This equate to an average of approximately 29 movements per hour, based on an average 10 hour working day.

Table 1.7 - Predicted noise level ($L_{Aeq,1hr}$ dB) from lorry movements and unloading events

Receptor	Unloading events*	Movements along the haul road
Costa Coffee and Subway	59.4	56.4

* Taken at closest cell to receptor

Table 1.8 - Noise level difference between the predicted noise level ($L_{Aeq,1hr}$ dBA) due to operational activities and existing daytime background noise level ($L_{A90,T}$ dBA) at the proposed Costa Coffee development

Receptor	Average background noise level ($L_{A90,t}$)	Unloading events*	Movements along the haul road
Costa Coffee and Subway	58.0	+1.4	-1.6

The results indicate that noises from vehicle movements along the internal haul road are unlikely to have an impact on visitors at Costa Coffee and Subway. However, there is the potential for a minor adverse impact from noise from unloading events, during the infilling of Cell 1. This is due to the close proximity of this cell and the proposed location of the Costa Coffee development.

Note that the predicted noise levels at the Costa Coffee and Subway development is only slightly above the current background level and is still below the reasonable design level stated in BS8233: 1999 (assuming 10dB from an open window).

b) Redistribution and compaction of waste

During the operation of the landfill it is assumed that there will a waste compactor and dozer active on-site. The impact due to the operation of these items of plant on site will vary over the life of the landfill, depending on which cell is being filled at that time and the level of the fill relative to the surrounding ground level.

The site development plan indicates that the cells will be filled in a clockwise fashion with Cell 1-4 initially being filled to grade i.e. level with the surrounding land elevation (sequences 1-4). This will be followed by a new sequence, with cells 4, 1, 2, 3 being filled to their completion elevation, above grade (sequence 5-8).

Based on a lifetime of 15 years for the landfill, it is likely that each sequence will be undertaken over a period of approximately 20 months. Thus the maximum period that landfilling will take place in each cell is approximately 40 months.

For the purpose of this assessment, a worst-case assumption has been made i.e. that the two items of plant will be in operation simultaneously in the closest cell and at the closest position to the receptor. Predicted noise levels have been calculated for both sequences 1-4 and sequences 5-8.

It is assumed that reversing beepers will be used on the dozer and hence a tonal correction of +5dB has been applied to the predicted noise levels.

During sequences 1-4 operations will be active below surrounding ground level for a large proportion of the time. The sides of the landfill will provide natural screening from noise, significantly reducing the risk of impact experienced at noise-sensitive receptor locations. As a result, a barrier correction of -5dB (for a partial screen) has been applied to the calculations for sequences 1-4. Note that the attenuation is likely to be significantly greater than this initially, with activities being undertaken in excess of 20m below the existing ground level.

Representative noise levels for a waste compactor and dozer have been taken from the waste disposal sites section of the DEFRA database. The calculations assume that the plant will be in operation for 75% of the reference period (1 hour during the day).

Table 1.9 - Predicted noise level ($L_{Aeq,1hr}$ dB) from redistribution and compaction of waste

Receptor	Cell Sequence 1-4*	Cell Sequence 5-8*
Costa Coffee and Subway	62.3	65.7

* Taken as closest cell to receptor

Table 1.10 - Noise level difference between the predicted noise level ($L_{Aeq,1hr}$ dBA) due to operational activities and existing daytime background noise level ($L_{Aeq,T}$ dBA) at the proposed Costa Coffee development

Receptor	Average background noise level ($L_{A90,t}$)	Cell Sequence 1-4*	Cell Sequence 5-8*
Costa Coffee and Subway	58.0	+4.3	+7.7

The results above (Tables 1.9 and 1.10) indicate that the redistribution and compaction of waste during sequences 1-4 has the potential to result in a minor adverse impact for visitors and workers at the proposed Costa Coffee development.

The redistribution and compaction of waste during sequences 5-8 when activities will be undertaken above grade, is likely to result in a moderate adverse impact at the proposed Costa Coffee development. This is mainly during the infilling operations in Cell 1, adjacent to the proposed Costa Coffee and Subway development.

The results above indicate the predicted noise level for cell sequences 1-4 is still within the design range considered reasonable in BS8233: 1999 for the Costa Coffee and Subway development. However, the predicted noise level is slightly above the upper level of $L_{Aeq,T}$ 65dB (assuming a 10dB attenuation for an open window).

c) Gas flare and engines

The Environmental Statement indicated that a maximum of 3 No. landfill gas utilisation engines and a flare will be used at the proposed landfill. The plant will be situated in the north-eastern corner of the site.

Typically landfill gas collection will commence when approximately 10m depth of waste has been deposited. Initially the quality and quantity will not be sufficient to support efficient combustion as fuel supply for gas driven engines. As a result, the gas collected during this initial stage will be flared. Note that the operation of the gas engines will take place once a significant depth of waste has been deposited.

The main noise generating mechanisms of a gas flare are:

- turbulent air flow caused by the high-velocity, high temperature gas flow. Noise caused by this turbulent airflow is usually low frequency (below 50Hz). Noise increases with velocity and temperature. The Environment Agency's Internal Guidance for the Regulation of Noise from Waste Management Facilities (2002) states that noise generation from flare is generally not regarded as a major concern at velocities below 30m/s;
- combustion produced low frequency noise, below 350Hz;
- noise from injection of smoke suppressants, such as high pressure steam, produced high-frequency noise.

In addition, under rare conditions the low frequency vibration derived from the turbulence within the enclosed flare can induce resonance within nearby structures, such as buildings and vehicles. The effect of vibration is attenuated with distance. Given that the nearest residential properties are located over 200m from the proposed location for the gas engines/flare, it is considered unlikely that vibration will result in a significant adverse impact to residents.

For the purpose of this assessment it is assumed that there will be one gas flare and three engines present on site. This represents the worst-case scenario. Noise levels for a typical gas flare (3000Nm3/f) and gas engine have been provided by the manufacturer. These noise levels have been utilised in order to estimate the potential noise levels at the proposed Costa Coffee and Subway development (see Tables 1.11-1.12 below).

Table 1.11 - Predicted noise level ($L_{Aeq,1hr}$ dB) from the operation of the gas flare and engines

Receptor	Gas flare	Gas engines
Costa Coffee and Subway	38.6	39.4

Table 1.12 - Noise level difference between the predicted noise level ($L_{Aeq,1hr}$ dBA) due to the operation of the gas flare and engines and existing background noise level ($L_{A90,T}$ dBA) at the proposed Costa Coffee development

Receptor	Average background noise level ($L_{A90,t}$)	Gas flare	Gas engines
Costa Coffee and Subway	58.0	-19.4	-18.6

The results indicate that the operation of either the gas flare or the gas engines during the day is very unlikely to result in disturbance to visitors to the proposed Costa Coffee development

d) Traffic

The previous noise and vibration assessment demonstrated that the changes in traffic flow and composition were negligible on the local road network. As a result, no adverse impacts are considered likely as a result of changes in traffic noise due to the proposed landfill.

1.4.3 Combined Noise Levels

As mentioned previously, there is the potential for both site preparation works and operational noise from landfilling activities to occur at the same time on site. Consequently, the noise impact of the development may be greater than the individual impacts described above for each of the noise sources.

Note that the calculations above are based on a number of worst-case assumptions. In reality, the noise levels experienced from these activities is considered likely to be less than that predicted, with activities taking place at the closest point to the receptor for a very short duration in comparison to the life of the landfill. Furthermore, depending on the positioning and orientation of the Costa Coffee and Subway building, the building itself could offer some noise attenuation for workers and visitors at the site. As a result, it is not considered appropriate to merely combine these noise levels to provide an overall potential noise level from the site as this is likely greatly overestimate the impact on nearby noise-sensitive receptors.

Based on the individual noise levels predicted for each activity and the proximity of each receptor to these activities and the receptors sensitivity, it is considered likely that visitors to the Costa Coffee and Subway development will experience, at worst, a temporary minor adverse impact, as a result of operational activities taking place over the majority of the proposed landfill lifetime. There is the potential for workers and visitors to experience a moderate adverse impact during operational activities within Cell 1. However, this is only likely when works are being undertaken above grade during Sequence 6.

1.4.4 Vibration

The prediction of vibration levels during the site preparation and operational activities on the landfill have not been undertaken, due to the a number of varying factors which need to be considered including the soil type and properties between the source and receiver and building type.

Given the type of activities proposed and type of equipment likely to be utilised on the site, it is considered unlikely that vibration will be an issue during the site preparation and operation of the landfill. However, in the event that vibration is a found to be a nuisance to residents, and complaints arise, it is recommended that noise and vibration surveys are undertaken to ascertain whether the vibration is ground-borne or airborne and mitigation measures should be adopted if necessary.

1.5 Mitigation Measures for Noise

1.5.1 Construction Phase

It is recommended that a noise management plan is submitted to Flintshire County Council prior to the commencement of the construction phase. The noise management plan should utilise the guidance in BS5228, which describes the measures which will be taken in order to arrange and minimise as far as reasonably practical the noise impacts of construction. It is recommended that consultation with Flintshire County Council is undertaken during the preparation of the noise management plan.

The noise management plan should contain the proposed hours of operation during the construction phase, details of any proposed noise mitigation including any scheduling of noisy activities to certain times of the day etc. and any procedures for improving community relations and dealing with complaints.

1.5.2 Operational Phase

A number of mitigation measures were recommended within the previous noise and vibration assessment. Although this assessment has indicated that there is the potential for a minor to moderate adverse impact to workers and visitors to the proposed Costa Coffee and Subway development, taking into account the receptors sensitivity and the fact that any disturbance is likely to be temporary, no further noise mitigation is considered necessary.

1.6 Residual Impacts

1.6.1 Construction Phase

There is the potential for noise disturbance during the initial site preparation works to result in disturbance to nearby residents. This is mainly due to the construction of the internal haulage route.

The development and use of a noise management plan during the construction phase of the works should minimise noise disturbance to nearby residents as far as reasonably practicable. Visitors to the proposed Costa Coffee and Subway development may at worst experience a moderate adverse impact.

1.6.2 Operational Phase

The operation of the site in accordance with best practice should ensure that visitors and workers around the site at worst, experience a temporary minor to moderate adverse impact due to operational activities on the site during the day. Assuming that the local community and Council are kept informed of the stage of the landfilling operations and the likely timing and duration of noisy events at the site, it is considered unlikely that complaints will be received.

1.7 Conclusions from Noise and Vibration Assessment

This noise and vibration addendum report has assessed the potential for noise disturbance at the proposed Costa Coffee and Subway development, which is to be located adjacent to the Holiday Inn Hotel, to the north-east of Parry's Quarry.

Noise levels for both construction and operational activities have been predicted for the proposed Costa Coffee and Subway development. The results indicate that there is the potential for short-term disturbance to visitors and workers at the proposed Costa Coffee and Subway, during the infilling of Cell 1 above grade. However, this is not considered sufficient to warrant further noise mitigation at the proposed landfill.

2.0 AIR QUALITY

2.1 Introduction

This addendum report should be read in conjunction with the previously submitted Air Quality Chapter contained within the Environmental Statement (ES) for Parry's Quarry.

Information relating to a proposed Costa Coffee and Subway restaurant adjacent to the Holiday Inn Hotel, located to the north-east of Parry's Quarry, has been provided by Flintshire County Council (FCC). It is understood that the Costa Coffee and Subway outlets previously obtained planning consent for the development and have recently applied for planning consent again due to a revision in the plans.

The previous air quality assessment considered and described the existing baseline air quality within the vicinity of the proposed landfill. Sensitive receptors that could potentially be affected by changes in air quality due to the construction and operation of the proposed landfill were identified and included the area of the Holiday Inn, but not the area for the proposed Costa coffee and Subway outlets.

The impacts of the development on these receptors were evaluated for both the construction and operational phase and noise mitigation was proposed, where necessary.

This addendum considers the location of the proposed Costa Coffee and Subway restaurant, with respect to the proposed landfill and the subsequent potential for impacts on air quality during the site preparation and construction, operational and post closure phases.

2.2 Air Quality Assessment Methodology

2.2.1 Guidance and Legislation

The air quality assessment has been undertaken with reference to the legislation and guidance documents.

Environment Act 1995

Part IV of the Environment Act 1995 introduces a framework for ensuring that a number of objectives in reducing and controlling key air pollutants are met. This includes a National Air Quality Strategy first published by the Secretary of State in 1997 and then revised in 2000 with an addendum published in February 2003.

National Air Quality Objectives have been established and included in the National Air Quality Strategy based upon the recommendations of work carried out by the Expert Panel on Air Quality (EPAQS) and taking into account the requirements of the EU Air Quality Daughter Directive. Objectives have been established for both the protection of both human health and vegetation. The objectives set for the protection of human health are summarised in Table 2.1, and with the exception of ozone, are prescribed in the Air Quality (Wales) Regulations 2000 and (Amendment) (Wales) Regulations 2002 as air quality objectives for the purposes of Local Air Quality Management LAQM.

Local Authorities are required to carry out periodic reviews and assessments of air quality in their areas. Areas identified where the objectives may be exceeded should be designated as Air Quality Management Areas (AQMA).

Table 2.1- Air Quality Objectives for Local Air Quality Management (DEFRA, 2003)

Pollutant	Objectives Concentration	Measured as	Date to be achieved by
Benzene	16.25µg/m^3 (5ppb)	Running annual mean	31 December 2003
	5 µg/m^3 (1.5 ppb)	Annual mean	31 December 2010
1,3-butadiene	2.25µg/m^3 (1ppb)	Running annual mean	31 December 2003
Carbon monoxide	10mg/m^3 (8.6ppm)	Running 8 hour mean	31 December 2003
Lead	0.5µg/m^3	Annual average	31 December 2004
	0.25µg/m^3	Annual average	31 December 2008
Nitrogen dioxide*	200µg/m^3 (105ppb) not to be exceeded more than 18 times a year	Hourly average	31 December 2005
	40µg/m^3	Annual mean	31 December 2005
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	40µg/m^3	Annual mean	31 December 2004
	50 µg/m^3 not to be exceeded more than 7 times a year	24 hour mean	31 December 2010
	20 µg/m^3	Annual mean	31 December 2010
Sulphur dioxide	350µg/m^3 (132ppb) not to be exceeded more than 24 times a year	1 hour mean	31 December 2004
	125µg/m^3 (47ppb) not to be exceeded more than 3 times a year	24 hour mean	31 December 2004
	266µg/m^3 (100ppb) not to be exceeded more than 35 times a year	15 minute mean	31 December 2005

ODPM. (2005) MPS 2: *Controlling and Mitigating the Environmental Effects of Mineral Extraction in England – Annex 1: Dust*

The document details the reduction and control of dust from mineral workings and associated operations and outlines good practice for dust assessment.

Environment Agency Guidance Documents
A series of technical guidance notes have been produced in relation to the management and monitoring of landfill gas and the gas flares and engines. The documents provide information regarding the monitoring and management requirements in relation to landfill gas, flares and engines for landfill sites. The following documents have been referenced:

- TGN03 – Guidance on the management of landfill gas (2004);
- TGN04 – Guidance on monitoring trace components in landfill gas (2004);
- TGN05 – Guidance for monitoring enclosed landfill gas flares (2004);
- TGN06 – Guidance on gas treatment technologies for landfill gas engines (2004);
- TGN07 - Guidance on monitoring landfill gas surface emissions (2004);
- TGN08 – Guidance for monitoring landfill gas engine emissions (2004); and
- Guidance on landfill gas flaring (2002).

In addition, an Environment Agency document has been produced regarding the monitoring of particulate matter in ambient air around waste facilities (M17- 2004). The document provides background information regarding particulate matter generation and sources within waste facilities and presents methodologies for particulate monitoring.

Environment Agency. (2002). IPPC Horizontal Guidance for Odour H4 Part 1 – *Regulation and Permitting and Part 2- Assessment and Control*
The documents provide guidance regarding the regulation and control of odour.

Highways Agency. (2003). *Design Manual for Roads and Bridges: Volume 11 – Environmental Assessment (DMRB11).* Section 3 Part 1.
The Design Manual for Roads and Bridges: Volume 11 (DMRB11) provides a screening methodology for assessing the impacts of additional vehicle movements on the local road network. The DMRB 11 methodology is strictly applicable to new road scheme, the procedures are widely adopted for assessment of general schemes to consider the impact of vehicle related pollutant concentrations.

Kukadia, Upton and Hall (2003). *Control of Dust from Construction and Demolition Activities.* BRE Press
The document provides guidance regarding the control of dust generated from construction and demolition activities including suggested methods for the reduction of dust nuisance from sites.

London working group on Air Pollution Planning and the Environment (APPLE). (2005): *Draft London Code of Practice, Part 1- The Control of Dust from Construction.*
A wide range of dust control measures for various construction activities are presented along with suggested monitoring protocols. The code has been developed for London, but provides useful generic information and case studies.

NSCA. (2004). *Development Control: Planning for Air Quality.* NSCA.

The document provides guidance regarding the assessment of air quality issues within planning applications including a summary of relevant legislation, the content of assessments and the assessment of significance.

2.2.2 Assessment Approach

The approach to assessment was agreed in writing and during a meeting held with the Environmental Health Department at Flintshire County Council (22.8.06 – R Johnston, A Fuller, E Hocking and G Bishop).

Impact assessments associated with the proposed facility have been undertaken in relation to both the construction and operational phases. All potential impacts associated with the landfill proposals have been assessed qualitatively.

The potential impacts during the site preparation and construction phase (site infrastructure and cell preparation) have been assessed using data regarding proposed construction methodologies and considering the sensitivity of the proposed development site and the surrounding environment. The main elements of the preparation and construction phases include the construction of fences, access road and access point, cell preparation and shaping and provision of a lining system.

The filling of the site is proposed to progress in parallel with the continuation of the quarrying activities. The site will be filled in a series of 4 No. cells from cell 1 (north east quadrant) clockwise round to cell 4. The cells will then be restored commencing with cell 4 followed by cells 1, 2 and finally 3.

Impacts during the operational phase (i.e. filling of the cells) may include odours, dust generation, emissions from gas flares and engines and exhaust related emissions associated with the use of plant on site, vehicles delivering waste to the site and the transportation of employees.

Impact Description

Potential impacts associated with the proposed scheme have been assessed through a description of the impact and consideration of the degree of significance. Impacts have been considered in terms of the following:

- Direct or indirect;
- Spatial extent: localised (within a few metres) or widespread;
- Temporal extent: short term (few days), medium term (months), long term (years);
- Reversible or irreversible;
- Adverse or beneficial; and
- Temporary or permanent.

Assessing the Degree of Significance

The degree of significance of the impact has been considered with respect to its probability of occurrence, the magnitude of change and the sensitivity of the receiving environment. Probability of occurrence is considered in terms of low (0-25%), medium (26-50%), high (51-75%) and very high (76-100%). The sensitivity of the

receiving environment will vary depending on the nature of the receptor and have been described as low, medium, high and very high.

Sensitive Receptors

Sensitive receptors were identified for the assessment undertaken as part of the ES in line with the list of generic categories of potential receptors which need to be considered with respect to landfill gas and odour as specified within the EA documents "Guidance on the Management of Landfill Gas" and "Procedures for Identifying Risks from Landfill Sites". The Costa Coffee and Subway restaurant would fit into the category of "offices, industrial units and commercial premises."

The Costa Coffee and Subway restaurant are located approximately 50m from the closest operational areas of the site.

Dust Assessment

One of the main impacts during both the site preparation and construction and operational phases relates to the generation and deposition of dust. Dust is defined within in BS6069 (British Standards Glossary of Terms) as *Particulate matter in the range 1-75 microns in diameter*. Dust deposition and dust emissions occur when dust becomes airborne. The generation and deposition of dust varies depending on the prevailing weather conditions, topography and the size of the dust particles generated.

The generation and deposition of dust is most significant during dry conditions and strong winds. Rainfall decreases dust emissions due to surface wetting and increases the rate at which the dust is removed from the air.

The potential for impacts to occur as a result of dust generation has been assessed in relation to weather conditions and the prevailing wind direction, the proposed activities and the presence and location of sensitive receptors. Wind rose data presented as Appendix 1 has been obtained for Hawarden airport for the period January 2001 to December 2005. The data indicates that the most frequent wind direction is from the south east (approximately 21% of the time). However, the most dominant wind direction is from the north west, west and south west (37%).

2.3 Baseline Air Quality Conditions

A review of baseline air quality was undertaken as part of the original ES. This comprised the identification of point, line and area sources of emissions in the site locality, review of existing monitoring data and Review and Assessment documents produced by FCC.

Existing air quality within the locality of the site is influenced by current site operations comprising quarrying and the waste transfer station and including the potential generation and deposition of dust and vehicle related exhaust emissions. Other contributions to pollutant concentrations in the site vicinity include former and operational landfill sites and other industrial land users.

2.4 Assessment of Potential Air Quality Impacts

The proposed landfill may have an impact upon air quality during the site preparation, construction, operational and post closure phases.

2.4.1 Site Preparation and Construction Phase

The site preparation and construction works will comprise the provision of site infrastructure and initial cell preparation.

The initial site preparation works will comprise the following:

- Construction of 4m closed timber boarding fence along the northern site boundary;
- Filling of vegetation gaps along the eastern and western site boundaries;
- Construction of enhanced access point for vehicles onto Pinfold Lane
- Construction of internal haul road; and
- Establishment of infrastructure including construction of weighbridge, waste reception office, administration office and welfare facilities.

The works to the cells will comprise the preparation and shaping of the landfill base and the sidewalls, the emplacement of a liner and geotextile and the initial construction of the leachate collection system. Additional preparatory works are required for Cell 4 including the construction of an external retaining wall to the south west quadrant of the site to ensure full enclosure of the landfill void.

Impacts during the site preparation and cell construction phases have been considered in relation to the potential for the generation and deposition of dust and vehicle and exhaust related emissions.

Dust

The potential for dust generation and nuisance is likely to be greatest during the undertaking of the initial site preparation phase including the construction of the site haul road and construction of site services. Dust generation during the cell preparation will be limited by the fact that a majority of the work will be undertaken within the quarried void, at levels below the surrounding area and will therefore be sheltered from external winds, restricting the potential for dust dispersion beyond the site boundary.

The main impact upon air quality during the site preparation and construction phases is likely to result from the generation of dust from:

- Mechanical disturbance from the movement of vehicles along dry, unpaved haul roads (prior to the construction of the surfaced haul road) and the re-suspension of dust from the movement of vehicles along surfaced roads.
- Uncovered and unvegetated stockpiled materials;
- Mechanical disturbance of materials during construction activities e.g. earthworks; and
- Earth moving and handling operations.

Dust emissions can lead to increased dust deposition and elevated particulate concentrations in the atmosphere. The potential effects resulting from dust generation for the Costa Coffee and Subways restaurant are as follows:

- Nuisance resulting from the soiling of windows and cars; and
- Health effects resulting from exposure to particulates.

Site procedures relating to dust include the provision for daily and monthly site inspections, minimising soil handling operations during high winds and using a dust suppressant on site haul roads as required. The potential for dust deposition beyond the site boundary will be further minimised through the retention of existing site mature vegetation present along the eastern boundary- i.e. between the site and the proposed Costa Coffee and Subway restaurant area.

Nuisance to Users of the Proposed Costa Coffee and Subway Restaurant

The area for the Costa Coffee and Subway restaurant are approximately 50m from the closest operational area of the site.

The potential for the deposition of dust beyond the site boundary will be reduced by the 30m buffer zone, the presence of vegetation around a majority of the site perimeter and the proposed site procedures relating to dust management. On the basis of the wind rose data (Appendix 1), any dust generated on site is most likely to be deposited within areas to the north east, east and south east (37% of time) and areas to the north west (21% of the time).

Users of the Costa Coffee and Subway outlets would only be present on site for a limited amount of time thus and impacts relating to dust deposition are likely to be limited to the occurrence of dry, windy conditions. On the basis of the wind rose data and the position of the receptor in relation to the site, it is considered that impacts would be negligible to minor, adverse and direct, occurring over the short term, localised in scale and reversible and temporary in nature.

Vehicle and Exhaust Related Emissions

Traffic levels on roads in the vicinity of the site are also likely to increase during the site preparation and construction phases through the use of vehicles by construction workers, the delivery of plant and equipment. In addition, plant used on site may make a small contribution to local pollutant emissions.

Exhaust emissions would be produced by plant and machinery utilised during cell preparation and construction phase. Plant would include the following:

- 2 No. 360° excavators;
- Dump truck;
- Bulldozer; and
- Roller.

Exhaust emissions from mobile plant will only be significant within a 200m radius of the emission point. In such areas site users and residents may be exposed to slightly higher vehicle pollutant concentrations than typical background levels. On the basis that visitors would only be present at the Costa Coffee and Subway restaurant areas

for a short amount of time, it is not considered that vehicle related emissions will have an impact on the health of visitors.

2.4.2 Operational and Post Closure Phases

The filling of the site is proposed to progress in parallel with the continuation of the quarrying activities. The site will be filled in a series of 4 No. cells from cell 1 (north east quadrant) clockwise round to cell 4. The cells will then be restored commencing with cell 4 followed by cells 1, 2 and finally 3.

It is anticipated that it will take approximately 20 months to fill each cell up to the existing grade and then a further 20 months to fill the cells above grade to the final height.

During the filling of Cell 1, the gas management plant will be constructed including piping valves overall system control, gas extraction blowers and a maximum of 3 No. gas utilisation engines and flares.

The potential impacts during the operational and post closure phases have been assessed with respect to the following:

- Landfill gas generation associated with the degradation of wastes within the site and lateral migration;
- Emissions from engines and flares;
- Odour;
- Global warming and ozone depletion potential;
- Dust; and
- Traffic and vehicle related emissions associate with the use of plant on-site and vehicles delivering waste materials to the site.

A detailed outline of the various potential impacts associated with the above is provided within the original ES and is not reproduced within this assessment. The potential impacts on local air quality for the Costa Coffee and Subway restaurant site have been assessed qualitatively. The magnitude of impact will vary depending on the area of the cell being filled and on the positioning of each particular operational activity relative to the location of the receptor.

Site procedures will be adopted for the operational phase to help reduce potential impacts relating to dust and odour. Site procedures relating to dust include the provision for daily inspections, minimising soil handling operations during high winds, using a dust suppressant on site haul roads as required and the vegetating of inactive areas as required in order to reduce the potential for the re suspension of loose particles. In addition, a wheel wash facility will be utilised to reduce the potential for the tracking of mud and dust particles beyond the site boundary.

Odour relating to waste materials will be minimised through the provision of daily cover materials over all exposed waste materials to a depth of 150mm. In the event that odours occurred from landfill gas, the problem would be investigated. The investigation would consider issues such as gas generation rates and the areas of

the problem and would identify potential methods to reduce the odours utilising the gas collection system.

Emissions from Flare and Engines

The gas utilisation plant will be located in the north eastern corner of the site. This is located approximately 250m from the Costa Coffee and Subway Restaurant site.

The impacts of emissions from the flares and engines will vary over the operational and post closure phases of the landfill site. However, through the control over emissions that would be provided through monitoring, impacts would be minor, adverse and direct, localised occurring over the long term (i.e. operational and post closure phase), reversible and temporary.

Odour

The impact of potential odours at the site would be mitigated through the adoption of good operational practices at the site including the provision of daily cover at the end of each working day.

The potential for migration of odour beyond the site boundary resulting from landfill gas management would be reduced as a result of the gas collection system. The potential for complaints resulting from odour from the site is also likely to be reduced as a result of the 30m buffer zone around the site perimeter.

The potential for odour nuisance to users of the Costa Coffee and Subway site will vary depending on the area of the site being filled, the nature of the waste, weather conditions (particularly with respect to wind speed and direction and temperature). Degradation of putrescible material is likely to be higher during hot weather. The potential for odour nuisance is therefore likely to be greatest during the placement of odorous waste and hot whether. Potential impacts associated with odour are likely to be most significant during the filling of cells 1 and 2 as these are the closest to the area of Costa Coffee and the Subway restaurant

In the event that odours are generated at the site, they should be identified and rectified during the routine site inspections. This should ensure that odour nuisance does not occur. However, in the event that odours do migrate from the site, impacts for users of the Costa Coffee and Subway site are likely to direct, of short term in duration and temporary in nature and irreversible.

Global Warming and Ozone Depletion Potential

The contribution of the project to global warming and ozone depletion is not considered to be of relevance to users of the Costa Coffee and Subway site and is more widespread and global in nature.

Dust

The potential for dust generation during the operational phase of the site would be limited to the wind scouring of deposited wastes awaiting capping and materials retained within temporary stockpiles (such as daily cover and capping materials), and

the re-suspension of deposited particles on the internal road and areas of hardstanding.

The potential for dust generation for half the placement of waste within the cells will be limited by the fact that the actual tipping and compaction of waste will be undertaken within a void at levels below the surrounding area and will therefore be sheltered from external winds, restricting the potential for dust dispersion beyond the site boundary.

On the basis that the Costa Coffee and Subway restaurants are within 100m of operational areas of the site, there is potential for impacts relating to dust generation at the site. However, on the basis of the dust control measures to be employed at the site, it is considered that the potential impacts would be negligible to minor, adverse, direct, localised in nature, occurring over the short term and would be reversible and temporary.

Traffic and Vehicle Emissions

The traffic data provided Veryards Opus Ltd indicated increases in traffic flows on the A494 both east and west of the site, Pinfold Lane up to the point of the new site access road and Pinfold Lane to the south of the site. On the basis that the area of Costa Coffee and the Subway restaurant are in excess of 200m from the centreline of the A494, no additional impacts relating to traffic are anticipated.

Exhaust emissions would also be produced by plant utilised on site during the operational phase of the scheme. However, such emissions are likely to be very limited.

2.5 Mitigation Measures for Air Quality

Mitigation measures for the site preparation and construction and operational and post closure phases are outlined within the ES. It is not considered that any further mitigation measures are required with respect to reducing any potential impacts for users of the Costa Coffee and Subway restaurant site.

Mitigation measures for the site preparation and construction phases include the preparation of a Construction Environmental Management Plan (CEMP) with a comprehensive range of dust reduction, suppression and control techniques and methods to reduce the potential impact of exhaust related emissions.

Potential impacts during the operational and post closure phases will be reduced through the implementation of standard operating procedures and Environment Agency requirements. In addition, site monitoring protocols and procedures will be implemented to ensure that impacts on adjacent land users are negligible.

2.6 Residual Impacts

The implementation of mitigation measures will ensure that any potential impacts to users of the Costa Coffee and Subway restaurant will be further reduced and as such are considered to be negligible.

2.7 Conclusions for Air Quality Assessment

This air quality assessment addendum report has assessed the potential for impacts on air quality at the proposed Costa Coffee and Subway development, which is to be located adjacent to the Holiday Inn Hotel, to the north-east of Parry's Quarry.

On the basis that users of the site would only be present for a limited amount of time, following the implementation of the proposed mitigation measures and the operational procedures at the site, the impact on air quality within the vicinity of the area proposed for the Costa Coffee and Subway restaurant would be negligible.

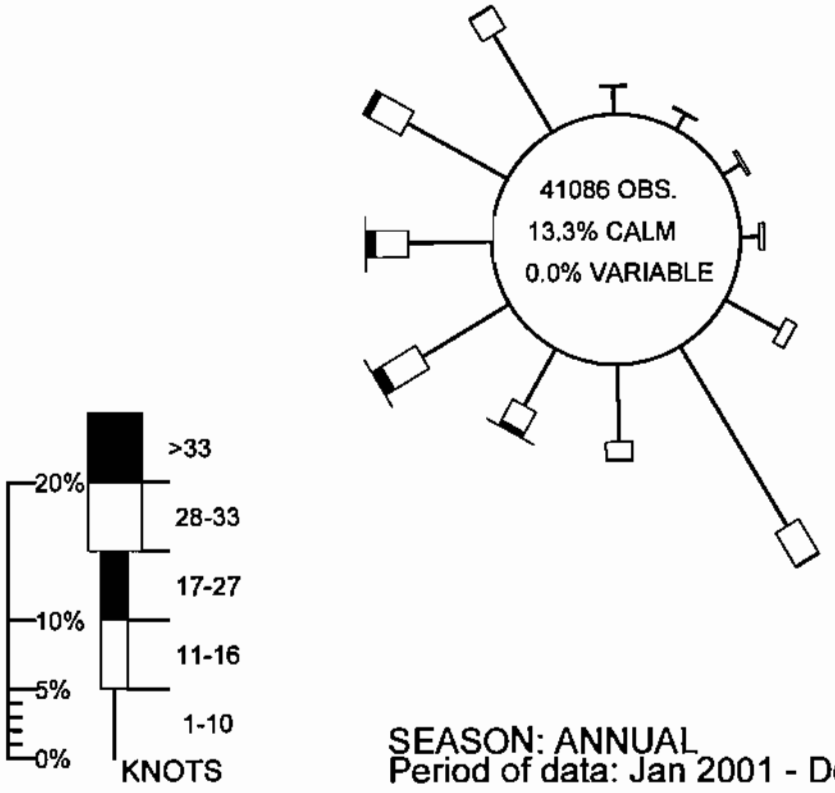
REFERENCES

BSI. (1994). Characterisation of Air Quality- Glossary. BS6069- 2 (1994)- ISO 4225: 1994. BSI London.

DEFRA. (2003). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum. HMSO

APPENDIX 1- WIND ROSE DATA

WIND ROSE FOR HAWARDEN AIRPORT
N.G.R: 3341E 3646N ALTITUDE: 10 metres a.m.s.l.



SEASON: ANNUAL
Period of data: Jan 2001 - Dec 2005

PARRYS QUARRY ENVIRONMENTAL STATEMENT

ADDENDUM ON ECOLOGY

RESPONSE TO CCW COMMENTS ON PARRYS QUARRY DATED 27.03.07

amec

PARRYS QUARRY ENVIRONMENTAL STATEMENT

ADDENDUM ON ECOLOGY

RESPONSE TO CCW COMMENTS ON PARRYS QUARRY DATED 27.03.07

A series of communications have taken place between the developer and CCW since the submission of the Environmental Statement, regarding nature conservation issues at Parrys Quarry. AMEC Earth and Environment, working on behalf of the developer, provided to Flintshire County Council a tabulated response to CCW's consultation letter of 19th January 2007. We have enclosed below a copy of CCW's recent replies to that tabulated response (Appendix 1 of this document), together with further information requested by them on seven points. These seven points are:

- **Insufficient provision of compensation land for newts (during operation of the landfill) .**
- **Insufficient provision of GCN dispersion corridors**
- **Need to provide tree report on bat roost suitability.**
- **Need to state in text that ponds will not be created in woodland.**
- **Need a map showing retained areas of nature conservation on site.**
- **Assessment of cumulative ecological impacts.**
- **Indirect ecological impacts.**

Each of these issues is addressed below. In addition to these points, we wish to point out that a great crested newt survey will be carried out during the current (2007) breeding season. This data will be used to confirm the methodology proposed for great crested newt compensation measures on and off site.

1. Insufficient provision of compensation land for newts

Provision of compensationary land for great crested newts during the operation of the landfill requires "like for like" in terms of the area of suitable habitat for this species within the quarry which will be lost. We started this exercise by remeasuring all areas of land at Parrys Quarry to confirm the exact footprint of the landfill (and associated infrastructure) as well as the non-landfill parts of the site, including all open green areas and woodland area which will be retained. These final areas are tabulated below:

Location	Area (ha)
Total proposed landfill footprint (including infrastructure and access road)	12.745
Total non-landfill area (including railway line)	5.39
Area of existing SSSI/SAC	1.63
Area of proposed new SSSI/SAC	0.73
Area of Cell 4 (excluding bund)	1.28
Area of railway line	0.94
Total area of green open space after restoration of the landfill site	18.138 ha

The currently proposed nature conservation areas which will provide great crested newt compensation habitat within the Parrys Quarry site are: all the woodland areas that surround the site boundaries, the existing SSSI/SAC and the new conservation area and the former railway line to the east of the site. In total, these areas amount to 5.39ha.

The following table provides information on the "like for like" area calculation of newt compensation land at Parrys Quarry:

Location	Area (ha)
Total proposed landfill footprint (including all infrastructure and access road)(i.e. area of suitable newt habitat which will be lost)	12.75
Total non-landfill area (including all woodland, the existing SSSI/SAC, the proposed new conservation area and the former railway line). All of this land will act as compensationary land for great created newts	5.39
Total additional required compensation area to achieve "like for like"	7.36ha

The landfill site will be divided into four cells for its operation. It is proposed that cell No. 4, in the north western corner of the landfill, will be devoted to newt conservation during the first half of the landfill's operation. This will be achieved by use of newt exclusion fencing to protect newts which are translocated to this area during the site enabling works. As landfilling operations proceed and cell 4 is required for infilling, the newt conservation areas will be moved to cell 1 in the north east of the site which will have been completed by this stage in the landfill's life. If the area of cell 4 is included in the calculation of available newt compensation area within the site, only a further 6.08ha of newt compensationary land off-site is required.

Location	Area (ha)
Area of Cell 4 (excluding bund)	1.28
Total area of compensation land on site (including Cell 4)	6.67
Total additional required compensation area	6.08ha

The applicant is currently vigorously seeking additional land off-site in the vicinity of Parrys Quarry which would be leased as newt compensation habitat for the duration of the landfill development. This process is ongoing at the time of writing. Flintshire County Council will be updated with the results of this process as soon as it is available.

2. Insufficient provision of GCN dispersion corridors

It is recognised that the great crested newt population at Parrys Quarry is the most isolated part of the Buckley Claypits and Commons SSSI and the Deeside and Buckley Newt Sites SAC.

Parrys Quarry lies in a triangle of land which is isolated by the A494 to the south, the A55 to the north and east and Pinfold Lane to the west. A new road junction and spur road are being proposed by the Welsh Assembly Government for the A55/A494 junction. If one of the proposed routes (the "Purple" route) of this proposal goes ahead, the Parrys Quarry site will be more significantly isolated than it currently is due to the upgrading of Pinfold Lane into a dual carriageway. This will result in busy traffic-congested roads

surrounding the boundary of Parrys Quarry to the south and east, with a small buffer zone created by the Holiday Inn and OK Diner between Parrys Quarry and the A55.

Provision has been made in the Parrys Quarry ES for the former railway line running along the eastern boundary of Parrys Quarry, which is in the ownership of the developer, to become part of the nature conservation area. Since the developer cannot propose works on land which is outside their ownership, it has been impossible to include in the development proposals for any further connections to off-site locations for great crested newt dispersal from the site. The developer will, however, make the commitment to seek all opportunities with the Welsh Assembly Government Roads Directorate to improve off-site connections for newt dispersal as soon as the plans for the A494/A55 road realignment and junction are finalised.

3. Need to provide tree report on bat roost suitability.

All trees to be removed to provide improved visibility at the site entrance were inspected for their potential to provide suitable niches for bat roosts. The detailed survey was limited to those trees which have breast height diameters (DBH) >10cm. 17 semi-mature trees at the site entrance were found to be >10cm DBH. A further 22 trees <10cm DBH are likely to be removed. All trees <10cm DBH were considered to be inappropriate for bat roosts. The tree condition survey conducted on the trees >10cm DBH is provided in Appendix 2. The results of the survey show that the majority of trees are young and semi-mature goat willow and silver birch with no suitability for bat roosts. The results also indicate that there is one mature oak and five semi-mature oak trees which will be removed with several semi-mature trees having a discontinuous cover of ivy. However, all the semi-mature oak trees are young to semi-mature with DBH <15cm. None show suitability for bat roosts. The mature oak trees is in good condition and although it has an intermittent cover of ivy, shows no potential for bat roosting. In summary, 17 trees were inspected in detail using binoculars and hand inspection in good light and weather conditions. None were found to have any suitability as bat roosts. Accordingly, it is not considered necessary for a bat handler to be present during the removal of these trees.

A programme of tree and shrub planting is proposed both at the outset of the landfill development, to provide additional screening of the site, and at the landfill closure and restoration stages. These plantings of British native tree and shrub species of local provenance sourced from a local supplier will provide further wooded edges within the site for bat foraging. It is also anticipated that the planned programme of pond restoration and habitat management within the existing SSSI/SAC will improve significantly the southern portion of the site for bat foraging.

4. Need to state in text that ponds will not be created in woodland.

Two new ponds will be created within the new conservation area for newts in the east of the site. These ponds will be created within the open grassland part of the site and will avoid any wooded areas. There are several reasons for this, including (a) prevention of shade and (b) prevention of tree litter fall into the pond which would cause accumulation

of organic matter and possible alteration of pond substrate and water quality conditions. In summary, no ponds will be created within woodland and thus no good terrestrial habitat for great crested newt will be lost due to the digging of new ponds.

5. Need a map showing retained areas of nature conservation within the site.

A map of all wooded and open grassland areas of the site which will be retained and unaffected by the landfill development, together with their areas, is attached as Figure 1. This area includes all the unaffected woodland and open grassland areas that surround the boundaries, the existing SSSI/SAC, new conservation area and the railway line. The overall area of these parcels of land is given in Section 1 (above) and in Figure 1.

6. Assessment of cumulative ecological impacts.

Three planning proposals currently exist for the near vicinity of Parrys Quarry:

- the proposal to change Parrys Quarry into a landfill site
- the construction of a Costa Coffee and Subway retail outlet adjacent to the Holiday Inn on the A55 immediately east of the site
- proposals for improvements to the A55/A494 Interchange.

There are three types of potential cumulative impacts associated with these developments. These relate to a cumulative adverse impact on dispersion for great crested newts from the Parrys Quarry site, and cumulative adverse impact due to land take and a potential cumulative adverse impacts on breeding birds and badger. These four potential cumulative impacts are described and assessed below.

6.1 Cumulative impact on dispersal routes for great crested newt

The population of great crested newts within Parrys Quarry is already isolated from other ponds off site by the A494 and Pinfold Lane to the south and west respectively. The proposal to extend the car parking and service areas associated with the Holiday Inn to the east of the site, to incorporate new Costa Coffee and Subway outlets will further restrict the potential for newts to disperse in an easterly direction. The proposal by the Welsh Assembly Government to upgrade the A55/A494 Junction could result in the site becoming even more isolated due to upgrading of Pinfold Lane (see Section 2 above).

In view of the above planning proposals in addition to Parrys Quarry landfill site, there will be an adverse cumulative impact on the ability of great crested newts from Parrys Quarry to disperse to other ponds off site. As described in Section 2 above, the development cannot propose works on land which is outside their ownership to secure dispersal routes for great crested newts. However, the developer will, however, make the commitment to seek every opportunity with the Welsh Assembly Government Roads Directorate to improve off-site connections for newt dispersal as soon as the plans for the A494/A55 road realignment and junction are finalised.

6.2 Cumulative Impact on available suitable land for great crested newt

The proposal to extend the car parking and service areas associated with the Holiday Inn to the east of the site, with new Costa Coffee and Subway outlets, will take existing grassland out of use as great crested newt habitat. The proposal by the Welsh Assembly Government to upgrade the A55/A494 Junction could, if the "Purple" route is chosen, result in a small area of land take for the upgrading of Pinfold Lane. The area taken would comprise semi-mature woodland which currently provides excellent foraging and refuge habitat for great crested newts.

In view of the above planning proposals in addition to Parrys Quarry landfill site, there will be an adverse cumulative impact on the availability of suitable foraging land for great crested newt. Compared to the area of the SSSI/SAC and the existing quarry, these areas are small. As well as provision for compensationary newt habitat within Parrys Quarry landfill site, further areas of compensationary terrestrial habitat are being sought off-site to provide sufficient terrestrial land for what is anticipated to be a significant population of great crested newt within Parrys Quarry (see Section 1 above).

6.3 Cumulative impact on breeding birds

The proposal to extend the car parking and service areas associated with the Holiday Inn to the east of the site, with new Costa Coffee and Subway outlets, will take a small area of existing grassland. This is of little use for breeding birds. However the construction activities of these new developments have the potential to disturb birds nesting in trees along the former railway line to the east of Parrys Quarry. The proposal by the Welsh Assembly Government to upgrade the A55/A494 Junction could, if the "Purple" route is chosen, result in a small area of land take for the upgrading of Pinfold Lane. The area taken would comprise semi-mature woodland which currently provides moderately good nesting habitat for common breeding birds.

In view of the above planning proposals in addition to Parrys Quarry landfill site, there could be a small adverse cumulative impact on breeding birds around the woodland boundaries of Parrys Quarry. To minimise the potential for cumulative disturbance, several mitigation measures are relevant.

(a) the **Costa Coffee and Subway developments** are currently under way. Mitigation provided by these developers should include searches ahead of disturbing operations to check nearby trees for nests. If any nests are found then disturbing and noisy activities should cease in the vicinity of the nest until the young have fledged and left the nest.
(b) **Parrys Quarry site entrance.** Where a small number of trees need to be removed to create improved visibility at the Parrys Quarry site entrance, the removal will take place outwith the bird breeding season (March to July) to avoid disturbance to breeding birds. If the trees must unavoidably be removed during the bird breeding season, a suitably qualified ecologist will check these trees for nests one week ahead of the works being carried out. If any nest is found, the work shall be stopped and further work postponed until the young have fledged and left the nest.

(c) if **road improvements** are to take place along Pinfold Lane, involving removal of trees, then the Welsh Assembly Government and its contractors should carry out the works outwith the bird breeding season (March to July). If the trees must unavoidably be removed during the bird breeding season, a suitably qualified ecologist should check these trees for nests one week ahead of the works being carried out. If any nest is found, the work should be stopped and further work postponed until the young have fledged and left the nest.

6.4 Cumulative impact on badger

Although there are no badger setts on site, current active tracks of badger have been found within the Parrys Quarry site (March 2007). It is thus known that badgers are active in the area. Although there are currently no badger setts along the former railway, badgers may be using the railway line as a commuting route onto Parrys Quarry. A range of mitigation measures has been proposed in the Environmental Statement to prevent damage to badgers using the site during the operation of the landfill.

The proposal to extend the car parking and service areas associated with the Holiday Inn to the east of the site, with new Costa Coffee and Subway outlets, will take a small area of existing grassland. This is of only minimal use for badger foraging. The proposal by the Welsh Assembly Government to upgrade the A55/A494 Junction could, if the "Purple" route is chosen, result in a small area of land take for the upgrading of Pinfold Lane. The area taken would comprise semi-mature woodland which currently provides only a very small area suitable for badger foraging.

In view of the above planning proposals in addition to Parrys Quarry landfill site, there could be only a very small, negligible adverse cumulative impact on badgers around the boundaries of the Parrys Quarry site. It is considered that the currently stated mitigation measures in the Environmental Statement are adequate to prevent any adverse effects on badgers.

7. Indirect ecological impacts.

A full assessment of indirect ecological impacts has been provided as part of the Environmental Statement. However these are provided again below for completeness.

In Chapter 11 of the Environmental Statement, the following indirect ecological impacts were identified, assessed and mitigation provided for the construction phase of the development:

- Soil erosion and runoff from construction of the access road could damage the GCN fencing and SSSI integrity, including pond and terrestrial habitat for GCN
- Fuel or chemical spillages could contaminate pond and terrestrial habitat for amphibians
- Dust generation during construction and earthworks could contamination water and vegetation in the SSSI, rendering pond and terrestrial habitat unsuitable for newts.

Assessment of and mitigation for these indirect impacts will not be repeated here, but can be found in Sections 11.8.4 and 11.8.5 of the Environmental Statement.

In Chapter 11 of the Environmental Statement, the following indirect ecological impacts were identified, assessed and mitigation provided for the operational phase of the development:

- Dust generation and the potential contamination of pond and terrestrial habitat within the SSSI
- Soil erosion and runoff from the access road could damage the GCN fencing and SSSI integrity, including pond and terrestrial habitat for GCN
- Disturbance or injury to wildlife due to vermin associated with landfilling operations

Assessment of and mitigation for these indirect impacts will not be repeated here, but can be found in Sections 11.8.4 and 11.8.6 of the Environmental Statement.

The Countryside Council for Wales has requested further details of site management during the operation of the site to prevent adverse impact on nature conservation of the SSSI/SAC.

In Section 11.8.6, part O4 of the Environmental Statement, the rigorous management of the site is described. The site will be required to be managed to regulatory standards. The appropriate Regulation is provided in Landfill Directive Regulatory Guidance Note 5 – Habitats Directive and in Landfill Technical Guidance Note Appendix 6 – Waste Management. This regulation requires management to prevent

- Vermin (rats, gulls, corvids)
- Litter

Measures proposed to manage these issues are described below.

Birds.

A bird management plan is being produced as part of the response to queries from Airbus. This report will be submitted to Flintshire County Council as soon as it is available.

The working operation of each cell of the landfill will be such that all areas of waste will be covered by spoil daily so that there are no exposed areas which would attract feeding birds (see Section 2.3 of the Environmental Statement). In addition, bird management measures will involve the daily use of bird control, particularly during the dawn/early morning period when site activities are less intensive and hence when birds a re more likely to settle. Ultrasonic bird scarers will be used daily to prevent gulls or corvids from landing on or around the site and becoming habituated to the site. These ultrasonic devices emit a range of patterns and frequencies to ensure that birds do not become

habituated. These devices for bird use operate over a range of wavelengths from 8000-60,000Hz but are most effective for birds at wavelengths around 17,000Hz.

The normal hearing for a health young person ranges between approximately 20Hz to 20,000 Hz. Generally the range of audibility for the higher frequencies reduces with age. Assuming that the bird scarers are set at around 17,000Hz, there is a low potential that noise emitted from the bird scarers will be audible. Given the location of the SSSI, the only potential residential properties that could be affected by the bird scarers are Parry's Cottages. However, it is likely that noise from both the A494 and Parrys Quarry will mask noise from the bird scarers to some degree and hence noise disturbance to human receptors from the use of this equipment is considered unlikely.

The use of ultrasonic bird scarers around the southern and eastern sections of the site every year during the great crested newt breeding season (March to June) will prevent gulls and corvids from settling and preying on newts as they are moving into ponds and foraging around ponds. It is also proposed to use overhead lines to prevent birds from settling on landfill areas during their active use. The layout of the aerial lines will be designed for each landfill cell individually, to ensure their effectiveness. When cells are not being actively used for landfilling, they will be temporarily grassed over to stabilize the surface and to provide a more acceptable visual appearance.

It is considered that the use of the above methods of bird deterrent will be effective in preventing predation to newts in the SSSI/SAC and in reducing any adverse impact of birds on newts to a level of negligible to minor. This is considered to be acceptable for the development.

Rats

For control of rats, good site and landfill management will involve daily covering of all waste by spoil (see Section 2.3 of the Environmental Statement) to ensure that no decomposing and putrescible waste is exposed to cause attractive odours. Regular weekly inspections, which will be part of the site's environmental management plan, will assess how effective these vermin control measures are and will vary preventative techniques according to need and geographical location. If required, rat control will be implemented, as for birds, using ultrasonic scarers. The fertility of rats and mice means that trapping or poisoning alone cannot effectively control populations because the dead animals would soon be replaced by others. The only solution is by making that environment unacceptable to rodents. This will be achieved by the use ultrasonic scarers which emit a series of variably pulsating and constantly changing combinations of ultrasonic sound which coincide with the frequency range of the distress and aggression calls of rodents. The result is an environment which is unacceptable to rodents and consequently they do not enter the ultrasonic protection zone. These devices for rat use operate over a range of wavelengths around 50,000Hz. This range is well over the audible range for humans and will cause no noise disturbance to human receptors.

The use of preventative exclusion fencing together with the use of strategic ultrasonic rat scarers is considered to reduce the likely impact of rats on great crested newts to a level of minor to negligible. This is considered to be acceptable for the development.

Overall. it is considered that after implementation of the above mitigation measures, any residual impacts due to the presence of vermin on protected species, particularly great crested newts, will be reduced to a level of negligible to minor and hence will be acceptable for the development.

Litter

Litter management during operation of the landfill will be effected through use of good site housekeeping, catch drift netting and through regular site inspections and litter cleanup campaigns. Assuming that these activities are implemented, any residual impacts due to the presence of litter on the SSSI/SAC, protected species will be reduced to a level of negligible and hence will be acceptable for the development.

APPENDIX 1. Specific responses to CCW's paragraphed points. Status after Consultation Meeting with Matthew Ellis CCW on 14.02.07

DRAFT

Without Prejudice Comments by CCW (Matthew Ellis) 27 March 2007

CCW Para	CCW Comment	AMEC Response	ES Reference	CCW Comment
1	Flags up the need for an Appropriate Assessment	AMEC wrote to Roger Bennion FCC about this on 3rd August 2006.		We note and accept your comments.
2	States that the proposals are unlikely to have any *direct* effects on the SAC/SSSI – but could have *indirect* effects (predation or removal/deterioration of fence).	The ES identifies a number of potentially indirect effects on the SAC/SSSI and on protected species. These have been fully assessed and a full and very detailed programme of mitigation has been proposed.	See Sections 11.8.4, 11.8.5 and 11.8.6.	As discussed, we consider proposals outlined within the ES do not adequately address indirect impact issues. Key indirect issues relate to the need for proposals to address newt dispersal issues.
3 and 4	Detailed design and operations info (as for PPC) needed at this stage. The detail for the Appropriate Assessment	Detailed design information is contained within the design statement report contained within the planning bundle submitted to FCC as a component of the planning application. Further reports concerning odour management and bird control are currently being complied for submission to the FCC.	Design statement submitted with the ES.	We note and accept your comments. We look forward to receipt of further documents and reports.
5	FCC should condition proposals for green linkages around the site and their future maintenance for exchange of wildlife. Request for amphibian underpasses under roads and permanent fencing	ES states that the former railway corridor along the eastern boundary of the site (which is in the ownership of the developer) will be maintained as part of the proposed extension to the SSSI/SAC and will provide a connective green wildlife corridor along this side of the site. The ES also states that permanent exclusion fencing will be erected and maintained around the entire boundary of the operational part of the site. The A494 and land on both sides of it, as well as Pinfold Lane and the land to the west of it	See Section 11.8.5. Section 11.8.5	CCW welcomes proposed revisions in respect of size and locations of compensation areas as discussed during our meeting. We also identified proposals to address the provision of compensation areas during the operational use of the quarry. We welcome the proposal to erect a permanent fence around operational areas. In our view, as quarrying is actively being carried out, we suggest that this issue should now be progressed as a priority.

		are outwith the ownership of the developer. Hence any works to provide underpasses under roads would be the responsibility of Flintshire County Council Highways Department or the Highways Agency.		We note and accept limitations in respect of your ability to deliver schemes that address amphibian dispersal issues across the Highways network. As discussed, we would welcome proposals that would enable resources to used specifically address this issue.
6	Maes y Grug SSSI not mentioned in ES	Maes y Grug SSSI lies approximately 1.3km east of Parrys Quarry. Lying *between* Parrys Quarry and Maes y Grug SSSI are (a) Pinfold Lane, (b) the active working area of Brock Quarry and (c) the Alltami Brook. While there is a recorded population of great crested newt in both sites, there is *no possibility* of any interaction between the populations of the two sites. A short addendum to the ES has been provided to include details and location of this SSSI. (see attachment to this letter).		We disagree with this statement. In our view, whilst Alltami Brook may act as a partial barrier, and therefore limit dispersal, we consider that it **does not** prevent dispersal. We note comments about potentially unfavourable land management activities, though we do not consider these to constitute material barriers to dispersal. We therefore conclude there is a possibility of dispersal and consequently genetic exchange between the neighbouring sub-populations
7	Impact of discharge waters on Alltami Brook and downstream habitats not addressed. However accepts that PPC compliance would prevent any adverse effects	While there is the potential that discharges from the dewatering activities on site could impinge on the Alltami Brook and downstream habitats, CCW acknowledge that compliance with PPC will mean that there will be no adverse impacts. A discharge from the water management ponds currently permits discharge of water to the Alltami Brook, and presumably does not impact downstream habitats. Any discharge permitted under a PPC permit issued by the EA will contain limits as stringent, or more so than the currently issued consent.		We note and accept your comments.
8	States that surveys for reptiles and bats are inadequate.	**Reptiles.** A comprehensive reptile search took place in May 2006 (methodology provided in ES). No reptiles were found either in the existing SSSI or within the working quarry. The ES text acknowledges that despite disturbance due to quarrying activities, they are still likely to	ES Section 11.6.5. and 11.7.5.	We note and welcome your comments in respect of reptiles

		occur on site. A new ES Addendum detailing reptile mitigation is attached to this letter. **Bats.** During the Phase 1 Habitat survey an informal inspection of trees took place during which they were assessed for suitability for bat roosts. It is acknowledged in the ES bats use the woodlands bounding the site. These trees were found to be generally unsuitable for bat roosting. No mature trees will be removed for the development – only a small number of young/semi-mature trees at the site entrance which have no suitability for bat roosts. More suitable mature trees in the woodland south and east of site will remain completely unaffected by the development. We agree that there is the potential for reptiles, specifically grass snake, to be present within the working area of the quarry despite the fact that none were found during comprehensive searches. A full mitigation programme to capture and translocate reptiles will be implemented as part of the mitigation package during the site enabling works. Please see Addendum attached to this letter.	See ES Section 11.7.6 Mitigation for reptiles in working area of the quarry will be a new mitigation element. See Addendum to the ES	As discussed during our meeting, CCW has received verbal reports of bats dispersing and/or foraging over site We recommend further info should be provided to demonstrate no impact on bats. (i.e. no impact arising from tree removal, and no impact on bat foraging and dispersal behaviour.
9	States that GCN value of lagoons within quarry is high and since they were not surveyed for H&S reasons (their omission from the GCN survey was agreed in advance by CCW) information is incomplete.	There are currently two lagoons present on site, the southerly of which is a transient feature, while the northern lagoon will be retained throughout both operation and restoration of the site. The habitat within the quarry is suitable for both reptiles and amphibians – but is not at all optimal - due to continuous earthmoving works and frequent daily movements of heavy vehicles. Lagoons within the quarry are not ideal breeding habitat for amphibians because:		We accepted your submission that surveys of selected water bodies could not be carried out owing to concerns re health and safety. Owing to the absence of any justifiable scientific data, we advise and consider that a significant newt population must be presumed to be present within the quarry. As a consequence, mitigation and compensation schemes must be based on the presence of a significant

		(a) their configuration (size, shape and depth) and water levels are continuously changing as a result of on-going active quarrying activities, (b) the lagoons have vertical sides with no access, (c) they are deep, (d) they have no bankside, submerged, floating or marginal emergent vegetation and (e) they have fish. All of these factors mitigate against these water bodies being ideal for breeding GCN. We're not saying there are no GCN inside the quarry – simply that the lagoons are not ideal breeding habitat for them. When designing comprehensive GCN mitigation measures (for dewatering and capture/ translocation programme) we have assumed that amphibians, including GCN *are* present within the quarry. We have also assumed that there may be significant numbers of individuals present.	See ES Section 11.8.5	population. We acknowledge that you have accepted the presence of a large GCN population, though proposals to date have not provided sufficient compensation habitats during operational phases of the landfill site.
10	States that data is absent for amphibians, reptiles and bats for the working area of the quarry. The precautionary principle that the working area of the site is of value for amphibians, reptiles and bats means that more compensation areas need to be identified and managed in the long term.	**GCN.** 2006 data for GCN is absent (with CCW's agreement) only for the two large lagoons within the working area of the quarry due to Health and Safety reasons. (Their omission was agreed in advance of GCN survey with CCW). Repeat GCN surveys have been carried out at Parrys Quarry since the formation of the SSSI area in 2000 – so a fairly complete picture of the GCN conditions over the past six years is available. We believe sufficient information on the GCN population is available to inform the very comprehensive mitigation measures that have been proposed.		**GCN** We disagree with comments in respect of the potential presence of GCN and the assumption that it is of poor value for newts. This view is based on experience of actively advising on the safeguard of exceptional populations in working claypits. However, we do acknowledge that the presence of fish is limiting factor suggesting the site is not as "ideal" as populations encountered in other working claypits Irrespective of possible population size, compensation schemes have to be based on a like for like basis. This is required for the purposes of addressing range issues and ensures demonstration that FCS is not likely to

				be affected at any point in the future.
		Reptiles. A comprehensive search was carried out for reptiles in summer 2006 and none were found. A full capture and translocation scheme is now proposed for the working area of the quarry (see response to paragraph 9 above)		**Reptiles** We accept your proposals in respect of reptiles
		Bats. There is no possibility of bat roosts anywhere within the working area of the quarry (there are no trees or suitable structures). No structures or trees with potential to house a bat roost will be affected by the proposed landfill development. Thus, specific mitigation for bat roosts is not required. The tree-lined boundaries of the site will continue to provide flight lines and possibly foraging routes for bats. The proposed planting of native trees as part of the enabling works, the restoration of ponds within the existing SSSI/SAC and the creation of an extension to the SSSI to include two new ponds will provide significant new and improved areas of foraging habitat for bats.		**Bats** We discussed bat related issues. We understand that c.11 trees will be felled. We advise that all trees that may be felled are subject to surveys for bats. We are aware of reports that bats use the site for foraging and dispersal purposes. We would welcome the submission of proposals that address this potential issue.
		The area of compensation habitat proposed (extension to SSSI/SAC on site is approximately 7300m^2 (including the former railway line). This amounts to an almost 50% increase in the area of the protected site (SSSI/SAC), includes new habitat and includes a new green wildlife corridor (former railway line) which will remain in perpetuity. The restoration of key habitats, including ponds, in the existing SSSI plus the creation of appropriate new habitats (including ponds) in the new SSSI extension, both of which will create *optimal* habitat conditions for		Issues concerning the satisfactory provision of compensation habitats are discussed above.

		amphibians (including GCN), reptiles and bats, is considered to be entirely satisfactory and appropriate mitigation for the loss of the larger area of completely sub-optimal and transient quarry habitat.		
11	States the law governing licensing for GCN works. States that FCC should condition need to deliver conservation schemes and mitigation for protected species	We have stated that a license will be necessary and we have already discussed this and all other aspects of the proposed ecological management, including GCN mitigation, with North East Wales Wildlife (NEWW) who is likely to be appointed to carry out the ecological management works. We would expect conditions of this type to cover the required ecological mitigation.	See ES Section 11.8.5	Noted and welcomed
12	Proposes RAMs for GCN including permanent fencing around the entire working area, compensation habitats and specialised measures for GCN during dewatering.	All of these measures are proposed as ecological mitigation in the ES	See ES Section 11.8.5 – Mitigation C5 and specific mitigation for amphibians	We note and accept your comments.
13	Requires conservation schemes including perpetuity provision of compensation and mitigation habitats within the environs of the site.	These are all proposed in the ES. It is proposed to (a) increase the SSSI/SAC by 7300m^2 (approx increase of almost 50%), (b) two new ponds will be created, (c) the existing ponds in the SSI/SAC will be restored, (d) restoration of the site after landfilling will provide 18.75ha of new open meadow habitat and native woodland, (e) funds will be commuted for long term (20 years) management of the new conservation area, (f) NEWW have agreed in principle that they would be interested to manage the site long-term. Discussions have been held with NEWW to discuss ways in which this would happen.	See ES Section 11.8.5 Specific mitigation for amphibians	Noted but this response does not effectively consider the provision of compensation areas during operational phases of the landfill site. We note and accept your proposals in respect of possible long term site managers. However, we previously advised that other parties are also capable of managing compensation areas. A list of possible site managers is attached for your information

14	Identifies a non-statutory site (26NE13), some of which will be lost by the development. States that this needs to be considered and compensation put in place.	We have discovered that this non-statutory site (26NE13) is a designation made by Flintshire, based on advice from CCW in 1999, on the "old quarry of Parrys Pit". (designation details provided as an Addendum to the ES, attached to this letter). We believe that the designation was made at a time when the quarry was not being worked – at the end of Hanson's landholding and before Robin Jones landownership. Although the quarry has been actively worked since Robin Jones' ownership in 2000, the owners have not been made aware of any nature conservation designation, nor has the status of the site (i.e. an actively worked area with frequent and regular major earthworks and heavy plant movement) been taken account of in the designation. We believe that the provisions made in the ES for creation of (a) a new protected nature conservation area during the operation of the landfill (the new extension to the SSSI/SAC, which will include the former railway line as a wildlife corridor) together with (b) the post landfill-closure restoration package to create 18.75ha of new green open space, comprising wildflower meadow and native woodlands, is a very significant contribution to nature conservation in this part of Flintshire which more than compensates for the loss of the disturbed and working area of the current quarry.		Noted. Responsibility of administering the non-statutory Wildlife Sites system is by FCC Following the meeting, we understand that c.11 tree will be removed on the southern tip of Wildlife Site 26NE13. These trees are to be lost as a consequence of proposed improvements to access. We understand that the remainder of the Wildlife Site is to be retained. As discussed, we do not consider the proposal as adequately addressed habitat compensation issues. We suggest that this material issue must be addressed. Failure to adequately address this issue may result in Regulation 44 (2) (e) licence applications being refused.
15	FCC needs to consider issues of biodiversity in its planning decisions. Insufficient survey and mitigation info has been provided for FCC to do this. "mitigation	The working area of the quarry is not currently "*optimal*" for amphibians. It might be suitable for amphibians – but without stable vegetation, with constant earthworks and vehicle movements and with limited refugia the area is		From previous experience, active quarrys can support very large amphibian populations, e.g. Hafod, Standard, and Brookhill, We therefore disagree with statements suggesting the site is

	proposals are likely to result in the loss of areas of optimal amphibian habitat following pond creation". Proposes creating ponds on land adjacent (not owned by developer) and on top of tip after it's closed.	definitely not optimal. The proposed creation of the new SAC/SSSI extension will provide optimal (specially designed) amphibian habitat which is a stable, fenced area with meadow and shrub vegetation, 2 new ponds and refugia. We believe that the creation of this area, together with the adjacent former railway line will more than compensate for the loss of sub-optimal habitat within the working quarry.		not optimal for amphibians We do not consider proposals identified with the ES satisfactorily EPS compensation issues during the operational phases of the proposal We were concerned that your proposals would entail the construction of ponds within woodland communities. This would have resulted in the loss of amphibian terrestrial habitat. We therefore welcome your verbal proposals for pond construction to take place outside wooded habitats
16	Need full consideration of alternative sites	Consideration of alternative sites was assessed within the Need Chapter of the Environmental Statement and drew on information considered within the Enviros market study.	See ES Section 2.4.3	We note and accept your comments.
17	Need to consider existing sites' further capacity	The capacity of existing sites was addressed within the Enviros market study supplied within the planning bundle and the issues raised are fully discussed within the need chapters within the Environmental Statement. We would also point out that as stated within the Enviros report all capacity at both Brookhill and Llandullas is taken up by existing long term contracts and that there is therefore no available additional void space available for arisings of waste generated within FCC's boundaries. At the time of the production of the Environmental Statement, Mersey Waste had given undertakings that Hafod Quarry would only accept waste generated within Merseyside boundaries. We would also point out that neither Llandullas or Hafod is acceptable on the basis of the proximity principle. Sending FCC's waste arisings to these sites would generate additional traffic and emissions burdens which	See ES Section 2.2.2	We note and accept your response to our comments. For your information, I understand that c.40% of waste entering Hafod is of Welsh [Wrexham] origins.

		would far outweigh any advantage to be gained from using these existing sites.		
18	The site should contain a MRF to maximise recycling	An MRF is already present on site to recycle inert materials from waste arisings delivered to the site and has a valid waste management licence. This facility will allow the site to eliminate the use of any virgin materials apart from tarmac and poured concrete from the construction of roads and other infrastructure, placement of daily cover, drainage blanket and site restoration.		i) We note your comments ii) During our meeting, you indicated that the use of more sophisticated MRF technologies was being investigated to increase recycling rates. We welcome this proposal.
19	Full detail of design and operations needed for FCC Planning decision makers. Particularly details of litter and pest control.	Additional reports concerning, odour management and bird control are currently being compiled for submission to FCC.		Noted. We welcome the submission of these reports.
20	Flaring of gas prior to its collection could affect birds	The flare is an enclosed stack (see the design statement) and will not generate glare.	Planning Proposal Design Statement, submitted along with the ES.	Noted
21	Putrescible waste and green waste should be diverted away from landfill to reduce production of gas.	The need statement for the site and the Enviros report took account of the requirement for FCC to reduce by 25% the amount of waste being disposed of to landfill. We would also point out that the final finished contours and levels for the site will not be exceeded under any circumstances. No allowance for settlement has been made within the design statement to allow an increase in available void space and the final cap will be designed in order to minimise any substantial change in the final landform post settlement.		We note and accept your response to our comments.
22	Site restoration after closure should include wildlife corridors,	It does! These are proposed in the ES. Meadow and woodland restoration of the whole	See ES Section	We note your comments and do not consider this to be a material issue.

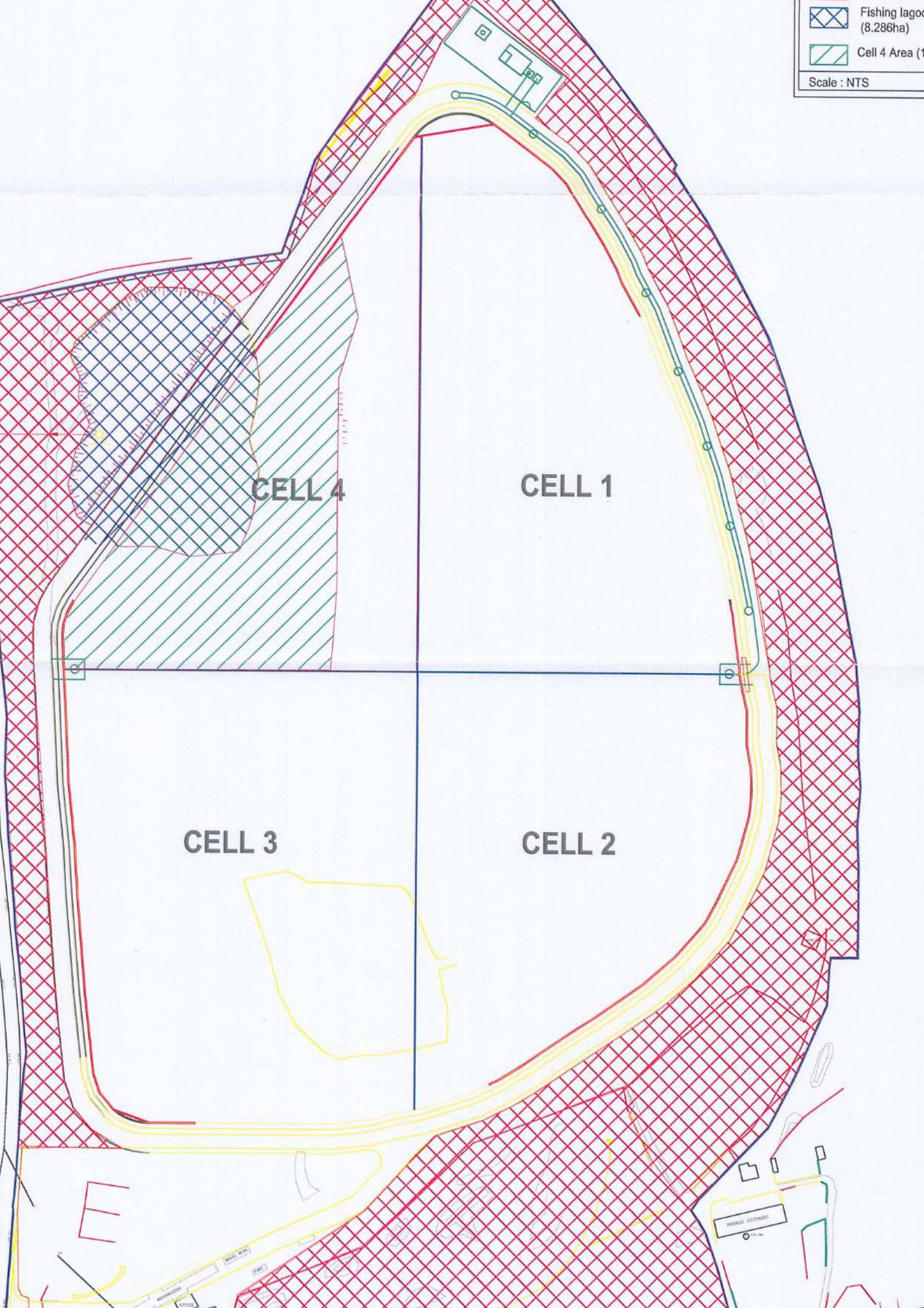
	habitats to function as stepping stones etc., hedgerows and trees to be retained and managed.	of the closed landfill site, including the former railway line along the eastern boundary of the site. Including the original SAC/SSSI and the new extension to the SSSI, this amounts to 18.75ha of new green space.	11.8.6.	
23	Restoration of the closed site at the end of the development should consider local biodiversity objectives and habitats – hedgerows, woodland etc.	It does! We have proposed in the ES that restoration will be wildflower meadow and belts of native woodlands planted with stock of known local provenance.	See ES Section 11.8.6.	We note your comments and do not consider this to be a material issue
24	Key concerns are size, location and design of mitigation/compensation. Recommends refusal	We have proposed an initial approx. 50% increase in size of the SAC/SSSI, which includes a 1175m stretch of former railway line (woodland) habitat, amounting to a total of some 7300m2 new protected SAC/SSSI, including this green corridor. After site closure, the whole site will amount to approximately 18.75ha of new open green space and woodland. We believe that this is significantly more than compensation for loss of the existing continuously disturbed operational quarry void. It is proposed in the ES that a sum be commuted for the long term management of the site (20yrs) and discussions have now taken place with NEWW regarding long term management of the site.	See ES Section 11.8.5	We do not accept this statement. In our view, the proposed compensation scheme is not adequate during the operation phase of the landfill site. To inform decision making, we advise the use of like for like throughout the duration of activities at the Quarry. We welcome your suggested verbal proposals in respect of increasing the extent of wildlife corridors around the perimeter of the site. We look forward to seeing these proposals being incorporated into amended design plans for the site. We note and accept your proposals in respect of possible long term site managers. However, we previously advised to you that other parties, such as Flintshire County Council's Countryside Service, are also capable of managing compensation areas. A list of possible site managers is attached for your information
25	Proposal is likely to have a significant effect on the Deeside and Buckley SAC/SSSI Newt Site – therefore proposal needs an Appropriate Assessment.	As has been noted the site is already permitted to discharge water from the dewatering ponds which we assume in the absence of comments to the contrary from CCW has no impact on the sites cited within their letter. Any permitted discharge from the site under PPC is unlikely to	Design Statement submitted with the ES.	i) We note your comments. ii) In our view, it appears that cumulative impacts have not been considered. iii) We are of the view that direct impacts are not likely to affect the integrity

		have any additional impact. The site has been designed to ensure that there is sufficient buffering capacity within the dewatering ponds to regulate the rate of discharge of water from the site. No leachate or contaminated run off of any sort will be directed to the dewatering pond, this will only be utilised for the storage and discharge of basal groundwater during cell preparation and initial filling. The proposed extension to the SSI/SAC to include the former railway line corridor, together with the creation of new ponds and restoration of existing ponds will significantly increase the area available for GCN and will significantly enhance the quality of habitat for GCN. The exclusion fencing and translocation of GCN from the working part of the quarry will improve significantly the protection for GCN within the quarry. In addition, the proposed long-term management plans, to be carried out by NEWW will ensure that the habitat remains in excellent condition for GCN. There is excellent potential for the whole are of the restored site to be available for GCN after closure and restoration has been completed.		of the site. However, we are of the view that indirect impacts have not been satisfactorily addressed. Without prejudice, the principle of proposals discussed during our meeting should address our concerns in relation to indirect impacts.

APPENDIX 2. TREE SURVEY FOR BAT ROOSTS, PARRYS QUARRY, MARCH 2007 (all trees <10cm DBH)
(see sketch map 1)

Tree	Species	Description	DBH (cm)	Height (m)	Condition	Bat roost potential?
1	*Salix caprea* (goat willow)	Semi-mature. Multi-stemmed (4 No)	10-20	4.5	Good	None
none	*Betula pendula* (silver birch) 4 individuals	All young	9-10	4-5	Good	None
2	*Betula pendula* (silver birch)	Semi-mature, with horizontal bend (at 2m height)to main stem/branch. No visible damage on trunk/main branches.	19	2.5	Intact but very poor habit	None
3	*Salix caprea* (goat willow)	Semi-mature. Intact, with ivy growing on lower third of trunk	16	3.5	Intact but poor habit	None
4	*Salix caprea* (goat willow)	Semi-mature; straggly ivy on lower 40% of trunk	14	3.5	Intact but slightly leaning	None
5	*Quercus robur* (oak)	Intact, semi-mature, no visible damage.	17	4	Good	None
6	*Salix caprea* (goat willow)	Semi-mature. Multi-stemmed. Aerial branches broken off. Ivy on all lower 2m of trunk.	20	3	V poor. All aerial branches broken off at 3m	None
7	*Salix caprea* (goat willow)	Semi-mature. Multi-stemmed (3 No). Main stem broken off at 1m. No damage on trunk.	5-7	2	Poor (main stem broken off at 1m)	None
8	*Betula pendula* (silver birch)	Semi-mature; ivy on trunk to height of 5m. No visible signs of damage.	24	7	Good	None
9	*Salix caprea* (goat willow)	Semi-mature. Multi-stemmed	4-8	2	Poor. 2 main stems broken off at 1.5m	None
10	*Salix caprea* (goat willow)	Semi-mature. Multi-stemmed. Lower 4m clothed in ivy. No visible signs of damage.	5-12	5.5	Moderate	None

11	*Betula pendula* (silver birch)	Semi-mature. Ivy clothing lower 3m of trunk. No visitble damage.	16	8	Good	None
12	*Quercus robur* (oak)	Mature. Ivy on lower 3.5m of trunk. All limbs in good condition. No cracks, No fungal damage, no broken branches, No holes etc.	51	8	Good	none
13	*Quercus robur* (oak)	Semi-mature. Multi-stemmed. % branches broken off at 1-2m height. Ivy on all limbs to a height of 1.5-2m.	5-10	2.5	V poor	None.
14	*Quercus robur* (oak)	Semi-mature. No visible signs of damage (no cracks, holes, fungal damage etc).	18	8	Good	None
15	*Betula pendula* (silver birch)	Semi-mature. Ivy clothing most of tree to 4m height. Stunted crown. I branch broken off at 5m. No visible cracks, holes etc.	17	6	Moderate	None
16	*Quercus robur* (oak)	Semi-mature, 2 stems. No visible damage to trunk or branches.	12 and 15	6.5	Good	None
17	*Quercus robur* (oak)	Semi-mature. 2 main stems. No visible damage to trunk or branches.	6 and 9	4.5	Moderate-good	None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(8.286ha)
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CELL 4
CELL 1
CELL 3
CELL 2

Highways and Transportation Division
Is-adran Priffyrdd a Chludiant

CYNGOR
Sir y Fflint
Flintshire
COUNTY COUNCIL

Opus International Consultants (UK) Ltd
Burton House
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LL12 0HY

Your Ref/Eich Cyf	HD/PJT/42468
Our Ref/Ein Cyf	20 March 2007
Date/Dyddiad	Mr P Traynor
Ask for/Gofynner am	01352 704610
Direct Dial/Rhif Union	
Fax/Ffacs	

For the attention of: Hywel Jones

Dear Sir

PARRY'S QUARRY, PINFOLD LANE, ALLTAMI, MOLD, FLINTSHIRE
CONSTRUCTION AND OPERATION OF A SOLID WASTE LANDFILL

Please find attached comments received from the North Wales Trunk Road Agency on 05 February 2007 with respect to the traffic signal works as part of the above proposals.

Yours faithfully,

[redacted]

For Chief Highways and Transportation Officer

Dave Faulkner
Acting Director of Environment and Regeneration
Cyfarwyddwr Dros Dro yr Amgylchedd ac Adfywio

Environment and Regeneration Directorate
Cyfarwyddiaeth yr Amgylchedd ac Adfywio

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Asiantaeth Cefnffyrdd Gogledd Cymru
North Wales Trunk Road Agency

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Uned Rheoli Cefnffyrdd / Trunk Road Management Unit

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Ein Cyf / Our Ref: TRA/TEI/F/JY
Eich Cyf / Your Ref:

Acting Director
Environment and Regeneration
Flintshire County Council
Mold
Flintshire
CH6 6NF

31 January 2007

Dear Sir,

Parrys Quarry, Planning Application & A494 (T) / Pinfold Lane, Altami – Traffic Signals

I refer to my engineer, Mr J Yorke's, meeting with your Mr P Traynor on 25th January 2007 relating to the above subject.

As discussed, I confirm that this Agency at this time requires the following issued to be highlighted and pursued with the applicant:-

1) expected additional flows (and type) generated by proposal. Their likely hours of operation and, arrival and departure rates to / from the quarry. Peak hours conflict are of special importance.

2) that capacity of signal installation, using OSCADY, is presented with each of the following concepts:-

   a) as per applicants submission with widening of Pinfold Lane

   b) as per applicants submission but with lane 1 as left turn only lane which could be released when right turn into Pinfold Lane from A55 is released – subject to creation of 'no U turn' order on A494

   c) with each Pinfold Lane leg running as separate stage

   d) ability to alter present staging – say both A55 right lanes running together

ER039187

FLINTSHIRE COUNTY COUNCIL
DIRECTORATE OF ENVIRONMENT AND REGENERATION
- 5 FEB 2007
MAIL SERIAL NO: ER
RECEIVED

✓	DTR				
	CESO				
	CPSO				
	CEMS				
✓	CHTO	PJ			
	DRG	91 – 92 Bowen Court			
		Pfordd William Morgan			
		St Asaph Business Park			
ACK		St Asaph			
DELT WITH		Denbighshire LL17 0JE		FILE	

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3) applicant to ensure County would allow ' KEEP CLEAR' carriageway marking for entry only into quarry, as any backup created by such waiting vehicles would impact upon the junction

4) increasing flows at this site will exacerbate problems of interaction between this site and the adjacent Alltami, The Goldmine PH, signal installation during the morning peak hour. Applicant to report on linking of that MOVA site and this MOVA site for that period especially.

5) applicant to be made aware of his liability of all costs in amending the signal installation (note island on A494 (T) is shown as to be confirmed. This island is most important with regards to turning circle, especially if Pinfold Lane is widened even further as provisionally discussed) Formal Section 106 & 278 agreements will have to have my inputs at a later stage, but I hope the above assists you in your deliberation.

6) Vehicle washing facilities in form of wheel bath for exiting vehicles from the quarry to be provided, with sufficient quantity to allow for breakdown of a unit(s).

Yours faithfully

[redacted]

Dave Cooil
Network Manager Area 2

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10 April 2007

The Director of Environment and Regeneration
Flintshire County Council
Planning Department
County Hall
Mold
Flintshire CH7 6NF

For the attention of Mr R Bennion

RC5101/WHMJ/SEA

Dear Sirs

PROPOSED DEVELOPMENT AT PARRY'S QUARRY
PINFOLD LANE, ALLTAMI, MOLD, FLINTSHIRE

We refer to the letter dated 20th December 2006 (ref: DY/KW/04) from Brock Plc making representations about the above planning application and comment as follows (using the numbering system in their letter):-

Paragraph **1.1**

The proposed site access will be relocated to a distance 45 metres from the stop line at the traffic signals. In addition, and at the request of the Highways Authority, an additional entry lane will be provided at the approach from the site to improve the operation of the junction. The proposed access will be able to accommodate HGVs entering and leaving the site at the same time.

It is predicted that the Parry's site will generate some 95 HGV movements per day from the landfill operations and quarrying operations which will continue as at present and will generate some 20 HGV movements per day, i.e. approximately 12 HGVs per hour or 1 every 5 minutes. The existing approach from Pinfold Lane can only accommodate 2 HGVs between the site entrance and the stop line to the traffic signals. Surveys have shown that on a typical day 30 HGVs enter and leave Pinfold Lane via the traffic signals in the peak hour, i.e. 1 every 2 minutes. This will increase to 40 HGVs when the landfill site is operating (i.e. 1 every 1.5 minutes and therefore it is contended that the additional stacking capacity created by the additional entry lane will more than accommodate the additional traffic generated by the landfill site.

In addition, it is believed that driver behaviour and good driving practice would dictate that even if the queue of HGVs at the lights did potentially extend to or beyond the entrance to the proposed landfill site then a gap would be left to allow vehicles to enter the site instead of blocking the access. In the unlikely event that this should prove to be a problem then yellow 'box markings' or 'Keep Clear' markings could be laid to prevent HGVs and other vehicles from blocking the access to the landfill site. In addition, HGV vehicles turning right from the A494 would not enter the traffic signal controlled junction unless the exit road (Pinfold Lane) was clear. The applicant therefore does not accept the objector assertions.

Cont'd ...

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Paragraph 1.2 – 1.3

The applicant repeats the same argument and the applicant's response is as given above.

Paragraph 1.4

The objector suggests a different location for the site access however, the present arrangements are considered to be the most appropriate by the applicant.

Paragraph 2 and 2.1

The objector simply repeats previous objections and suggestions.

We trust you find the above helpful but please do not hesitate to contact us if you have any queries.

Yours faithfully

[redacted]

pp W H M Jones
Divisional Director

Copies to: Mr G Robbins
Mr G Bishop

10 April 2007

Flintshire County Council
Planning Department
County Hall
Mold
Flintshire CH7 6NF

For the attention of Mr R Bennion

RC5101/WHMJ/SEA

Dear Sirs

PROPOSED DEVELOPMENT AT PARRY'S QUARRY
PINFOLD LANE, ALLTAMI, MOLD, FLINTSHIRE

The Environmental Statement indicates that the landfill site will accept approximately 150,000 tonnes of waste per annum (paragraph 8.5.6) divided approximately into 90,000 tonnes of municipal waste and 60,000 tonnes of commercial and industrial waste.

On the basis that the landfill site is operating on 260 days in the year, the average weight of waste delivered to the landfill site each day will be 576 tonnes (346 tonnes of municipal waste and 230 tonnes of commercial and industrial waste).

For the purpose of estimating vehicle movement to and from the landfill site, it is assumed that the refuse collection vehicles (RCVs) will have a carrying capacity of 7.2 m^3 (7.2 tonnes based on 1 tonne of municipal waste weighs 1 tonne).

With regards to the collection of municipal waste, it has been estimated (from information relating to the Brookhill landfill site) that 36 trips will on average be made by RCVs to the proposed landfill site and an average of 12 vehicles will carry waste to the landfill sites from civic amenity sites in Flintshire.

Vehicles carrying commercial and industrial waste to the landfill site will vary in pay load capacity and for this assessment it is assumed that the average pay load is 5.5 tonnes and the number of trips will be 48 per day.

In addition, it is assumed that the waste recycling facility, that has previously been granted planning permission, will generate approximately 5 trips per day. The number of trips on an average day to the landfill site will therefore be approximately 95.

Trip Origins and Destinations – Municipal works

Flintshire currently have 12 RCVs operating each day, 6 serve the main centres of population within the County i.e. Mold/Buckley and Mynydd Isa (2), Greenfield and Holywell (part) Connah's Quay, Flint and Holywell (part) and Saltney/Broughton/Hawarden. These make 3 trips to the existing landfill site at Brookhill on Mondays to Thursdays and 2 on Fridays.

The other 6 RCVs serve outlying communities and visit the landfill site twice a day.

Cont'd ...

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On this basis, it is estimated that 60% would travel to the landfill site via A494 east, 20% via the A494 (west) from the Mold direction and 20% via Pinfold Lane. Of these travelling via A494 east, it is estimated that 50% would travel along the A55 to the Ewloe Interchange before accessing the landfill site from the A494 east. The number of RCVs reaching the landfill site via this route would therefore approximately be 15 per day.

The RCVs are currently parked overnight at the Queensferry depot which is accessed off the B5129 Chester Road East and they would return to the depot at the end of the day via A494 east.

The origins of the commercial and industrial waste stream would vary depending upon the sources of waste and cannot be estimated to the same level of confidence as the municipal waste stream where waste is collected from predetermined sources. The assessment has assumed therefore that the trip generation for the commercial and industrial waste would follow a similar pattern to the municipal waste i.e. 60% arriving from A494 east, 20% from A494 west and 20% from Pinfold Lane.

On the basis that 95 vehicles will on average visit the landfill site during a typical day, 57 would arrive via the A494 east with 20 having travelled along A55 and the Ewloe Interchange, 19 would arrive via A494 west from Mold direction and 19 would arrive via Pinfold Lane.

The proposed landfill site also operates as a quarry and if it was to continue then typically 20 vehicle trips would be generated each day (HGVs) – typically 20 tonne wagons. From available weighbridge data, it is apparent that up to 90% of trips would have destinations to the east of the site where the vast majority of markets are located.

The Environmental Statement includes Table 8.3 and 8.4 which outlines the typical hourly profile of vehicles (carrying municipal waste and commercial and industrial waste) to the Brookhill and standard landfill sites in December 2002. A typical hourly profile of vehicles leaving the existing quarry in 2005 is included in the table in paragraph 8.7.4. The tables show that trips to the existing landfill site for both municipal and commercial and industrial waste are evenly distributed throughout the working day and similarly trips to and from the existing quarrying follow a similar pattern.

In order to verify this data, a classified turning count was carried out to establish traffic flows to and from the existing Brookhill Landfill site at Pinfold Lane Industrial Estate, Buckley. The count which was carried out on Wednesday, 24th January 2007 recorded vehicles entering and leaving the landfill site and joining Pinfold Lane.

The count recorded 99 vehicles leaving the landfill site during the period 08.00 – 17.30 hours and 101 vehicles entering the landfill site. These figures are similar to the flows estimated to be generated by the proposed landfill site at Parry's Quarry and included in the Environmental Statement.

The breakdown of the movements by hour are given below:-

Time	In	Out
08.00 – 09.00	15	6
09.00 – 10.00	14	9
10.00 – 11.00	12	13
11.00 – 12.00	10	12
12.00 – 13.00	11	9
13.00 – 14.00	11	13
14.00 – 15.00	9	11
15.00 – 16.00	9	11
16.00 – 17.00	4	9

Cont'd ...

Of the 99 vehicles that visited the landfill site, 7 were cars, 8 light goods vehicles, 44 refuse collection vehicles/skips and 37 were wagons. In addition, there were 2 articulated lorries. Again these figures are similar to those estimated in the Environment Statement.

The traffic movements associated with the existing landfill site is generally evenly distributed throughout the day with a combined total of movements of approximately 20 each hour.

It is apparent from the count at the junction with Pinfold Lane that approximately 50% (51) vehicles entered the landfill site from the direction of Ewloe Place and Liverpool Road, Buckley whilst the remainder 48 travelled to the site via Pinfold Lane and the A494. Of the vehicles leaving the landfill site 24 left via Ewloe Place and Liverpool Road and 70 left via the A494.

The Welsh Assembly Government have proposals for two major road improvements along the A494/A550/A55 corridor. The A494 Drome Corner to Ewloe Improvement, which is a Phase 1 scheme in theirTrunk Road Programme involves widening the A494 at Aston Hill to three lanes wide with a crawler lane for southbound traffic (up the hill). The scheme includes a reconfiguration of the junction and slip roads at Ewloe Interchange and when completed will result in the removal of the off slip road link for A55 traffic which at present joins at Ewloe Interchange. Landfill traffic from the Holywell/Flint area which would normally travel to the site via Ewloe Interchange and A494 east will have to continue along the A55 to the Queensferry Interchange before travelling southwards up Aston Hill. This will result in the landfill traffic to and from A55 west (predicted to be 28 vehicles per day) travelling to and from the site via the Queensferry Interchange.

Other network traffic currently undertaking this movement will all have to follow this extended detour.

During the construction of the improvement works, traffic flows on the A494/A550/A55 will be disrupted and measures will be put in place to ensure that network traffic does not divert along other unsuitable local roads. The Welsh Assembly Government has confirmed that two lanes of traffic will be maintained on the A55/A494/A550 at all times during the work to minimise disruption to traffic.

With respect to the programme for this scheme, the Welsh Assembly Government have published draft Slip Road, Side Roads and Compulsory Purchase Orders and it is likely that a public inquiry will be held to consider objections raised. Although it is not possible to confirm an opening date for the scheme, it is likely to be after the opening of the proposed landfill site.

The second Welsh Assembly Government's scheme 'A55/A494 Ewloe Interchange with a connection to the A494 to Mold A55 Ewloe to Northop Improvement' is included as a Phase 2 scheme on the Trunk Road Programme. A public consultation on possible route options was held between May and July 2006.

The scheme includes the construction of a new interchange on the A55 just west of the existing Chester West Services with a direct connection with Pinfold Lane and there are options for the A494 link between the end of the Mold Bypass and the new interchange on the A55.

If the scheme were to proceed the A494 to the east of the traffic signal controlled junction at Alltami would effectively be stopped up and the existing road would remain open to serve as an access only road for the Ewloe Barns Industrial Estate, Smithy Lane and residential properties alongside the road.

Landfill traffic will therefore have a high standard connection between the A55 and the site. The new interchange would be used by all landfill and quarry traffic from the A55 and would negate the attractiveness of using Liverpool Road or other less suitable routes to get to the site.

Cont'd ...

This introduction of a 'routing agreement' would assist in ensuring that landfill traffic only uses the most appropriate routes to and from the site and so avoiding less suitable residential roads.

We trust the above clarifies the assessment of vehicle movements associated with the proposed landfill development and its likely impact of the proposed Trunk Road Improvement scheme on those movements.

Please do not hesitate to contact us if you have any queries.

Yours faithfully

pp W H M Jones
Divisional Director

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planit
intelligent environments

Our Ref: PL787/AV/KJ

Giles Bishop,
Amec Earth and Environment
Unit 1 - Long Barn
Pistyll Farm
Village Road
Nercwys
Mold
CH7 4EW

26th March 2007

Dear Giles

Re: Parry's Quarry – Landscape & Visual Assessment
Response to Objections raised by Brock plc

I refer to the letter from Mr D Young of Brock plc dated 21st December 2006 and addressed to Flintshire County Council. In the letter, Mr. Young outlines a number of objections to the proposed landfill development at Parry's Quarry. As requested, I am responding below to the matters that he has raised in his letter regarding landscape and visual assessment.

In responding to Mr Young's comments, I have made reference to the numbering in his letter of 21/12/06 and deal with each of the relevant issues in turn.

3. *Adverse Visual Impact above the existing ridge with land raising Municipal Waste into the skyline because the application is excessive in scale.*

The landscape and visual assessment has considered the proposals in terms of their likely impact on the skyline and wider landscape character. The key views identified are from Northop Hall to the north and the edge of Ewloe to the southeast. Whilst the proposed landform will be visible from these locations above the tree line surrounding the site, it appears as a shallow domed feature that echoes the undulating character of the surrounding landscape. The assessment concludes that following restoration, the landform is able to be accommodated without significant adverse impact on the skyline or landscape character.

4. *Inadequacy of ES in assessing Visual Impact on Hotel, Restaurants, Service Area and Main A55 Tourist Route into N. Wales.*

In identifying the principal viewpoints used for the production of photomontages, site survey was undertaken to understand the likely extents of visibility and key viewpoints. It was clearly apparent from site visits that the tree belt along the eastern edge of the site would significantly screen views of the development from the service area. Site photographs within Figures 6.9 and 6.10 were provided to illustrate the screening effect of the tree belt.

The original assessment was undertaken when the trees were in leaf and they form an effective screen to the proposed development. It is now apparent that over the winter months there will be filtered views through the trees from the Service Area. What is also apparent is that the existing mounding along the eastern edge of the site will have a significant role to play in terms of screening the inner part of the site. At ground level within the service area, the top of the proposed mound will be barely visible above the perimeter mound, and even then, views will be filtered by the intervening tree belt. Given the potential for these filtered views, it may be advisable to extend the 4m-screen fencing that is proposed along the northern boundary, around the eastern perimeter of the site. This should effectively provide an adequate screen to the service area over the winter months.

Observation from a car approaching the site along the A55 reveals that there is substantial tree cover between the road and the development site. We have analyzed likely visibility from the road and this confirms that there is unlikely to be any significant views of the development or restored landform from the road.

Our assessment discusses the implications of the A55 / A494 Highway Improvement Proposals and highlights potential future impacts. It is clearly impossible at this stage to carry out a formal assessment of impacts for a number of reasons. It is our understanding that the various options are currently the subject of consultation and there is no clarity over which of the options may ultimately be adopted. Furthermore, the lack of detail in respect of the proposals does not allow a meaningful understanding of impacts and mitigation measures. In the circumstances, we believe that it would be unreasonable to expect a full assessment of impacts in relation to proposals that are far from clearly defined.

10. *Third Lane Road widening because of the intensified use creates adverse screening and visual impact into the Quarry.*

Mr. Young has quoted the following statement from the Environmental Statement:-

> *"The widening of Pinfold Lane as currently proposed would require the removal of a significant width of the tree belt along the western edge of the site. This would seriously compromise the screening effect of the trees to Pinfold Lane."*

There appears to be some confusion on his part as this comment relates to the potential implications of the A55/A494 Highway Improvement Proposals and not the access works relating to the Parry's Quarry planning application. The highway works required to form the new access and short section of 3-lane widening has only limited impact on the existing tree cover along Pinfold Lane. The additional lane will eat into the edge of the site at its southwest corner but there are currently no trees in this area. The necessary sight lines from the proposed access is likely to require minor removal of a narrow section of the existing tree belt, but this will not significantly impact on the screening effect of these trees.

11. *Landfill Gas Flaring visual effects not assessed.*

I understand that it is proposed to locate a single flare stack within the far north eastern corner of the site. This will be a structure of approximately 2.5m wide by 7 to 8m high and will have an associated plant building of approximately 2.5m high.

On the basis that there will be a 4m-high screen fence around the edge of the site, the plant building will be entirely screened from view from outside the site. The top of the flare stack is likely to be just visible from the industrial area to the north of the site, and there may be potential views over winter, filtered through the trees, from the northern part of the service area, It should be noted that the gas flaring will not produce any visible naked flame but rather, a heat haze effect which will not be greatly prominent.

In the context of the wider views identified, the flare stack is only likely to be visible from the view from Northop Hall. From this distance, the stack will represent a minor element in the view and ultimately will be located in context with new tree planting.. The visual impact of the flare stack is considered to be of minor significance.

I trust that the above deals satisfactorily with the issues raised, however, if you need us to provide additional clarification on any matters, please don't hesitate to contact me.

With regards.

Yours sincerely
for Planit-ie

Andrew Vaughan MLI
Associate Director

ADDENDUM CONCERNING HYDROGEOLOGY ISSUES

PARRY'S QUARRY, ALLTAMI

PREPARED BY AMEC EARTH AND ENVIRONMENTAL

This document is an addendum to, and to be read in conjunction with, Environmental Statement Chapter 7.0 Hydrology and Hydrogeology. The need for this addendum arose from a meeting held in order to meet the requirements of the EA and Planning Authority for further detail in the Environmental Statement concerning proposed Landfill Operations at Parry's Quarry, Alltami, Mold. The requirements were discussed at a meeting held on Tuesday 30 January, 2007 which was attended by AMEC representatives, R Bennion and C Ringrose of Flintshire County Council and Dave Headworth of the Environment Agency. The following works were identified from the meeting:

1) Review geology in detail (from BGS 1:50,000 and 1:10,000 scale maps) to produce cross sections and a conceptual geological model of the quarry and its surrounds.

2) Review catchment areas of Alltami and Wepre Brooks, make some estimates of flows under various rainfall scenarios.

3) Reassess possible dewatering scenarios and some more detail on likely infrastructure.

4) Obtain available information on flows, rainfall, water quality etc from EA.

5) Carry out two more dip rounds on the site boreholes.

6) Carry out some snapshot flow gaugings on the Alltami and Wepre Brooks.

7) Carry out some surveys on brook streambed levels.

8) Review ES water chapter and produce update supplement.

This addendum presents the results of these works.

Please note that the titles and heading numbers follow the original ES

7.3 Baseline Conditions

Additional baseline information was obtained from:

- Amec surface water level and flow measurement and groundwater level measurement carried out in March 2007;
- Daily meteorological data obtained for Hawarden Airport from January 2001 to October 2006;
- British Geological Survey (BGS) borehole data was also examined. Apart from the boreholes drilled as part of this project, BGS possesses information

from some boreholes which are less than 10m deep and some between 10 and 30m deep associated with the construction of the A55 in the block to the east of the site. It was not thought that these would yield significant additional information for the project and further details on these were not sought.

7.3.1 Hydrology

Flow monitoring of the Alltami and Wepre streams was carried out on 16 March 2007 and 29 March 2007. The coordinates, elevations and flows are given in Table 7.1A.

Table 7.1A Surface water flow monitoring of the Alltami and Wepre March 2007

Location	Easting	Northing	Elevation mAOD 16/3/07	16 March 2007 Flow l/sec	29 March 2007 Flow l/sec
R1	327118	366561	93.95	38	21
R2	327424	367002	79.96	45	2.3
R3	327566	367097	75.96	104	57
R4	327663	367153	73.24	72	37
R5	327420	366982	83.55	25	0
R6	327743	367490	65.45	86	34
R6a	327748	367478			21
R6b					13

The locations are shown on Figure 1. Location R5 is at the discharge pipe from Parry's Quarry immediately prior to the discharge point into the Alltami. R2 is on the Alltami immediately downstream of the discharge point. R6 is on the Wepre immediately downstream of the Wepre / Alltami confluence, R6a is on the Alltami immediately above the confluence and R6b is the difference, ie the flow of the Wepre. These measurements were taken during a relatively dry period and are likely to approximate the seasonal base flow rate. The 29 March measurements were after around three weeks during which there had been no significant rainfall. The data suggest that the Alltami is receiving water from groundwater between R2 and R3 and losing water to groundwater between R3 and R4 and between R4 and R6a. This conclusion can only be considered tentative at this stage because of the methodology (impeller flow meter in a rather irregular stream bed configuration) and the measurement frequency (two spot measurements). If this conclusion is accurate, then groundwater flow via the fault / fracture systems is suggested and flow into the Gwespyr Sandstone from the Alltami stream in the fault block in which R4 is located may be occurring.

Based on Hafren Water's estimate of dewatering requirements of 25 l/s for an excavation to 70m AOD, the proposed invert of 82m would result in an inflow from groundwater of about half this amount, say 12.5 l/s. This is equivalent to around one quarter of the low flow of the Alltami at R3, 180m downstream of the discharge point. This proportion would decrease during periods of greater rainfall (see below). Based on the tentative conclusion that downstream of R3 the Alltami loses water to groundwater, the fate of water pumped from the site for dewatering would be to enter the groundwater downstream of R3.

7.3.2 Rainfall

The Alltami catchment is approximately 6.9 km2 of which 0.9 km2 is the catchment between R2 and R6. The daily rainfall record for Hawarden Airport for the period Jan

2001- Sept 2005 is shown in Figure 5.. Blank periods of one month or more represent periods for which there is no record. Taking the wettest day within this period of 17 July 2003 of 43.6mm and a rainfall runoff coefficient of 75% would give a flow at R2 of 2270 l/s. In this instance the groundwater dewatering requirement of 12.5 l/s calculated above would comprise around 0.5% of the stream flow.

7.3.7 Local Geology

Based on the 1:10,000 geological map of the area the downthrows of the faults immediately to the east and west of the site have been estimated at 200 – 240m for the former and 60m +/- 15m for the latter, see Figure 2.

Geological Sections are presented in Figures 3 and 4. Figure 3 is parallel to the direction of dip observed in the fault block in which the site is located and includes data from boreholes SBH4, 6 and 7, DBHB, PQ4 and PGW1. The section shows that it is difficult to identify clear marker horizons. However, the sandstone layer immediately beneath the drift deposits in the area of the site is apparent though the dip cannot be confirmed due to PGW1 not identifying it and SBH4 not penetrating it.

Figure 4 is a strike section along eastern site boundary fault and presents data regarding the strata looking eastwards and superimposes the strata encountered west of the fault line.

Figure 2 (geological map) indicates that the dip of the block immediately to the east of site and down hydraulic gradient from it is towards the south east at around 16 degrees whilst that of the block at the site is to the north east (see Figure 4). Also the proportion of the potentially more permeable strata such as sandstones or even silty sandstones is limited. The combination of these two factors indicates that the opportunity for permeable strata to abut other permeable strata across a fault, assuming the fault permitted flow, is very limited. It is therefore much more likely that flow will be controlled by fractures rather than primary permeability.

The only exception is at the northern end of the site where the site block abuts the Gwysper Sandstone to the east. However, given the northerly groundwater flow direction, these strata, if part of the flow path from the site, will still be to the same portion of the Alltami.

7.3.10 Hydrogeology

Groundwater Levels and Flow

Groundwater levels measured on 16 March 2007 and 29 March 2007 are listed in Table 7.2A where they are compared with those measured on 10 August 2006.

Table 7.2A Groundwater Levels measured at Parry's Quarry on 29 March 2007, 16 March 2007 and 10 August 2006

Borehole	Groundwater Elevation (m AOD)			Difference
	29 Mar 2007	16 Mar 2007	10 Aug 2006	16/3/07 – 10/8/06
SBH1	91.34	91.61	88.99	+ 2.62
DBHA	91.40	91.68	88.81	+2.87
SBH2	Lost	Lost	94.49	-
SBH3	92.20	93.04	91.46	+1.58
SBH4	96.31	96.62	95.44	+1.18
SBH6	100.85	101.04	100.02	+1.02

SBH7	92.13	92.78	92.42	+0.36
DBHB	93.01	93.65	92.34	+1.31
PQW1	97.18	97.61	96.07	+1.54

Compared with the groundwater levels measured in August 2006, the March 2007 levels show a similar south to north groundwater gradient. The March 2007 gradient was approximately 2.4% from 101m in the south to 91.6 in the north, compared with 3% in August 2006. The higher levels of March relative to August are likely to reflect seasonal groundwater level changes. The rise is more noticeable in the northern, down hydraulic gradient, boreholes. The 29 March levels indicate a decline relative to those of 16 March commensurate with the lack of rainfall in this period. Those closest to the ponds (SBH3 and SBH7) showing the greatest decline. This is probably due to the changes in water levels in the ponds due to pumping activities at the site.

The downward hydraulic gradient noted in both sets of paired boreholes (SBH1/DBHA and SBH7/DBHB) in August 2006 was reversed to a slight overall upward gradient in March 2007.

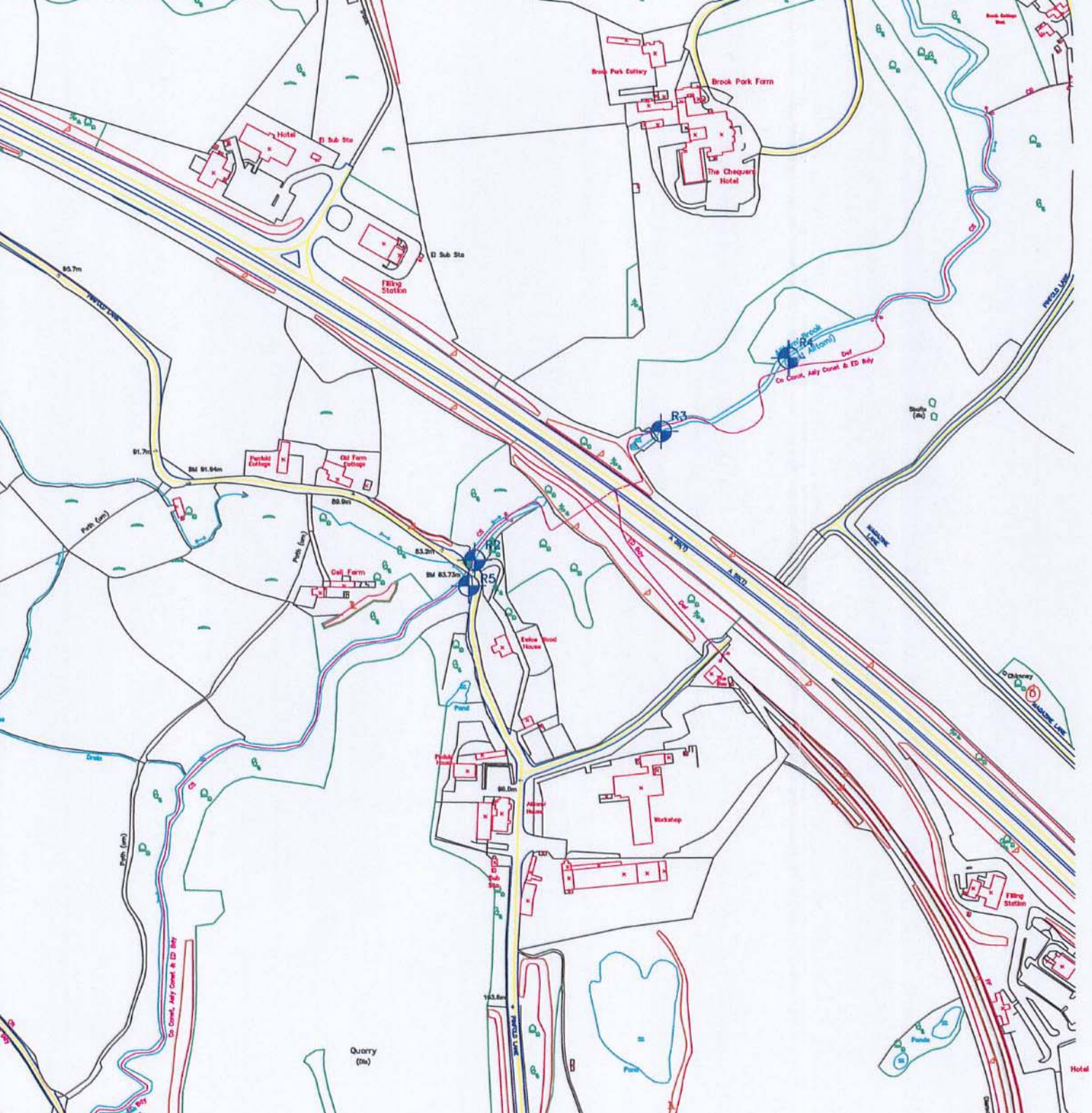
Water levels in the ponds continue to influence the groundwater flow pattern in the immediate vicinity (SBH3 and 7 and DBHB). The water level in the ponds recently rose significantly (January 2007) after slippages of parts of the adjacent quarry faces into both ponds. This may have caused the greater rise in groundwater level observed in the more northerly, down hydraulic gradient boreholes noted above.

The pond levels on 29 March 2007 were 92.20m AOD at the northern pond and 89.69m AOD at the southern pond. The pond levels are quite variable depending on pit dewatering status. However, at all times the pond levels and the groundwater levels across the site are higher than the level of the Alltami at the point of discharge from the site. The proposed invert of 82m AOD is 2m above the Alltami at the current discharge point. It is therefore very unlikely that the temporary groundwater lowering required to permit excavation to an invert of 82m will draw water from the Alltami brook at this (discharge) point. At its closest proximity, the Alltami is around 300m from the northeast corner of the proposed excavation, and at this point (327300E 366860N) the brook is at an elevation of approximately 85m. However, a cone of depression caused by the temporary groundwater lowering to 82m is unlikely to be significant at a distance of 300m. This is particularly so given; that the bed of the brook lies on relatively impermeable strata of the Middle Coal Measures in this reach and; that three faults lie between the brook at this point and the proposed excavation.

The conceptual hydrogeological model is of flow towards the north where the eastern and western site boundary faults converge at the Alltami stream. Upon this northerly flow pattern, westward flow towards the existing pits has been imposed. This may have caused the general regional groundwater flow towards the north east to have been deflected locally at the site towards the north to give the current overall northerly gradient across the site.

Groundwater Abstractions

The licensed groundwater abstraction for a bottling plant is located at Castle Farm NGR. 329080E 367320N. It is not in use and is not within either the Alltami surface water nor groundwater catchments.



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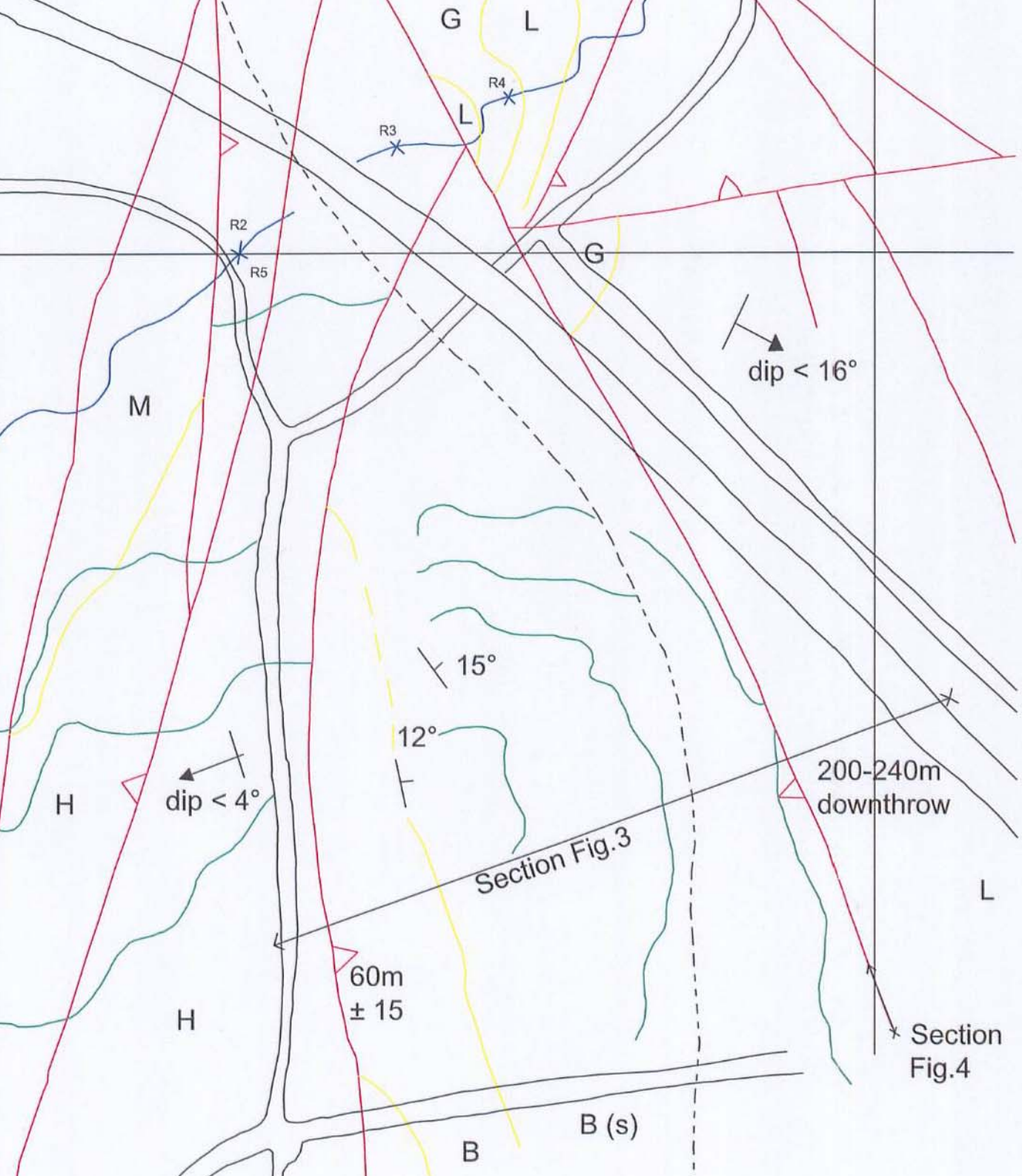

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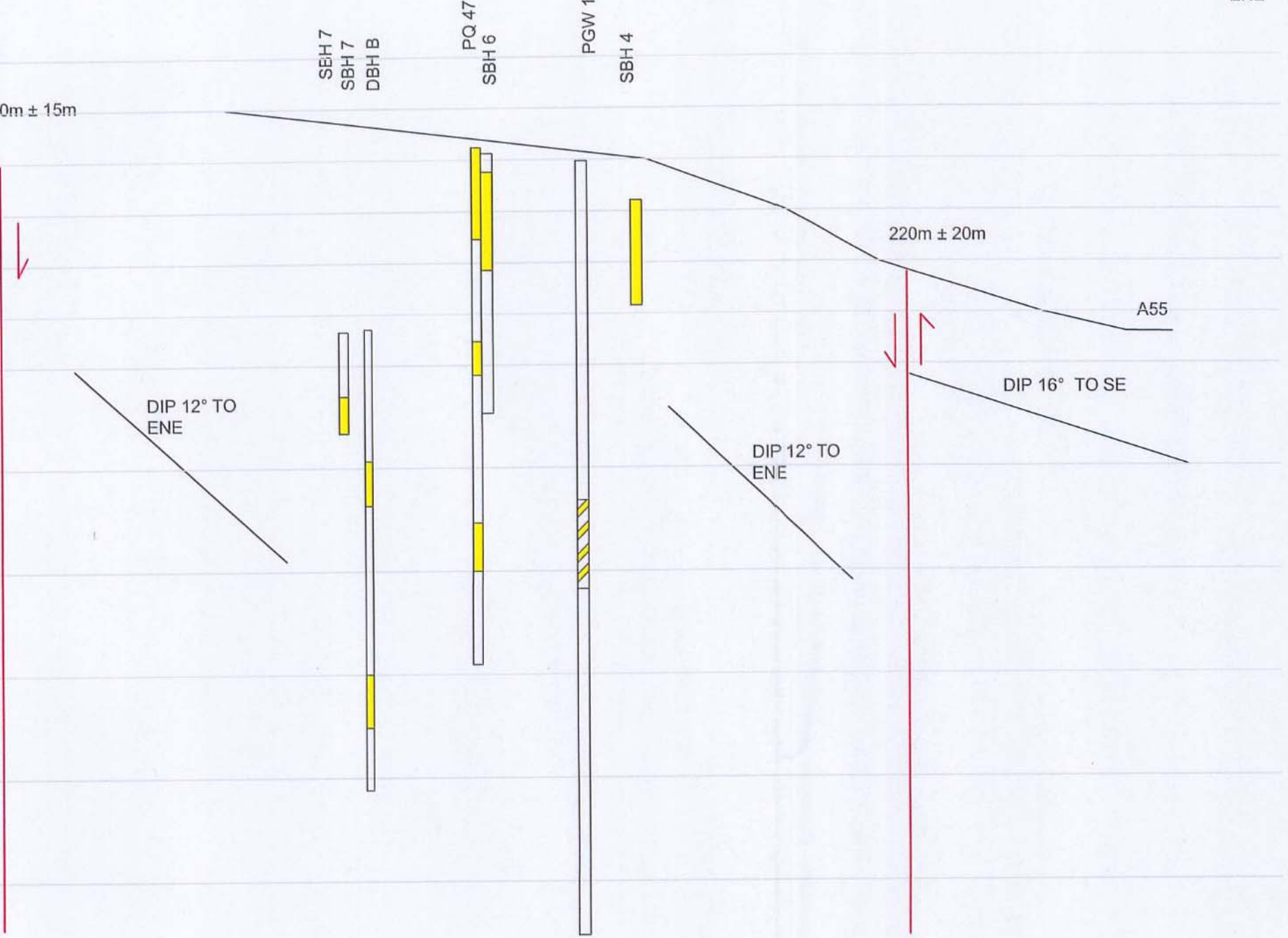

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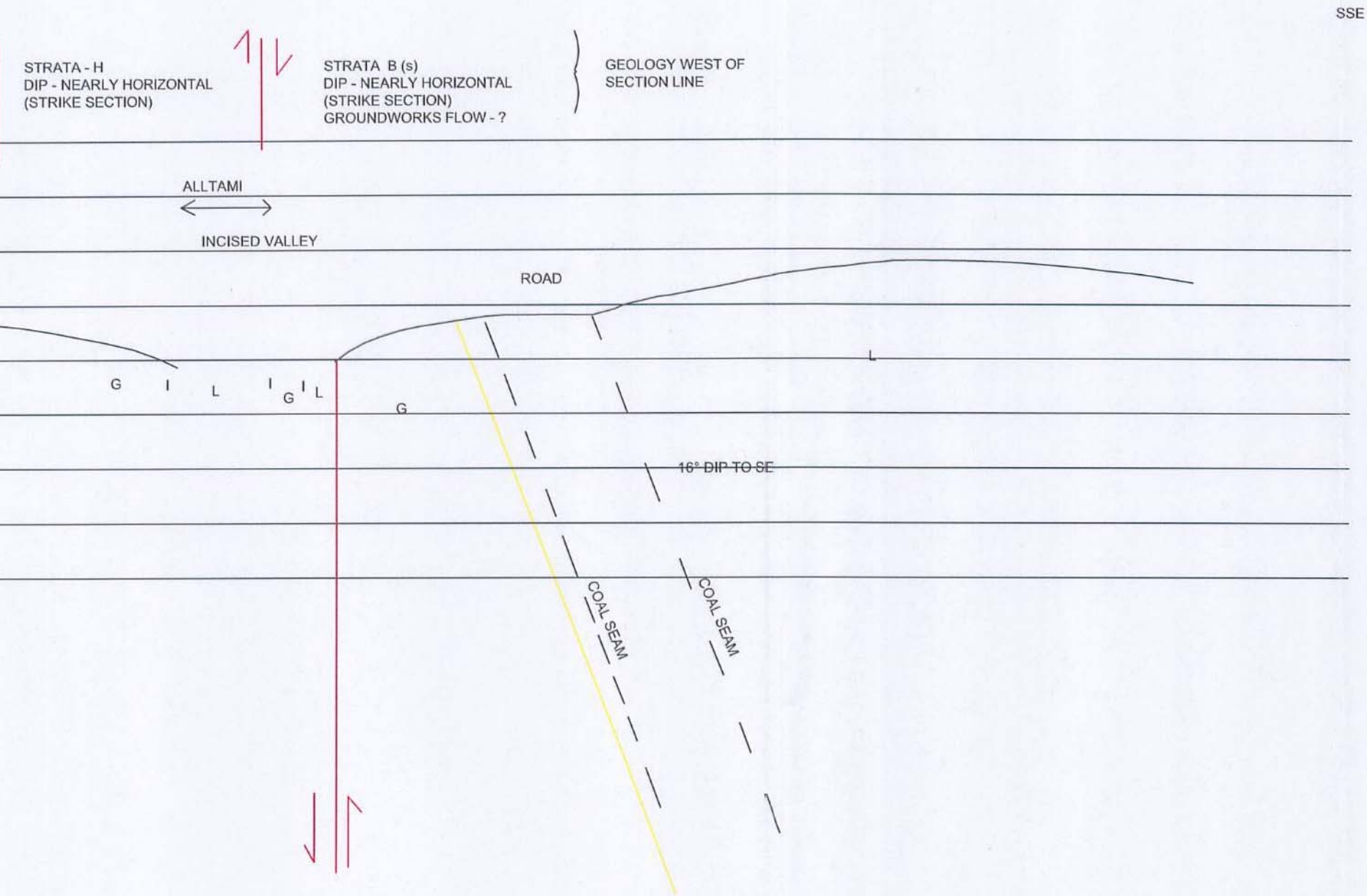

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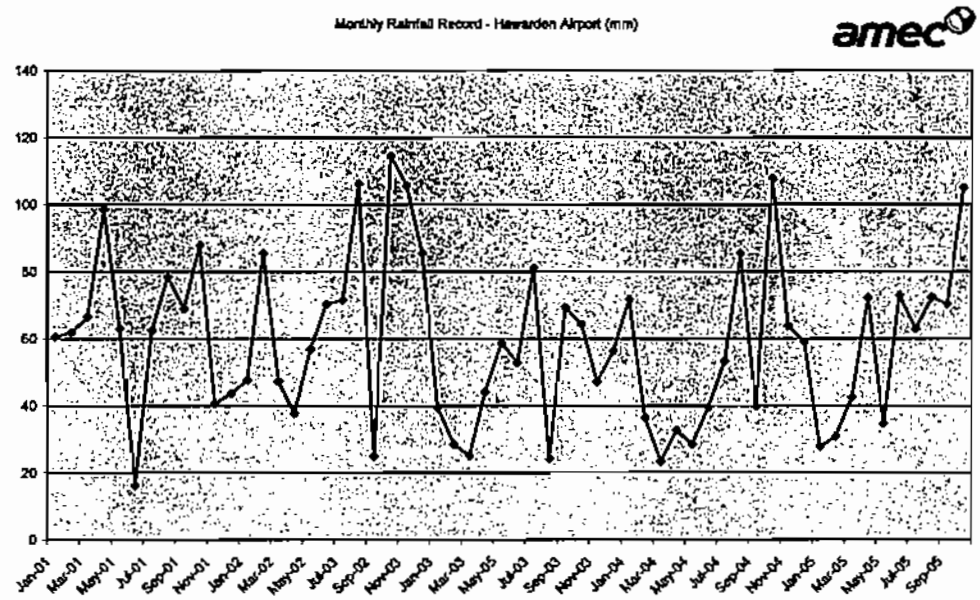
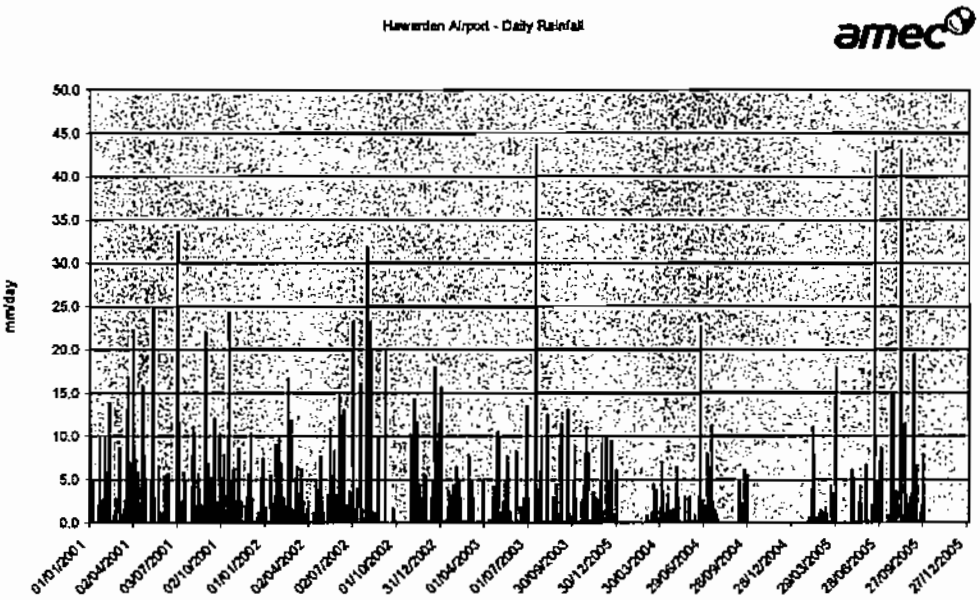
Figure 5. Rainfall Data – Hawarden Airport





ODOUR MANAGEMENT PLAN FOR PROPOSED LANDFILL SITE AT PARRY'S QUARRY, NEAR ALLTAMI, FLINTSHIRE

1.0 BACKGROUND AND INTRODUCTION TO ODOUR ISSUES AND LANDFILL SITES

1.1 Background and Guidance

This odour management plan relates to the landfill site at Parry's Quarry, near Alltami, Flintshire. The site accepts Municipal Solid Waste (MSW) and Non-Hazardous Industrial and Commercial Wastes.

Municipal Solid Waste typically comprises household waste, street sweepings and litter, park and garden wastes non- hazardous trade wastes and waste from institutions such as schools collected by or on behalf of a Local Authority (LA) (DEFRA, 2004). The exact composition of MSW varies between authorities but typically comprises 80 to 90% household waste. Full details of the wastes accepted at the site are outlined within the Waste Acceptance Criteria (WAC)

The landfill site has been designed in accordance with the requirements of the Landfill Regulations (England and Wales) 2002. The site is fully contained with an engineered lining, cells and capping system. The design includes leachate and gas management comprising collection systems with leachate to be discharged to sewer and gas to be sent to the utilisation plant including flares and engines. A number of other plans are relevant with respect to odour control and management including the following:

- Waste Acceptance Control and Procedures;
- Leachate Management; and
- Gas Management.
- Working plan

There are a number of potential sources of odour generation at the site. This management plan outlines the potential sources of odour, describes the site setting in relation to potentially sensitive receptors and details management procedures to be implemented at the site to prevent and manage odours. The Environment Agency (EA) Horizontal guidance regarding the regulation and permitting of odour (IPPC H4 Part 1) describes an Odour Management Plan as a working document for managing odour issues within a site.

The management of odour issues and prevention of nuisance are a requirement of the Landfill Regulations (England and Wales) 2002. The Regulations require that landfill sites are operated to reduce potential environmental and health impacts.

The management plan has been produced in line with relevant guidance documents as follows:

- EA. (2001). Internal Odour Guidance- The document covers issues including the inspection and monitoring of sites and enforcement issues. A procedure for undertaking an assessment of odour at waste management facilities is outlined and information regarding the sources and classification of odours is provided.
- EA. (2002). Integrated Pollution Prevention Control (IPPC) Horizontal Guidance for Odour H4, Part 1- Regulation and Permitting and Part 2- Assessment and Control. The documents provide guidance in relation to odour issues and IPPC installations including templates for odour management plans, monitoring and assessment.
- EA. (2005). IPPC Sector Guidance Note S5.02- The document outlines techniques for pollution control in relation to Best Available Techniques (BAT), provides information regarding emissions limits and potential impacts relating to landfill operations
- SITA. (2002). Managing Risks ay Landfill Sites- The document outlines regulatory controls regarding odour, presents methods for odour measurement and outlines the potential sources of odour at landfill sites. Detailed odour mitigation measures are provided in relation to the sources.
- AERC. (2000). Guidance Manual for Landfill Managers on the Assessment and Control of Odours- The document provides information regarding the various sources of odours at landfill sites and the options available for control and monitoring. Note that AERC has recently been acquired by AMEC Earth and Environmental.

1.2 Potential Sources of Odour

The main potential sources of odour at landfill sites include the following (DEFRA, 2004, AERC, 2000 and McKendry *et al* 2002):

- Gas escape from beyond the influence of the gas control system;
- Putrescible wastes;
- Disposal of particularly odorous wastes;
- Landfill gas escape;
- Poor daily cover;
- Poor gas abstraction;
- Leachate wells;
- Haul roads;
- Sewer lines; and
- Disturbance of deposited wastes.

Potential sources of odour at the site have been identified with reference to relevant guidance documents and through knowledge of odour issues and sources at other similar landfill sites.

Releases of odour include point, line, area and other sources. Potential sources of emissions from point line and area sources are summarised Table 1.

Table 1- Summary of Point, Line and Areas Sources of Odorous Gases from Landfill Sites		
Point	**Line**	**Area**
Leachate wells	Site haul road and haul routes	Active face
Passive gas vents	Discharge points of odorous leachate	Daily covered wastes
Leaking gas abstraction pipe-work	Passive venting gas trenches	Intermediate covered wastes
Fares and engines		Capped and restored areas
Deposition of waste from waste collection vehicles		Leachate lagoons and collection areas
		Temporary excavations into deposited wastes for engineering purposes

The report indicates that point source emissions tend to be discrete, and localised. They tend to be strong at the point of release but less significant in terms of the overall site contributions in comparison to odours from area sources. In contrast, area sources of emissions are relatively diffuse and whilst they are less concentrated, odour sources are emitted over a wider area and may therefore result in a more significant additive effect.

The character of odours varies according to the particular source and the type of waste that has been deposited. A table is reproduced from the AERC (2000) report as Appendix 1 summarising various types of odour and their characteristics.

1.3 Odour Management Options

Odour controls that will be implemented at sites include four main categories; operational and management controls, odour containment, odour suppression, and collection and treatment.

Operational and management controls relate to the way in which the site is run and operated including for example procedures regarding waste compaction and general good housekeeping. Odour containment includes measures such as sheeting and containing vehicles carrying wastes and the provision of effective daily cover. Odour suppression relates to the use of odour masking agents, neutralisers and/ or suppressants to prevent volatilisation of the odour. The collection and treatment of landfill gas and odours includes the collection of gas for flaring and treatment of odorous leachates.

2.0 ODOUR MANAGEMENT PROCEDURE AT PARRY'S QUARRY

Potential sources of odour at the site have been identified on the basis of the conceptual design and operational procedures. The standard procedures that will control the odours have been identified along with any additional measures that may

need to be implemented in order to rectify particularly persistent sources of odours or problem areas. The measures and odour controls are identified within Appendix 2.

Potential sources of odour have been identified as point, line and area sources and include odours associated with the waste and waste degradation, landfill gas and leachate.

The site procedures relating to waste including the delivery, receipt of particularly odorous wastes and placement within cells and provision of cover and capping, landfill gas, leachate are summarised in the following paragraphs.

In addition, the management of landfilling activities at the site will be aided through the provision by the operator of a dedicated site weather station, which will provide information regarding wind speed and direction. The data from the weather station will be used to consider the sequence and filling direction of the cells. This procedure will help to minimise any potential odour issues resulting from the location of the cell and area of the cell being filled in relation to prevailing weather conditions

2.1 Waste delivery, landfilling and Decomposition

The potential for odours relating to the waste delivery, landfilling and decomposition include the following:

- Vehicles delivering wastes to the site;
- Vehicles on arrival at the site;
- Vehicles delivering very odorous wastes to the site;
- Vehicles containing very odorous wastes to the site;
- Wastes at the tipping face/ working area;
- Deposits of litter and debris from delivery vehicles;
- Daily and intermediate covered wastes;
- Capped and restored areas; and
- Excavations into deposited wastes.

Waste Transit and Delivery

Waste will be delivered to the site primarily in covered and fully enclosed household waste refuse collection vehicles. All other vehicles will be fully sheeted or covered. All vehicles will as far as reasonably practicable, be routed to avoid sensitive areas and densely populate residential areas to avoid the tracking of odours. Additional measures will be required with respect to the delivery of particularly malodorous wastes. These measures shall includes pre-treatment where necessary in order to reduce the odour intensity of the waste prior to transportation and measures to reduce the potential for tracking of odours during transit such as sealing the waste within bags and containers. All potentially odorous wastes will require pre-notification so that the operator can be prepared to implement the necessary site controls to minimise odour during management on-site.

The potential for any point source odour emissions from the vehicles following arrival at the site will be reduced and minimised through immediate tipping of waste on arrival at the site, following initial inspection and collection of any necessary compliance samples. Wastes will only be quarantined for inspection in the event that they contain suspect loads. In such circumstances and loads containing out of compliance wastes will be rejected immediately. Any quarantined loads will be located as far as possible from sensitive receptors to avoid the potential for any odour nuisance.

Waste Acceptance

The potential for any odour issues associated with waste accepted at the facility will be minimised through the comprehensive Waste Acceptance Criteria. The procedures will prevent the acceptance and filling of any unsuitable wastes that may lead to odour nuisance.

Deposits of Litter and Debris

A number of measures to prevent the generation of litter and minimise the blowing of debris from the active area of the landfill have been developed for the site. Measures include; the sheeting and covering of all vehicles even within the site perimeter, use of daily cover soils over the working area of the site, minimising the area of the active face particularly during windy conditions and the use of portable litter control fences at the active face of the site as required. In addition, good housekeeping will be employed to ensure that in the event that any litter is deposited beyond the working face area of the landfill, the litter is removed as soon as identified, but at a worst case on a daily basis to ensure that odour issues do not occur associated with litter and debris.

Daily and Intermediate Covered wastes

Direct odour generation from the wastes will be minimised through the grading and compaction of wastes following placement and the provision of 150mm of daily cover. Supplies of daily cover material will be checked on a regular basis to ensure that a sufficient supply is maintained on site. The provision of daily cover will help to reduce any fugitive emissions from newly deposited wastes.

Any particularly odorous waste received will be buried immediately and covered with other waste materials. Once buried the odorous waste should not cause a problem due to the natural scrubbing effects of the covered wastes (EA, 2000). In line with regulatory requirements a separate record will be maintained for all very odorous wastes received and tipped at the site, on the form included as Appendix 3. The record includes details regarding the type, quantity and odorous nature of the waste, the date received, the exact location of its placement within the site and any measures taken to prevent potential odour nuisance issues.

A small working face area will be maintained to reduce the surface area for odour volatilisation. The active disposal area will be limited to a maximum of 900m^2.

Wind speed and direction information for the site will be consulted and used to determine the location for tipping, in order to reduce the potential for nuisance issues including odour.

Covered areas will be checked on a daily basis to ensure that there are no gaps in the cover materials through which odours could be volatilised. In the event that any gaps are identified within the cover additional material will be provided as necessary. A record of the provision of additional cover material will be maintained on site.

Filled cells that are not considered part of the active disposal area, but are scheduled to receive further waste prior to final capping, will be provided with an interim cover comprising 300mm soil, if they remain inactive for more than 90 days.

In the event that odour nuisance occurs, the need for the use of odour suppressants and masking agents will be considered.

Restored and Capped Areas

Final capping will be provided comprising an engineered cap to a depth of 1.0m followed by the provision of topsoil. The integrity of the cap will be inspected for all site areas on a minimum of a weekly basis. Results of the inspections will be recorded along with any required maintenance. Additional cover materials are provided to cover cracks and thus prevent a potential pathway for the release of odours.

Excavations into Deposited Wastes

Excavations into deposited waste will only to be undertaken when absolutely necessary- such as, for example, in the event that pipe work associated with the leachate and gas management system requires repair. Excavations will be carefully planned to avoid weather conditions that aid in the dispersion of odours (i.e. low wind speed in direction of sensitive receptors). Odour masking, neutralising and/or suppressant agents will be available on site during the undertaking of such operations to be used at the discretion of personnel undertaking the work.

2.2 Management of landfill gas

Full details of gas management including details of monitoring schedules will be provided within the Gas Management Plan.

Potential issues include:

- Gas generation resulting from the waste decomposition; and
- Gas escape/release from the monitoring boreholes and the gas abstraction wells.

The active gas extraction system which will be in place at the site will control the accumulation and migration of landfill gas. The system prevents uncontrolled releases of untreated landfill gas that may lead to odour nuisance. The comprehensive gas collection system will be installed progressively within the cells. The collection system shall comprise a series of horizontal and vertical trenches with gas collection commencing as soon as sufficient waste (generally to depths of between 4 and 6m below ground level (bgl)) is present within the cell.

The collection pipe work includes a series of valves and monitoring ports connecting to the peripheral header pipe work and gas management plant. The pipe work associated with the gas control system will be composed of high integrity HDPE, thus reducing the potential for damage and the release of fugitive emissions. Inspections will be undertaken at the site to check the integrity of the pipe work, seals on all valves and the presence of covers on all wells and boreholes on a weekly basis.

2.4 Gas Flares and Engines

Full details of gas management including the monitoring and inspection requirements for the flares and engines will be provided within the Gas Management Plan.

The gas management plant will be installed progressively at the site and will become active once sufficient waste depth is achieved within the cells. The plant incorporates a condensate trap, moisture separator blowers, gas utilisation engines and flares.

The gas plant has been designed to reduce the potential for any nuisance issues relating to exhaust emissions including the presence of vertical exhausts located at height to ensure the adequate dispersion of combusted gases. Furthermore, a monitoring strategy will be in place with monitoring undertaken in accordance with current EA guidance, but also includes potentially odorous compounds as necessary. The monitoring includes standard parameters and fugitive emissions from the engines and connecting pipe work and valves.

Potential odour issues associated with abnormal operating conditions such as the failure of a gas flare or engine will be prevented as far as possible through the monitoring and maintenance programme. The programme includes for checks on the operational effectiveness of the equipment as well as the monitoring of emissions and will be undertaken in line with both regulatory requirements and manufacturers specifications. The programme allows any problems which may be indicative of, for example leaks or odorous emissions, to be identified and rectified to prevent potential nuisance issues.

2.3 Leachate Management

Full details regarding leachate management and monitoring will be provided within the Leachate Management Plan.

Potential odour issues associated with leachate generation and collection may occur through fugitive releases at leachate wells, emissions from seals and pipe work and at leachate discharge points. Odour problems should not occur associated with storage, as all leachate generated at the site will be discharged to sewer immediately, thus no on site storage is required. The treatment of leachate prior to discharge is not currently anticipated to be required.

A comprehensive leachate management plan will be in place at the site. The management system will help to reduce the potential for nuisance and odour issues associated with leachate generation. It comprises a combination of drainage blanket, lateral collection pipes, perimeter header pipes, cleanouts leachate pump stations and a leachate connection to the foul sewer.

All pipe work will comprise high integrity HDPE, thus reducing the potential for damage and associated odour emissions. As with the gas management system, weekly inspections are undertaken to check the integrity of the pipe work, seals on valves and covers on leachate wells. Results of the inspections will be recorded along with any problems identified and measures taken to rectify these.

2.5 Inspections and Monitoring

Inspection and monitoring will be undertaken in accordance with the Gas and Leachate Management Plans. In addition, specific odour inspections/monitoring will be undertaken on a daily, monthly and annual basis.

Daily site walkovers will be undertaken at the site by site personnel to verify that general good housekeeping issues including odour are under control. The inspections will comprise a site walkover and completion of compliance status against a defined checklist of issues.

A log of the daily inspections will be maintained on site and any issues identified will be recorded along with measures taken to rectify these.

The inspections will include "sniff testing" in accordance with the monitoring protocol outlined within the Horizontal Guidance Note H4 Part 1. The "sniff test" provides a useful quick test to provide a snap shot assessment and record of the presence, strength and character of odours present within the landfill site boundary and the areas surrounding the site. The test will be undertaken at a total of eight locations

including four locations within the site boundary and a further four locations at receptors surrounding the site. The locations of the proposed monitoring points are identified on Figure 1. An odour monitoring record form is included as Appendix 4.

More detailed monthly monitoring will be undertaken by a third party to reduce any potential bias. The monthly monitoring will include completion of the "sniff testing" procedure along with monitoring for hydrogen sulphide. The monthly sampling is extended to include olfactometry testing in the event that particular odour problems have occurred that month. This will comprise the collection of odour samples using a specially designed sample collection bag and pump and submission of the sample to an odour panel.

2.6 Complaints Procedure

Odour complaints may be received either directly by the site or via Flintshire County Council or the Environment Agency.

The odour complaint form provided as Appendix 5 will be completed for all complaints received by the site personnel. The form is in two parts and includes a summary of information relating to the complainants as well as information from site records, used to assess the potential source of the odour.

The following information must be obtained from the person(s) complaining:

- When the odour episode started
- Location of the odour
- Is the odour still present
- Odour description (character/ strength and offensiveness)
- Is the odour constant or intermittent
- Why do they think it is from the landfill site
- Records details of complaint including:
    - Date
    - Times
    - Locations
    - Duration
    - Complainants name and address

2.7 Investigation of Potential Sources of Odour and Mitigation

Information regarding site conditions and activities being undertaken at the time of odour complaints will be included as the second part of the odour complaint form. Site specific information will be used to assess the potential source of the odour and weather conditions at the time of the odour. Actions taken to rectify the problem will be recorded on the form. Actions may include the following:

- Preventing particular activity during certain weather conditions for future operations;
- Use of odour neutralising agents when undertaking particular activity in future;
- Assessment of cover materials to ensure these are suitable;
- Assess waste streams accepted and consider banning from the site;
- Assess waste placement and compaction methodologies and consider whether modifications are required;
- Assess and monitor gas collection system and flares and engines and modify as necessary; and
- Assess and monitor leachate collection system and modify as necessary.

In the event the persistent odour problems occur at the site and these cannot be rectified using the above measures a permanent odour control system will be implemented at the site. A bespoke system would be installed at the site. The system would be designed to rectify the specific odour issue and would, by necessity, take into account power and operational requirements (some systems for example require mains power and a water supply), reliability, effectiveness of system based on similar installations and noise levels associated with the equipment.

The system would be designed in consultation with FCC and the EA. A neutralising system would be implemented where possible, rather than an odour masking system as the use of perfumed masking agents can be offensive to certain individuals.

3.0 REFERENCES

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DEFRA (2004). Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes. Enviros and the University of Birmingham for DERFA, May 2004.

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McKendry. P., Looney. J.H and McKenzie.A. (2002). Managing Odour Risk as Landfill Sites: Main Report. SITA.

Selwood. D and Roberts. R.D. (2000). Practical Odour Assessment and Control. Waste 2000- Waste Management at the Dawn of the Third Millenium Strafford-Upon-Avon.

APPENDIX 1 - Landfill Odour Character from: AERC. (2000). Guidance Manual for Landfill Managers on the Assessment and Control of Odours.

Odour Origin	Point/Linear Sources	Area Sources	Descriptive Key Words/Terms	Typical Primary Chemical Odorants	Relative Strength (1 = Low to 5 = V. Strong)
Fresh Wastes 1. General domestic	Waste vehicles.	Active face area. Areas of poor daily cover.	Bottom of dustbin, rotten cabbage, fruity/citrus, acrid/sour, rotten, putrid.	Esters (e.g. butanoates) + smells directly from volatilisation of chemicals from food etc. e.g. organic acids.	3 - 4
2. Other wastes	Waste vehicles.	Active face area. Areas of poor daily cover. Liquid/sludge trenches. Difficult waste disposal areas.	Depends on waste type. Examples include: • Sewage derivatives (faecal, sulphurous - rotten eggs, ammonia). • Food wastes (putrid, sour, fishy, rotten vegetables, rotten meat). • Oils and fuels (oily, acrid, petrol like). • Green wastes (woody, ammonia, earthy). • Chemical wastes (chemically, metallic, acidic/sour, soapy, acrid, preservative, disinfectant, sulphurous, fuel - like). • Animal wastes (putrid, sour, ammonia, sulphurous, rotting meat/fish).	Depends on waste type. Examples include: • Sewage derivatives (indole, skatole, hydrogen sulphide, organic sulphides, ammonia). • Food wastes (putrescine, cadaverine, amines, sulphides, ammonia). • Oils and fuels (aromatics; toluene, xylene etc.). • Green Wastes (terpenes, amines, aromatics, ammonia). • Chemical wastes (variable dependent on waste type). • Animal wastes (as for food wastes).	4 - 5 4 - 5 2 - 4 2 - 4 1 - 5 4 - 5
Landfill Gases 1. Young rapidly decomposing wastes	Leachate wells. Leaks in gas infrastructure. Passive gas vents.	Temporary cover areas. Capped areas (cracks). Peripheral venting trenches.	Sweet, sulphurous, fruity, citrussy, gassy, sickly, pungent.	Typified by esters (e.g. butanoates) and organosulphurs (e.g. methanethiol, DMS, DMDS) also some hydrocarbons, alcohols and terpenes (e.g. alkyl benzenes, butanols and limonene). Acetogenic wastes may be characterised by organic acids (e.g. butyric/ butanoic acid).	4 - 5
2. Older mature	Leachate wells.	Capped areas (cracks)	Citrussy (lemon-like), fruity, gassy, pungent	Typified by limonene and hydrocarbons (alkyl	

Odour Origin	Point/Linear Sources	Area Sources	Descriptive Key Words/Terms	Typical Primary Chemical Odorants	Relative Strength (1 = Low to 5 = V. Strong)
methanogenic wastes	Leaks in gas infrastructure. Passive gas vents.	Peripheral venting trenches.	(less sweet and sulphurous than above).	benzenes etc.) less sulphurous compounds.	3 - 5
Leachates					
1. Young, very organic poorly decomposed leachates.	Leachate wells. Leachate seepages. Sewer discharges.	Leachate storage/ treatment lagoons/tanks.	Extremely sweet, sugary, pungent, food like, sulphurous.	Organic acids (e.g. butyric acid + butanoic acid), aromatics, alcohols, hydrocarbons and sulphur compounds.	5
2. Mature, well decomposed leachates	Leachate wells. Leachate seepages. Sewer discharges.	Leachate storage/ treatment lagoons/tanks.	Mild, fuel like, oily, ammonia (if pH is high). Farm-yard like.	Aromatics and hydrocarbons	1 – 2
Combustion Systems	Inefficient flares and power-plant exhausts	N/A	Burnt odour. Occasionally pleasant. Very sweet, burnt toffee-like smell.	Unburnt hydrocarbons and nitrogen oxides	1

APPENDIX 2- POTENTIAL SOURCES OF ODOUR AND STANDARD AND ADDITIONAL CONTROL MEASURES TO BE APPLIED

Parry's Quarry- Potential Sources of Odour and Standard and Additional Control Measures to be Applied

Potential Source of Odour	Standard Odour Control to be applied	Additional Control Measures to be applied as necessary
Point sources		
Delivery vehicles on arrival at the site	▪ All wastes to be tipped immediately upon arrival at the site	▪ Use of odour neutralising and suppressant agents.
Very malodorous wastes on arrival at the site	▪ The site has a policy to only accept small quantities of particularly odorous wastes such as farm and catering wastes ▪ Particularly odorous wastes would be covered with non odorous wastes immediately following tipping prior to the placement of daily cover.	▪ Use of odour masking, neutralising and suppressant agents.
Leachate wells	▪ All wells to be covered/ capped ▪ Seals to be maintained and checked as part of a weekly inspection	
Gas wells	▪ All wells to be covered/ capped ▪ Seals to be maintained and checked as part of a weekly inspection ▪ Repairs to and new covers provided as necessary	
Gas abstraction wells	▪ All wells to be covered ▪ Seals to be maintained and checked as part of a weekly inspection ▪ Repairs to and new covers provided as necessary	
Flares and engines	▪ Monitoring and maintenance programme with emission checks/ monitoring of flares and engines will include odour ▪ Exhausts will be vertical and as high as feasible to ensure adequate dispersion of combusted landfill gasses ▪ Shrouded gas flares used to ensure effective destruction of odorous compounds ▪ Gas to be adequately dewatered before entering gas flare to prevent dispersal of odorous substances	▪ Review of adequacy and efficiency of flares and engines in the event that persistent odour problems arise
Deposits of litter and road sweepings	▪ Litter to be collected as deposited and as a minimum on a daily basis ▪ Amount of litter generated will be minimised through a number of measures including the sheeting of all vehicles, use of daily cover over active working face areas, active face of landfill to be reduced, use of portable litter fences at the active face as necessary	
Leachate storage tanks	▪ In the event that storage tanks and pre treatment of leachate is required prior	

	to discharge to sewer, all storage tanks will be covered to prevent the potential for odorous releases ▪ The tanks would be checked for odours as part of the daily inspection	
Storage of waste	▪ The only wastes to be stored at the site would be those quarantined for inspection and sampling	
Leachate discharge points	▪ Checked as part of daily inspection	▪ Dosing of leachate if considered to be an odour issue
Line Sources		
Delivery of wastes to site in vehicles	▪ Vehicle to be routed to avoid residential areas- where possible waste delivery vehicles will access the site directly via the A55 ▪ All vehicles delivering waste to the site will be sheeted and covered and all vehicles carrying domestic waste will be fully enclosed	
Delivery of particularly odorous wastes to site	▪ Vehicle to be routed to avoid residential areas- where possible waste delivery vehicles will access the site directly via the A55 ▪ All vehicles delivering waste to the site will be sheeted and covered and all vehicles carrying domestic waste will be fully enclosed ▪ Additional precautions will be taken in order to ensure that all particularly odorous wastes are delivered to site in sealed bags or that wastes are treated prior to arrival at the site to reduce the potential for odour generation whilst in transit.	
Fugitive emissions from seals and pipe work	▪ Integrity of pipe work to be checked as part of weekly inspection ▪ Use of high integrity pipe work- preventing the potential for any damage and thus fugitive emissions ▪ Monitoring to be undertaken to check for fugitive emissions from valves and seals	▪ Check for leaks in system in event that persistent odour problems odour and replacement of any faulty sections of pipe work
Area Sources		
Odours from the active site working face/ area	▪ Provision of daily cover of 150mm ▪ Following waste deposition, materials will be graded out using a bulldozer and compacted by traversing over it using a compactor fitted with specially adapted wheels. This will reduce the surface area available for odour ▪ Provision of immediate cover over any particularly odorous wastes and acceptance of only small quantities of such waste ▪ Provision of layer of low permeability soil material and further 150mm of soil for final restoration layer ▪ The active disposal area would be small- limited to a maximum of 900m^2 are	▪ Use of odour masking, neutralising and suppressant agents.

	the cell sizes small, reducing the area of exposed wastes for odour volatilisation ▪ Use of small cells to prevent the build up of young odorous leachates prior to capping	
Very odorous wastes at the working face area	▪ Disposal area to be selected to be remote from any surrounding receptors and to take account of weather conditions at the time of tipping (i.e. avoid areas immediately downwind of receptors where practicable) ▪ Waste to be deposited in a deep trench and covered immediately with non-odorous wastes	▪ Use of odour masking, neutralising and suppressant agents.
Daily covered wastes	▪ Areas to be checked to ensure no cracks or gaps in cover materials	▪ Use of odour neutralising and suppressant agents.
Intermediate/ Interim covered wastes	▪ Interim cover comprising a 0.3m layer of soil (fine grained where available) will be provided on any areas that remain inactive for more than 90 days. ▪ Areas to be checked to ensure no cracks or gaps in cover materials	▪ Use of odour neutralising and suppressant agents.
Capped and restored areas	▪ Provision of engineered caps to depth of 1.0m overlain by 0.15m of topsoil will reduce the potential for odours from such areas. ▪ Areas to be checked on a weekly basis to ensure that any settlement cracks are identified and additional cover materials are provided as necessary.	Use of odour neutralising and suppressant agents.
Excavation into deposited wastes for engineering purposes such as with respect to leachate and gas management systems and pipe work	▪ Such activities would be precluded unless absolutely necessary. ▪ Activity only to be undertaken during certain weather conditions ▪ Work to be undertaken to minimise amount of time excavated wastes exposed	▪ Use of odour neutralising and suppressant agents.

APPENDIX3- RECORD OF ODOROUS WASTE RECEIVED

ODOROUS WASTE RECORD - PARRY'S QUARRY, ALTAMI			
Date Waste Received:			
Time Waste Received:			
Description of waste:			
Source of waste:			
Quantity of odorous waste:			
Description of nature of odour:			
Location of waste within site:			
Measures taken to reduce potential nuisance issues associated with odour:			
Form completed by:		Signed:	

APPENDIX 4- ODOUR MONITORING RECORD SHEET

ODOUR MONITORING RECORD SHEET- PARRY'S QUARRY ALTAMI

This record sheet is to be used for the monthly 'sniff test' monitoring to be undertaken at the site. Locations for the monitoring are shown on the attached figure.

Date:	
Start Time:	**Finish Time:**
General Description of Weather during Monitoring:	
Name of Person Undertaking Monitoring:	
Average wind speed (m/s):	**Maximum Wind Speed (m/s):**
Wind Speed (Beaufort scale):	**Wind Direction:**
Temperature (°C):	**Atmospheric Pressure (mb):**
Other Observations:	
Activities being undertaken at landfill during monitoring:	

Location	Odour Intensity (1-5)	Odour Offensiveness	Extent of Odour (1-5)	Description of Odour	Potential Sources

Notes for Completion of Assessment Form

Odour Intensity	
1	No detectable odour
2	Faint odour (barely detectable, need to stand still and inhale facing into the wind)
3	Moderate odour (odour easily detected while walking and breathing normally)
4	Strong odour
5	Very strong odour (possibly causing nausea)
Odour Offensiveness	
1	Potentially offensive
2	Moderately offensive
3	Very offensive
Extent of odour	
1	Local and transient (only detected on site or at site boundary during brief periods when wind drops or blows)
2	Transient as above but detected away from site boundary
3	Persistent, but fairly localised
4	Persistent and pervasive up to 50m from site or site boundary
5	Persistent and widespread (odour detected more than 50m from the site boundary)

APPENDIX 5- ODOUR COMPLAINT FORM

ODOUR COMPLAINT FORM- PARRY'S QUARRY, ALTAMI	
Date:	
Information from Complainant	
Name and Address of Complainant:	
Time and date of complaint:	
Date, time and duration of odour:	
Location of odour if not address above and approximate extent:	
Weather conditions (at time of odour)- i.e. dry, rain, wind, temperature:	
Wind strength*- light, steady strong, gusting:	
Wind direction:	
Complainant's description of odour:	
Character/ Type of odour:	
Strength:	
Duration- continuous or intermittent:	
Why does complainant think odour is from landfill site?	
Other information/ comments:	

Information from Site records			
On- site activities at the time the odour occurred:			
Site/ met station weather conditions at time of odour:			
Is there evidence to suggest odour is associated with site?			
Actions taken to rectify problem if necessary			
Form Completed by:		Signed:	

Notes: * Attempt to classify wind speed from residents description on basis of Beaufort Scale specifications:

Beaufort Scale Specifications and Descriptions		
Force	Description	Effects
0	Calm	Smoke rises vertically
1	Light air	Wind direction shown by smoke drift
2	Light breeze	Wind felt on face, leaves rustle
3	Gentle breeze	Leaves/ small twigs move
4	Moderate breeze	Raises dust and small paper
5	Fresh breeze	Small trees begin to sway
6	Strong breeze	Large braches move
7	Near gale	Whole trees move
8	Gale	Breaks twigs off trees
9	Strong gale	Slight structural damage
10	Storm	Trees uprooted considerable damage
11	Violent storm	Widespread damage
12	Hurricane	-

ODOUR ASSESSMENT

1. INTRODUCTION

This report describes and presents the results of an odour assessment for the proposed Parry's Quarry landfill near Alltami, Mold, Flintshire. The assessment has been undertaken by AMEC Earth & Environmental (UK) Ltd on behalf of Robin Jones and Sons Ltd.

The odour assessment is quantitative in nature, and supplements the qualitative assessment previously submitted as part of the Environmental Statement for the site, and the Odour Management Plan.

Odour emissions from the proposed landfill have been predicted using Version 2 of the GasSim model (GasSim2) developed by Golder Associates on behalf of the Environment Agency. Predictions were based on information on waste inputs, cell phasing, engineering design and other aspects of the proposals set out in the Design Statement. Atmospheric dispersion of the odour emissions and the resulting odour concentrations at potentially sensitive receptor locations in the vicinity of the proposed site were modelled using the Breeze AERMOD "new generation" model.

2. BACKGROUND AIR QUALITY

The Environmental Statement describes the current air quality in the environs of the site in detail. Potential odour sources include industrial units immediately to the north and to the south-east of the proposed site, and agricultural activities in the general area.

3. ODOUR EMISSIONS MODELLING

3.1 Introduction

The decomposition of organic wastes leads to the generation of landfill gas (LFG), which consists primarily of methane, carbon dioxide and other non-odorous bulk gases. However, LFG also contains a large number of trace gas constituents that include potentially odorous compounds occurring at low concentrations. The rate of generation of LFG and the emission of its odorous components into the atmosphere from the proposed landfill surface were modeled using the GasSim2 model.

The GasSim2 model requires information on waste input rates throughout the lifetime of the site, the mix of the waste (domestic, commercial, etc), aspects of the engineering design and other parameters in order to estimate LFG generation rates

for a period of up to 150 years into the future. The model then predicts the rate of LFG flux to the environment (and its potentially odorous trace components), taking into account the odour concentration of the raw LFG, gas containment, collection, flaring, energy recovery, and biological methane oxidation. For each GasSim2 simulation, 500 iterations were conducted, providing a distribution of model outputs reflecting the distributions of the various model inputs. The outputs, i.e., the odour emission rates, are presented as 95th percentiles, which represent reasonable worst-case values, and 50th percentiles, which represent average or more typical values.

3.2 Model Parameterisation

Model parameters and justifications are provided in full in Appendix 1. Assumed values and distributions for key parameters are described below.

For modelling purposes, it has been assumed that landfilling would occur for a period of 16 years. This is towards the low end of the anticipated 15 – 20 year lifespan range, leading to annual waste input rates towards the high end of the possible range. It has been assumed that the available total void space of 2,616,425 m^3 would be filled at a constant rate over the 16 year lifespan. The annual input rate in terms of waste tonnage has been assumed to range from 98,116 to 147,174 tonnes, corresponding to waste densities of 600 $kg.m^{-3}$ and 900 $kg.m^{-3}$, respectively.

Wastes would be deposited sequentially in the four proposed cells in two cycles (Table 1). The first cycle would involve the sequential infilling to ground level of the void space created by quarrying activities. The second cycle would involve waste inputs above the original ground levels.

Table 1. Assumed Waste Input Sequence

Cell	Cycle 1	Cycle 2
Cell 1	2009 – 2010	2019 – 2020
Cell 2	2011 – 2012	2021 – 2022
Cell 3	2013 – 2014	2023 – 2024
Cell 4	2015 – 2018	

It has been assumed that approximately two-thirds of the wastes would arise from domestic sources (66%), and that the remaining one-third would arise equally from commercial (17%) and industrial (16%) sources. In order to account for the input of soils or similar materials as daily cover soils, it has been assumed that 1% of the wastes are inert. (Note that the beneficial effects of daily cover with respect to the suppression of odour emissions has not been accounted for in the model.] Within

these categories, waste compositions have been set at the default GasSim2 values for the year of waste input.

Odour concentrations in raw LFG have been set at default GasSim2 values.

Details of the gas containment and collection infrastructure have been determined from the Design Statement. Assumed installation dates and specifications for the temporary and permanent caps, liner and gas collection system are shown in Table 2. Temporary caps are assumed to be installed in the year following completion of the first cycle of infilling in each cell. Permanent caps are assumed to be installed in the year following completion of the second cycle of infilling in each cell. Gas collection was assumed to commence in the second year of the first cycle of infilling in each cell. Gas collection efficiencies were set at GasSim2 default values for permanent systems:

Details regarding the gas combustion and utilisation plant are not critical to the assessment, because flare and engine emissions do not contribute significantly to potential odour impacts. The combustion process degrades the odorous chemicals within the incoming landfill gas. It was determined that one flare and two engines would be capable of treating the predicted levels of LFG generation throughout the lifespan of the site.

Table 2. Assumed Engineering Controls

Model Parameter	Cell 1	Cell 2	Cell 3	Cell 4
Installation Dates				
Temporary Cap	2011	2013	2015	2019
Permanent Cap	2021	2023	2025	2019
Gas Collection	2010	2012	2014	2016
Specifications				
Temporary Cap				
Thickness (m)	Single (0.3)			
Hydraulic conductivity ($m.sec^{-1}$)	Uniform (1.0e-06,1.0e-07)			
Permanent Cap				
Thickness (m)	Single(1)			
Hydraulic conductivity ($m.sec^{-1}$)	Single (1.0e-8)			
Liner				
Clay:				
Thickness (m)	Single (0.5)			
Hydraulic conductivity ($m.sec^{-1}$)	Single (1.0e-09)			
Geomembrane:				
Thickness (m)	Single(0.0015)			
Hydraulic conductivity ($m.sec^{-1}$)	Loguniform(1.0e-15, 1.0e-13)			

3.3 Model Outputs

Total LFG generation rates throughout the lifetime of the site are shown in Figure 1. It can be seen that predicted generation rates peak at approximately 1000 $m^3.hr^{-1}$ in 2025, the year following completion of infilling.

Odour emission rates for each of the four cells are shown in Figures 2 – 5. Total rates for the site as a whole are shown in Figure 6. The odour emission rates are expressed in odour units (OU) per hour. An OU is defined as "the amount of odorant(s) that, when evaporated into 1 cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel . . . equivalent to that elicited by one European Reference Odour Mass . . ."[1]

It can be seen from Figures 2 – 5 that peak rates are predicted to occur during the final year of the first cycle of infilling in each cell (second cycle in Cell 4). Thereafter, emission rates decline as the temporary caps are installed, the gas collection efficiency increases and, after 2025, the generation rate decreases. The total odour emission rate for the site as a whole is predicted to peak in 2018, corresponding to the peak for Cell 4 (Figure 6).

Predicted 50^{th} and 95^{th} percentile odour emission rates during the peak years for each of the cells are provided in Table 3a. The rates normalised according to the surface area of each cell are provided in Table 3b.

[1] Environment Agency. 2002. *Integrated Pollution Prevention and Control. Horizontal Guidance for Odour, Part 1 – Regulation and Permitting, Part 2- Assessment and Control. Technical Guidance Note IPPC H4.* Draft, October 2002.

Table 3. Predicted Peak Odour Emission Rates

a) OU.hr^{-1}

	Cell 1		Cell 2		Cell 3		Cell 4	
Peak year	**2010**		**2012**		**2014**		**2018**	
	50th %ile	**95th %ile**	**50th %ile**	**95th %ile**	**50th %ile**	**95th %ile**	**50th %ile**	**95th %ile**
2010	7.35×10^6	1.27×10^7	0	0	0	0	0	0
2012	3.79×10^6	7.21×10^6	5.91×10^6	1.07×10^7	0	0	0	0
2014	2.33×10^6	4.76×10^6	3.51×10^6	6.79×10^6	4.73×10^6	7.75×10^6	0	0
2018	8.64×10^5	2.12×10^6	1.31×10^6	2.81×10^6	1.66×10^6	3.35×10^6	1.07×10^7	1.87×10^7

b) OU.m^{-2}.sec^{-1}

	Cell 1		Cell 2		Cell 3		Cell 4	
Surface Area	**25,178 m^2**		**21,734 m^2**		**29,011 m^2**		**20,370 m^2**	
Peak year	**2010**		**2012**		**2014**		**2018**	
	50th %ile	**95th %ile**	**50th %ile**	**95th %ile**	**50th %ile**	**95th %ile**	**50th %ile**	**95th %ile**
2010	0.081	0.140	0	0	0	0	0	0
2012	0.042	0.080	0.076	0.137	0	0	0	0
2014	0.026	0.053	0.045	0.087	0.045	0.074	0	0
2018	0.010	0.023	0.017	0.036	0.016	0.032	0.255	0.146

4. ATMOSPHERIC DISPERSION MODELLING

4.1 Methods

Atmospheric dispersion of odour emissions was modelled using Breeze AERMOD. AERMOD is one of the "new generation" models recommended for odour modelling by the Environment Agency.[2] The model was used to predict odour concentrations[3] in the breathing zone (2m above the ground surface) at potentially sensitive off-site receptor locations.

[2] Environment Agency. 2002. *Integrated Pollution Prevention and Control. Horizontal Guidance for Odour, Part 1 – Regulation and Permitting, Part 2- Assessment and Control. Technical Guidance Note IPPC H4.* Draft, October 2002.

[3] The odour concentration is defined as "*The amount of odour present in a cubic metre of sample gas at standard conditions. The odour concentration is measured in European odour units ($ou_E m^{-3}$). The odour concentration at the detection threshold is defined to be 1 $ou_E m^{-3}$. If an odour sample has been diluted in an olfactometer by a factor of 10,000 to reach the detection threshold, then the concentration of the original sample is 10,000 odour units.*" (Envionment Agency, H4 Guidance)

Odour emissions were modelled as four area sources corresponding to the four cells, using the 50th and 95th percentile odour emission rates predicted by GasSim2 for the peak years for each cell (Table 3). AERMOD is ideally suited for such modelling because the irregular outline of the different cells can be easily "mapped" as input to the model.

AERMOD requires hourly sequential meteorological data for the nearest representative met station. Meteorological data for the year 2006 were obtained from Hawarden Airport. Cloud cover data were not available for Hawarden, and so were obtained for Liverpool (87%) and Manchester (13%) airports. The Hawarden wind rose for 2006 (Figure 7) is similar to that for 2005 (Figure 8), being dominated by winds from the south-east, suggesting that the 2006 data are representative of conditions during previous years.

AERMOD models were run using local Ordnance Survey terrain data obtained from the eMapSite website.

Predicted odour concentrations were expressed as the 98th percentiles of the distribution of hourly predicted values, as per Environment Agency Guidance.[4]

The background concentration was set at zero $OU.m^{-3}$ for assessment purposes, in accordance with Environment Agency guidance, which states that:

> "*Odours are not generally additive in the same way as noise. A "new" odour cannot be added to an existing background or "ambient" odour level to give a figure for total odour.*"[5]

This is because the brain has a tendency to screen out odours that are normally present in the environment, leading to a tolerance to a constant background of local odours.

4.2 Model Predictions

Predicted 98th percentile odour concentrations based on 50th percentile and 95th percentile odour emissions rates are provided in Table 4 for each identified potentially sensitive receptor location.

[4] Environment Agency. 2002. *Integrated Pollution Prevention and Control. Horizontal Guidance for Odour, Part 1 – Regulation and Permitting, Part 2- Assessment and Control. Technical Guidance Note IPPC H4.* Draft, October 2002.
[5] Environment Agency. 2002. *Integrated Pollution Prevention and Control. Horizontal Guidance for Odour, Part 1 – Regulation and Permitting, Part 2- Assessment and Control. Technical Guidance Note IPPC H4.* Draft, October 2002.

The annoyance potential for a mixture of odorous chemicals, or the likelihood that exposures will lead to a "reasonable cause for annoyance" in the exposed population, depends in part on the offensiveness of the odour. The H4 Guidance suggests an indicative criterion of 1.5 $OU.m^{-3}$ for odours from putrescible wastes. This criterion has been used an indicator of potential odour nuisance for residential receptors, the Holiday Inn and the Shell Service Station. A criterion of 3 $OU.m^{-3}$ has been used as an indicator for industrial/business receptors to reflect their less sensitive nature.

Predicted odour concentrations based on typical (50^{th} percentile) odour emission rates were below indicative criteria for all modelled years and all receptors (Table 4a).

Predicted odour concentrations based on reasonable upper-bound (95^{th} percentile) odour emission rates were below indicative criteria for all modelled years and all receptors, with the exception of the business/industrial area immediately to the north of the site, Alltami House and Penfold Cottage for the year 2018 (Table 4b). These three receptors are located to the north and north-west of the landfill, and their potential susceptibility reflects the predominance of south-easterly winds in the general area. Figure 9 shows a contour plot of the odour concentrations for the year 2018.

The above predictions assumed that the emission sources occur at ground-level determined from the OS terrain map. This is appropriate for the peak years of 2010, 2012 and 2014, when landfilling would be at or below ground levels. However, landfilling operations would be at elevated levels in Cell 4 during the peak year of 2018. Therefore, the model for 2018 has been repeated, assuming that the Cell 4 surface is elevated at 15m above ground level. Predicted odour concentrations at the business/industrial area to the north, Alltami House and Penfold Cottage were lower than previously modelled, but still slightly higher than indicative criteria.

Figure 8. Wind Rose for 2005

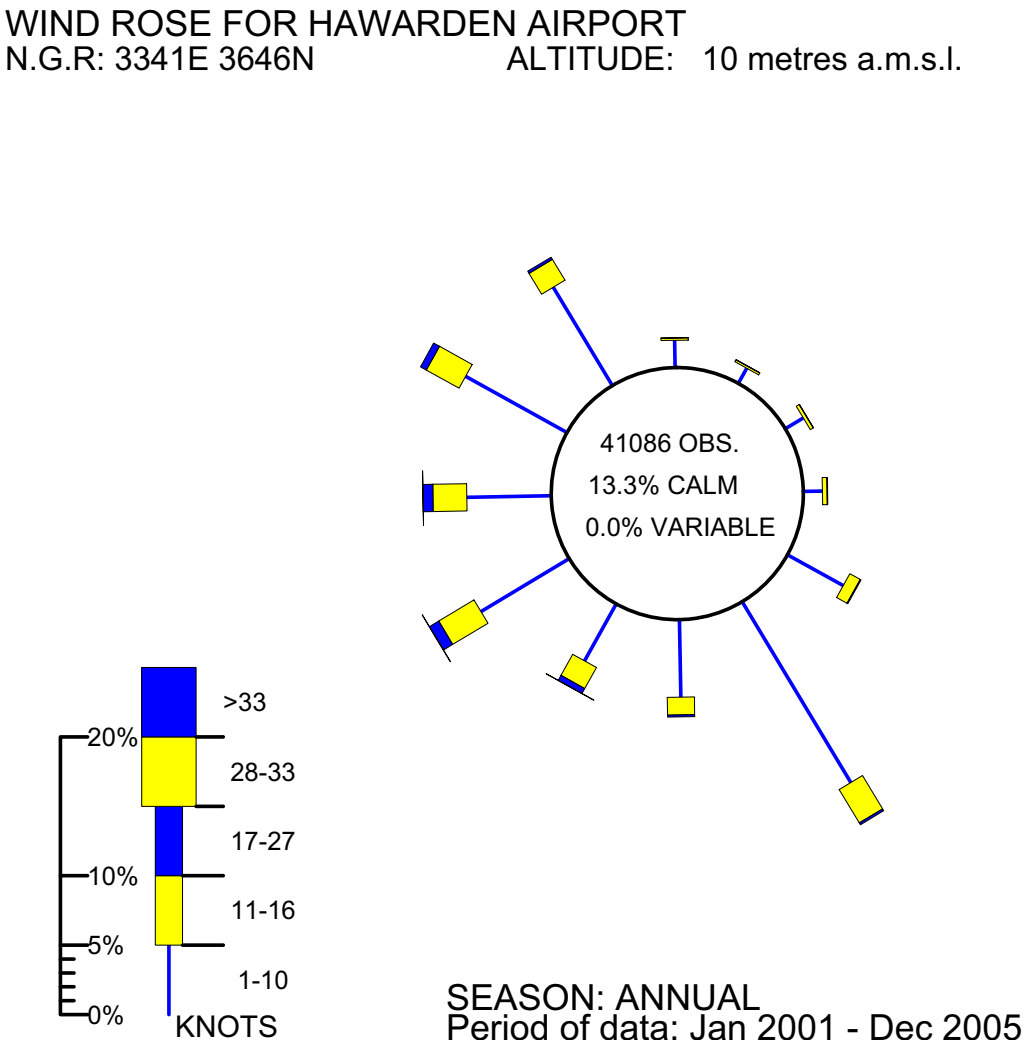


Table 4. Predicted 98th Percentile Odour Concentrations During Peak Years ($OU.m^{-3}$)

a) 50th percentile odour emission rates

Receptor	Peak Year				Critical Level
	2010	2012	2014	2018	
Parry's Cottages	0.06	0.46	0.74	0.39	1.5
Holiday Inn	0.40	0.44	0.35	0.41	
Shell Service Station	0.69	0.54	0.40	0.54	
The Box	0.51	0.41	0.44	0.66	
Alltami House	0.19	0.30	0.41	1.18	
Penfold Cottage	0.19	0.28	0.38	1.02	
Ewloe Wood House	0.22	0.25	0.32	0.75	
Ewloe Barns Industrial Estate	0.03	0.11	0.22	0.15	3
SCANIA and other business/industrial units (to north of site)	0.70	0.72	0.64	2.89	
FCC and other office/ business units to south-west of site	0.07	0.14	0.32	0.23	

b) 95th percentile odour emission rates

Receptor	Peak Year					Critical Level
				2018		
	2010	2012	2014	Ground-level Source	Elevated Source	
Parry's Cottages	0.11	0.83	1.26	0.74	0.77	1.5
Holiday Inn	0.70	0.84	0.66	0.78	0.71	
Shell Service Station	1.19	1.00	0.78	1.01	0.85	
The Box	0.88	0.77	0.80	1.19	1.01	
Alltami House	0.32	0.56	0.72	2.13	1.74	
Penfold Cottage	0.33	0.53	0.67	1.83	1.55	
Ewloe Wood House	0.37	0.45	0.59	1.35	1.27	
Ewloe Barns Industrial Estate	0.05	0.20	0.37	0.29	0.30	3
SCANIA and other business/industrial units (to north of site)	1.21	1.32	1.19	5.12	3.92	
FCC and other office/ business units to south-west of site	0.12	0.26	0.55	0.44	0.50	

5. EVALUATION OF IMPACT SIGNIFICANCE

According to National Society for Clean Air (NSCA) guidance for development control, there are three aspects of the potential impacts of planning proposals that need to be taken into account when determining significance:[6]

- the absolute concentrations in relation to air quality objectives;
- the magnitude of the change; and
- the number of people exposed to the changes.

Whilst there are no statutory air quality objectives relating to odour, the Environment Agency have suggested an indicative criterion of 1.5 $OU.m^{-3}$ for use in odour assessments for waste sites. This criterion has been used in the current assessment for residential and other sensitive receptors, and adjusted to 3 $OU.m^{-3}$ for industrial receptors. The odour emissions and atmospheric dispersion models for the proposed site suggest that landfilling activities would not result in exceedances of odour criteria, apart from during a limited peak period during the latter stages of landfilling in Cell 4, and then only when one assumes upper-bound odour emission rates.

Predicted upper-bound 98^{th} percentile odour concentrations during peak years ranged from <1 to 5 $OU.m^{-3}$ at sensitive receptor locations. Such odour concentrations are below those for normal background odours such as from traffic, grass cutting, plants, etc., which range from 5 to 40 $OU.m^{-3}$.[7]

There are few, scattered properties in the vicinity of the proposed site. The odour assessment predicted odour concentrations in excess of indicative odour criteria at only three receptor locations, including one industrial/business area immediately to the north of the site. Thus, in terms of the NSCA criterion relating to the number of people exposed to the emissions, relatively few people would be affected.

Given the small magnitude of the predicted odour concentrations in relation to odour criterion concentrations and background odours, the few receptors potentially affected, and the limited duration of the potential impacts, it is considered that the potential impact of the proposals would be intermittent and localised, and of minor significance, in the absence of appropriate odour control measures.

[6] NSCA. 2006. *Development Control: Planning for Air Quality. Updated guidance from NSCA on dealing with air quality concerns within the development control process.*
[7] Wijnen H. 1986. Air Quality Standards on Odours in the Netherlands. VDI Berichte 561: 365-385. Cited in the H4 Guidance, Part 1.

6. SCOPE FOR MITIGATION

Whilst the odour emissions and atmospheric dispersion models used in the odour assessment account for the containment, collection and treatment of LFG, they do not incorporate all the odour control measures described in the Odour Management Plan. Additional control measures not considered in the quantitative assessment include:

- application of inert cover materials over deposited waste at the end of each working day;
- application of odour suppressants and masking agents, where necessary;
- limitation of active working area to within 900m^2;
- immediate burial of particularly odorous waste materials; and
- pre-treatment of non-hazardous waste, which will be required from 1st October 2007.

The Odour Management Plan would be agreed and regulated by the Environment Agency under the PPC permitting process, along with an odour monitoring programme. Implementation of the measures incorporated in these plans would ensure that odour emissions are minimised to within or below the levels predicted by the odour assessment models.

Given the minor significance of the potential odour emissions, and the implementation of the range of odour control measures incorporated in the Odour Management Plan, it is considered that the residual odour impacts could be managed to negligible levels.

7. CONCLUSIONS

Detailed odour emissions and atmospheric dispersion model predictions indicate that, assuming upper-bound emission rates, odour concentrations may slightly exceed indicative acceptable odour criteria at a limited number of sensitive receptor locations during a limited period of the site development plan, i.e, in 2018, towards the end of landfilling operations at Cell 4. The models may have over-estimated the odour concentrations associated with Cell 4, because no account was made for differences in the sizes of the respective cells. Cell 4 would be the smallest of the four cells, and so emissions rates are likely to be lower than those predicted.

Given the small magnitude of the predicted odour concentrations in relation to odour criterion concentrations and background odours, the few receptors potentially affected, and the limited duration of the potential impacts, it is considered that the potential impact of the proposals would be intermittent and localised, and of minor significance, in the absence of appropriate odour control measures.

Through the implementation of the range of odour control measures incorporated in the Odour Management Plan, which would be agreed and regulated by the Environment Agency under the PPC permitting process, it is considered that potential odour impacts would be manageable to negligible levels.

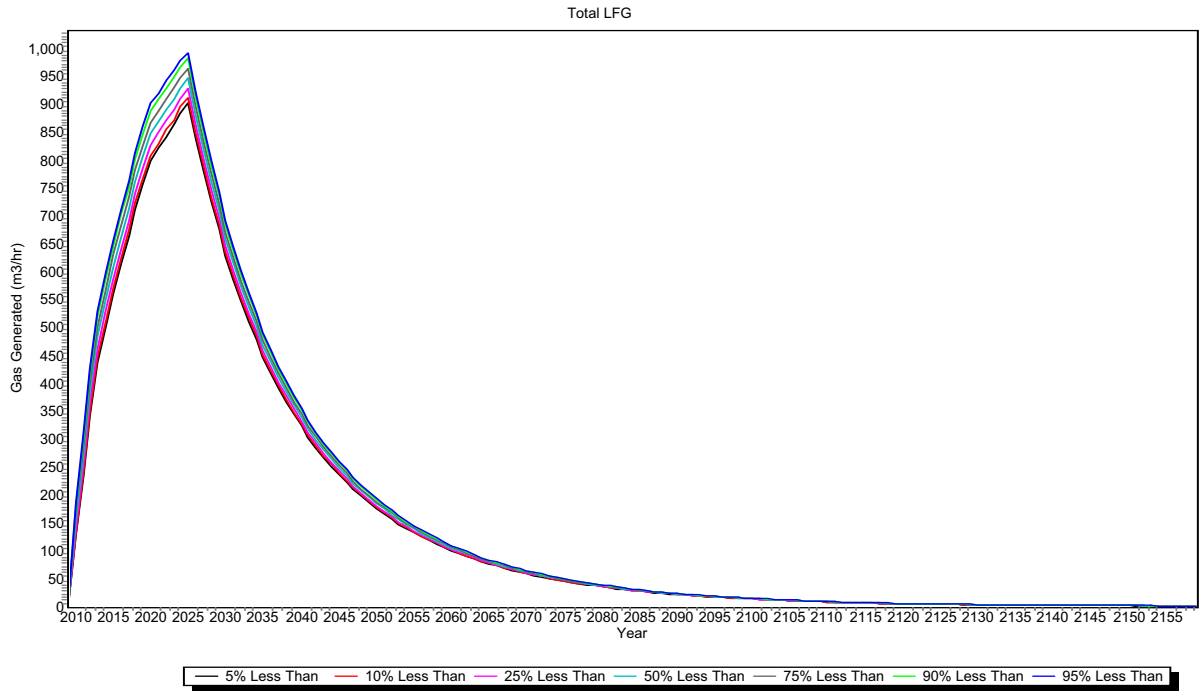
FIGURE 1

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Total: Total Bulk LFG Produced



parry1 average moisture.gss 19/05/2007 10:23:44

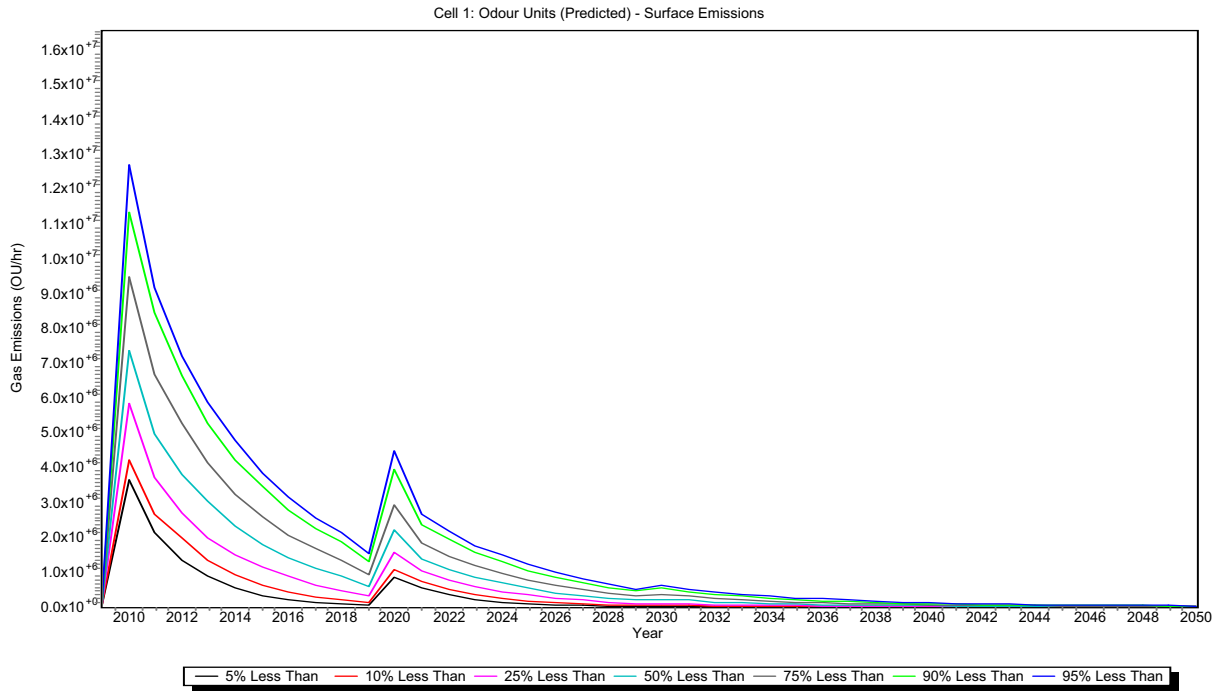
FIGURE 2

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Cell 1: Odour Units (Predicted) - Surface Emissions



parry1 average moisture.gss 19/05/2007 10:23:44

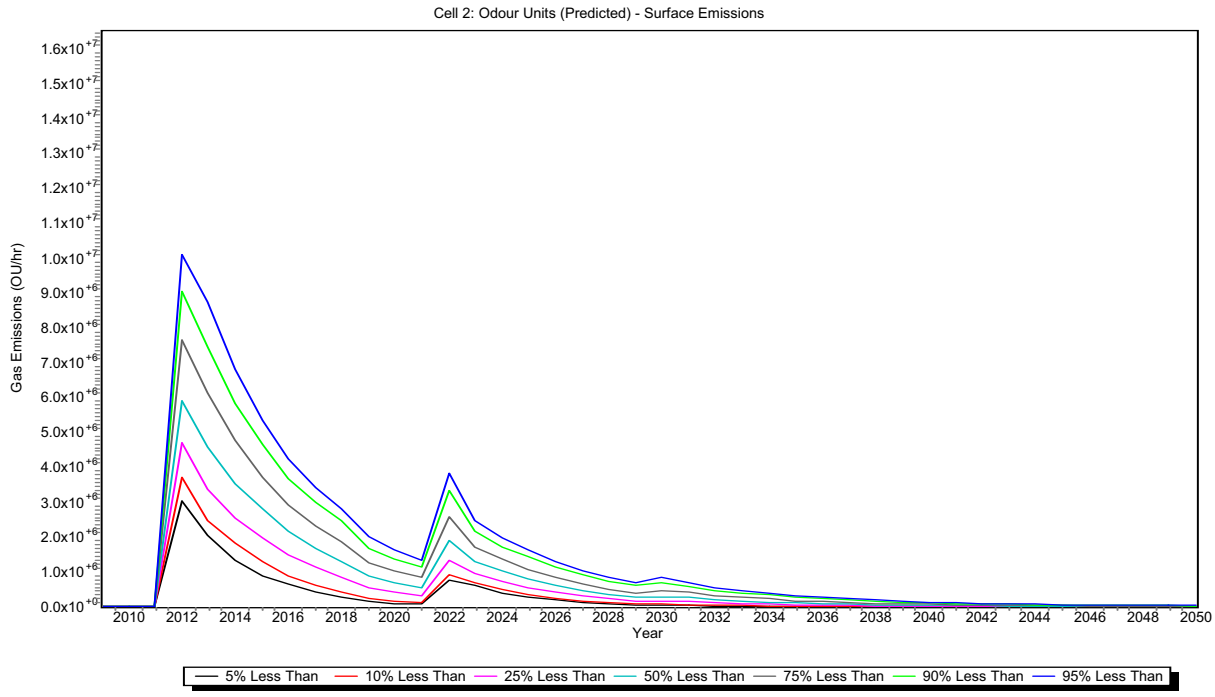
FIGURE 3

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Cell 2: Odour Units (Predicted) - Surface Emissions



parry1 average moisture.gss 19/05/2007 10:23:44

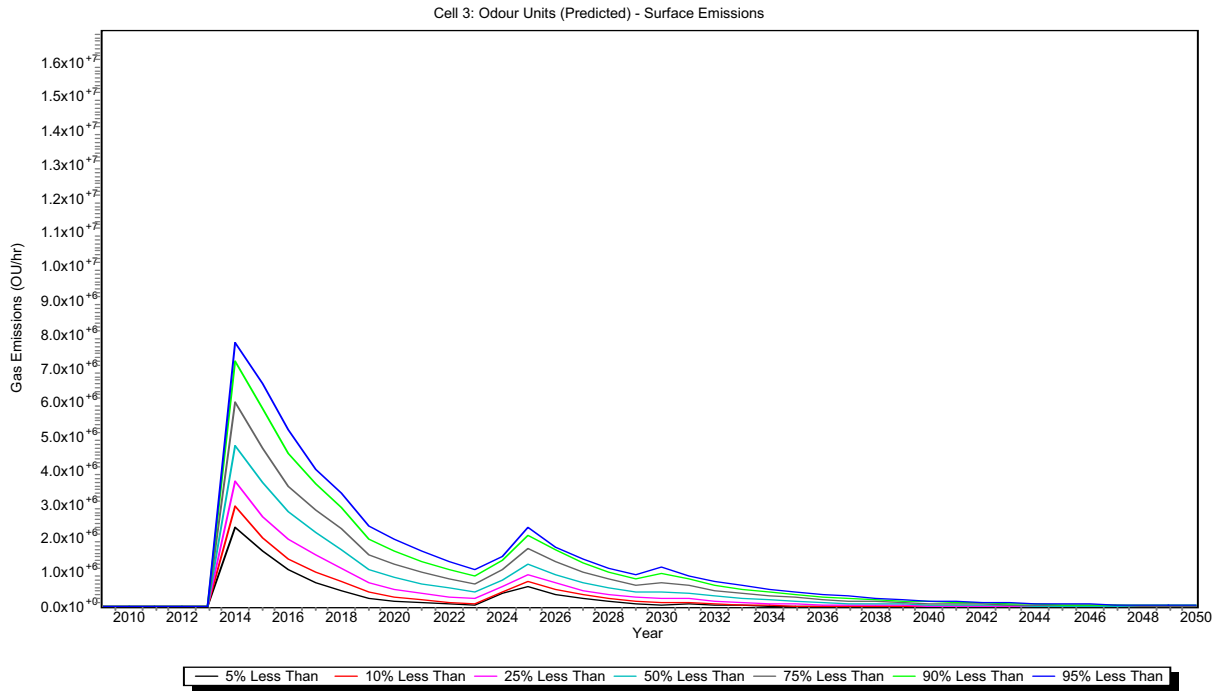
FIGURE 4

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Cell 3: Odour Units (Predicted) - Surface Emissions



parry1 average moisture.gss 19/05/2007 10:23:44

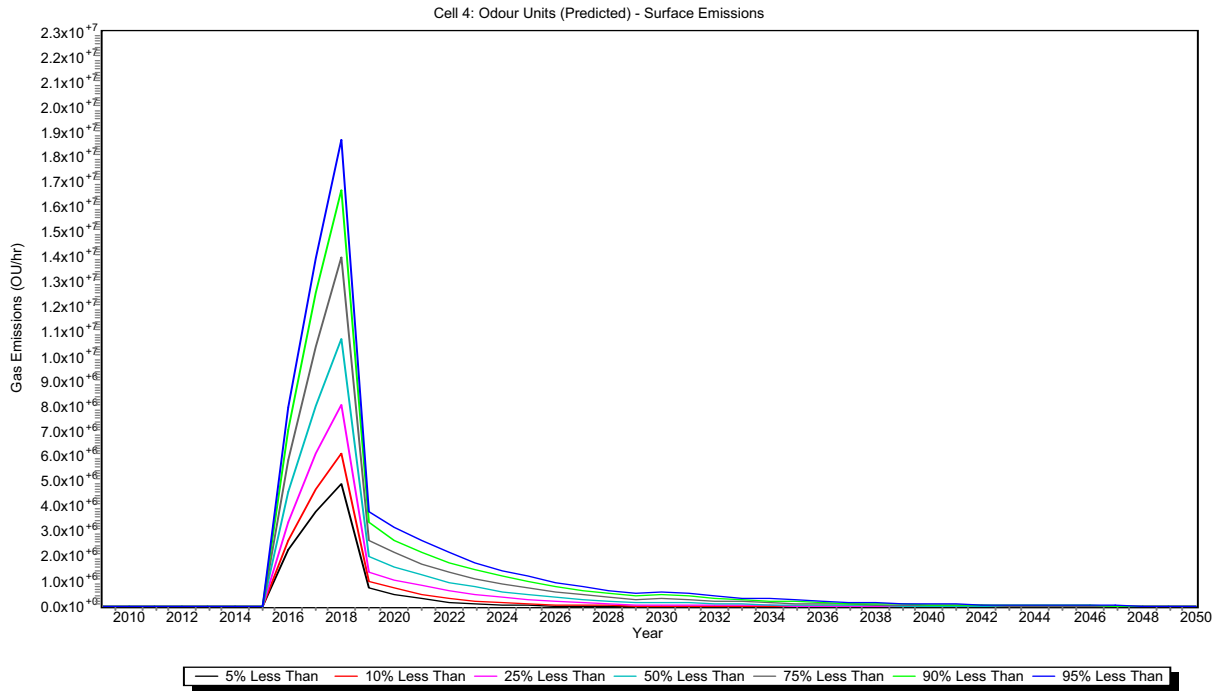
FIGURE 5

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Cell 4: Odour Units (Predicted) - Surface Emissions



parry1 average moisture.gss 19/05/2007 10:23:44

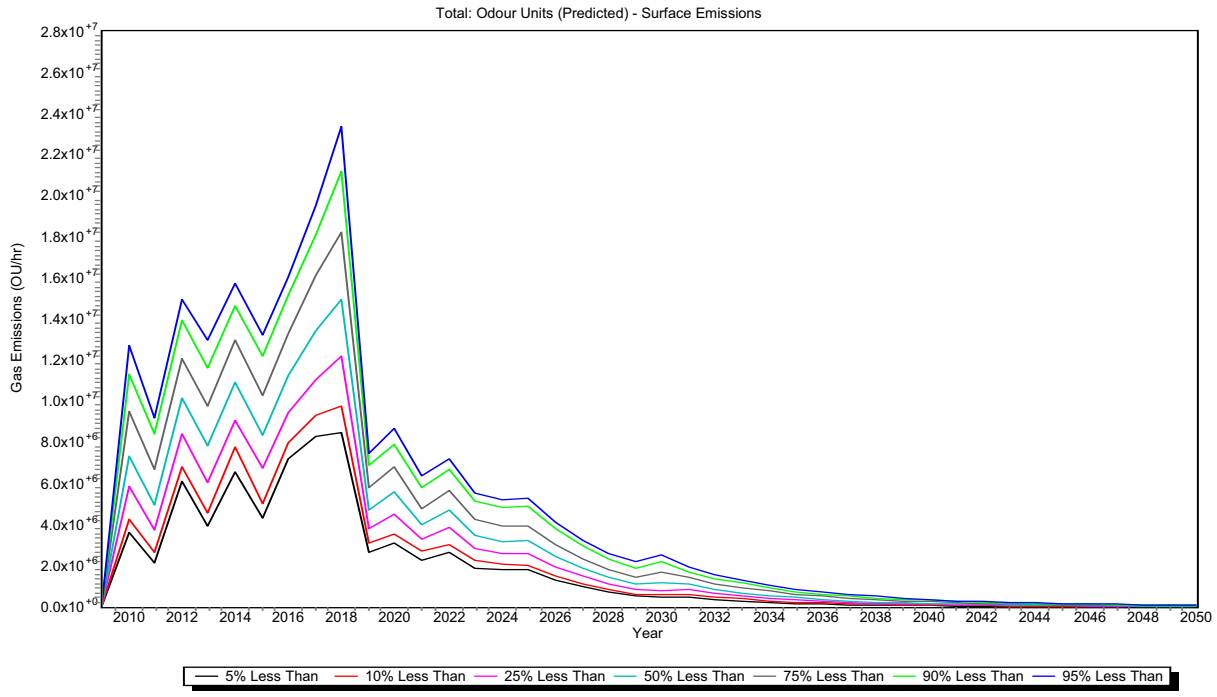
FIGURE 6

GasSim Version V 2.00

Project Name: Parry Quarry

Project Client: Robin Jones & Sons Ltd

Total: Odour Units (Predicted) - Surface Emissions



parry1 average moisture.gss 19/05/2007 10:23:44

FIGURE 7

01/01/2006 Hr 1 to 31/12/2006 Hr 24

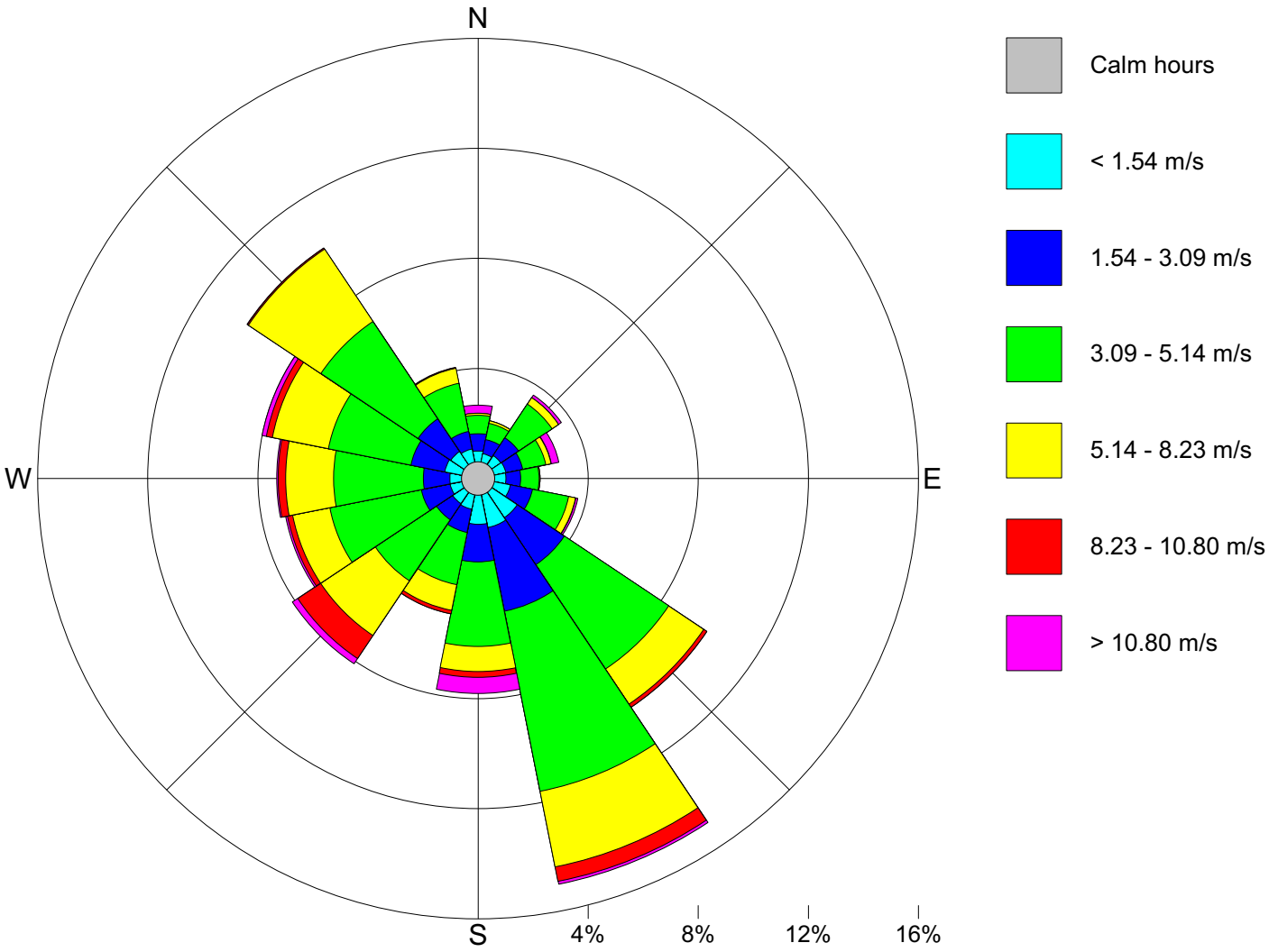
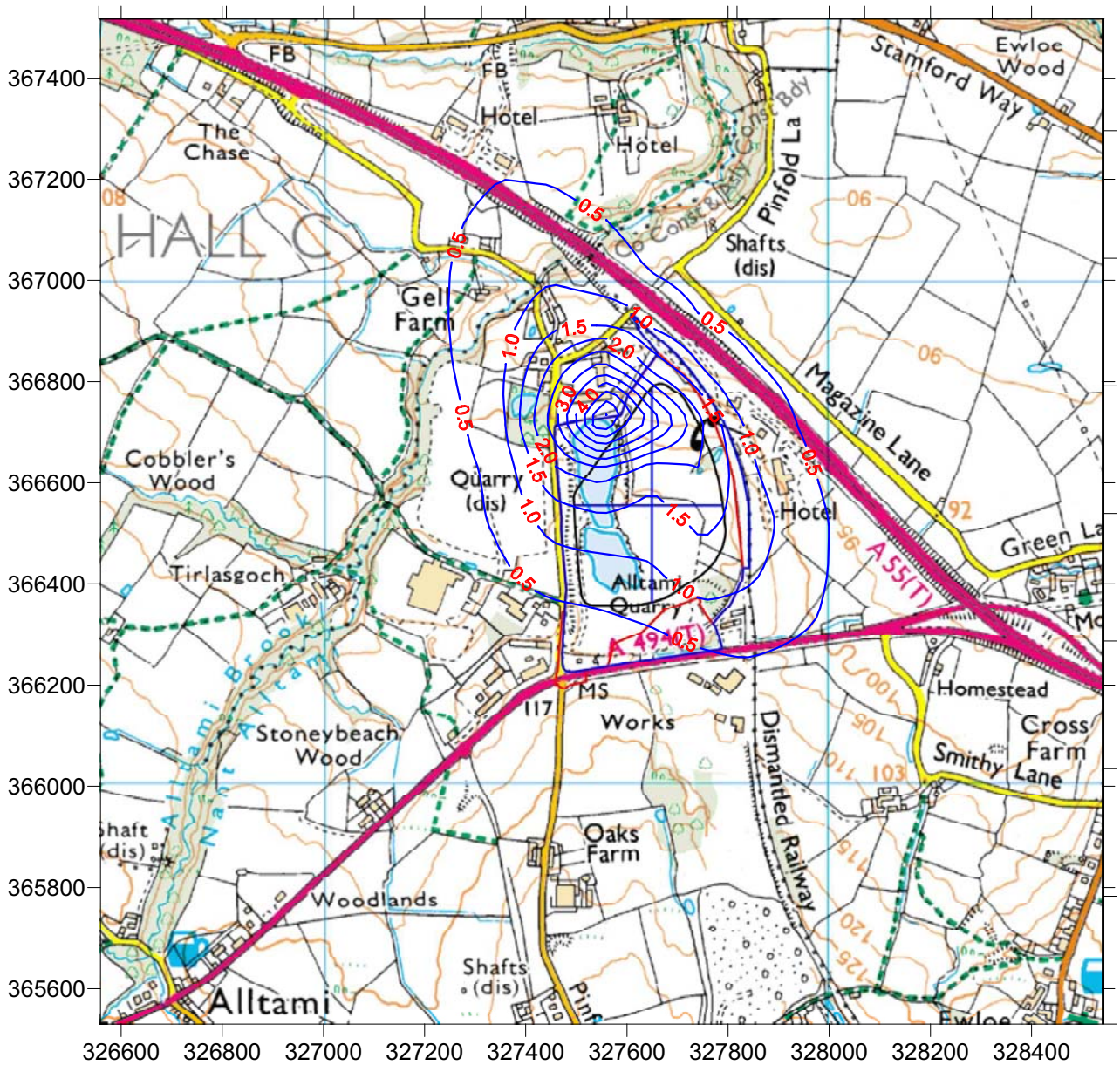


FIGURE 9

Figure 9. 98th Percentile Odour Concentration Contours, 2018



APPENDIX 1

ProjectDetails

Project Name	Parry Quarry
Client	Robin Jones & Sons Ltd
Model	C:\Julia\Parry Quarry\parry1 average moisture.gss
Model Date	19/05/2007 10:23:44
Comments	Odour assessment for planning proposals
Start Year	2009
Operation Period	16
Simulation Period	150
Iterations	500

Simulate Land Raise
Confined Migration Pathway

Waste Composition

Year	Composition
2009	England 2000-2010 waste streams
Newspapers	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(48.5)
Hemi-Cellulose (%)	SINGLE(9.0)
Decomposition (%)	SINGLE(35.0)
Magazines	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(42.3)
Hemi-Cellulose (%)	SINGLE(9.4)
Decomposition (%)	SINGLE(46.0)
Other paper	
Domestic	SINGLE(19.8)
Civic Amenity	SINGLE(3.3)
Commercial	SINGLE(28.8)
Industrial	SINGLE(8.8)
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(87.4)
Hemi-Cellulose (%)	SINGLE(8.4)
Decomposition (%)	SINGLE(98.0)
Liquid cartons	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Card packaging	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Other card	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Wood	
Domestic	SINGLE(3.0)
Civic Amenity	SINGLE(11.2)
Commercial	SINGLE(3.3)
Industrial	SINGLE(5.0)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(21.0)
Hemi-Cellulose (%)	SINGLE(11.0)
Decomposition (%)	SINGLE(75.0)
Textiles	
Domestic	SINGLE(3.3)
Civic Amenity	SINGLE(2.3)
Commercial	SINGLE(1.1)
Industrial	SINGLE(0.3)
Water (%)	SINGLE(25.0)
Cellulose (%)	SINGLE(20.0)
Hemi-Cellulose (%)	SINGLE(20.0)
Decomposition (%)	SINGLE(50.0)
Disposable nappies	
Domestic	SINGLE(3.3)
Civic Amenity	SINGLE(2.9)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Other misc. combustibles	
Domestic	SINGLE(0.3)
Civic Amenity	SINGLE(4.2)
Commercial	SINGLE(10.4)
Industrial	SINGLE(17.7)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)

Decomposition (%)	SINGLE(50.0)
Garden waste	
Domestic	SINGLE(16.0)
Civic Amenity	SINGLE(32.1)
Commercial	SINGLE(9.8)
Industrial	SINGLE(4.7)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(25.7)
Hemi-Cellulose (%)	SINGLE(13.0)
Decomposition (%)	SINGLE(62.0)
Other putrescible	
Domestic	SINGLE(25.6)
Civic Amenity	SINGLE(14.8)
Commercial	SINGLE(10.4)
Industrial	SINGLE(6.8)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(55.4)
Hemi-Cellulose (%)	SINGLE(7.2)
Decomposition (%)	SINGLE(76.0)
10mm fines	
Domestic	SINGLE(4.1)
Civic Amenity	SINGLE(1.2)
Commercial	SINGLE(1.9)
Industrial	SINGLE(0.5)
Water (%)	SINGLE(40.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Sewage sludge	
Sewage Sludge	SINGLE(100.0)
Water (%)	SINGLE(70.0)
Cellulose (%)	SINGLE(14.0)
Hemi-Cellulose (%)	SINGLE(14.0)
Decomposition (%)	SINGLE(75.0)
Composted organic material	
Composted Organic Material	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	UNIFORM(7.47, 9.59)
Hemi-Cellulose (%)	UNIFORM(7.47, 9.59)
Decomposition (%)	SINGLE(57.0)
Incinerator ash	
Commercial	SINGLE(0.2)
Industrial	SINGLE(25.5)
Incinerator Ash	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Hemi-Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Decomposition (%)	SINGLE(57.0)
Non degradable	
Domestic	SINGLE(24.6)
Civic Amenity	SINGLE(28.0)
Commercial	SINGLE(34.1)
Industrial	SINGLE(30.7)
Inert	SINGLE(100.0)
Water (%)	SINGLE(0.0)
Cellulose (%)	SINGLE(0.0)
Hemi-Cellulose (%)	SINGLE(0.0)
Decomposition (%)	SINGLE(0.0)
Calcium Sulphate (%)	
Domestic	TRIANGULAR(0.2, 0.35, 2.3)
Civic Amenity	TRIANGULAR(0.2, 0.35, 2.3)
Composted Organic Material	TRIANGULAR(0.2, 0.35, 2.3)
Incinerator Ash	TRIANGULAR(0.2, 0.35, 2.3)
Residues from MRF	TRIANGULAR(0.2, 0.35, 2.3)
Recycling Schemes	TRIANGULAR(0.2, 0.35, 2.3)
Chemical Sludge	TRIANGULAR(0.2, 0.35, 2.3)
Industrial Liquid Waste	TRIANGULAR(0.2, 0.35, 2.3)
Iron (%)	
Domestic	TRIANGULAR(0.3, 4.8, 8.2)
Civic Amenity	TRIANGULAR(0.3, 4.8, 8.2)
Commercial	TRIANGULAR(0.3, 4.8, 8.2)
Industrial	TRIANGULAR(0.3, 4.8, 8.2)
Inert	TRIANGULAR(0.3, 4.8, 8.2)
Liquid Inert	TRIANGULAR(0.3, 4.8, 8.2)
Sewage Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Composted Organic Material	TRIANGULAR(0.3, 4.8, 8.2)
Incinerator Ash	TRIANGULAR(0.3, 4.8, 8.2)
Residues from MRF	TRIANGULAR(0.3, 4.8, 8.2)
Recycling Schemes	TRIANGULAR(0.3, 4.8, 8.2)
Chemical Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Industrial Liquid Waste	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 1	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 2	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 3	TRIANGULAR(0.3, 4.8, 8.2)
2010	England 2010-2013 waste streams
Newspapers	

Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(48.5)
Hemi-Cellulose (%)	SINGLE(9.0)
Decomposition (%)	SINGLE(35.0)
Magazines	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(42.3)
Hemi-Cellulose (%)	SINGLE(9.4)
Decomposition (%)	SINGLE(46.0)
Other paper	
Domestic	SINGLE(14.9)
Civic Amenity	SINGLE(3.3)
Commercial	SINGLE(28.8)
Industrial	SINGLE(8.8)
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(87.4)
Hemi-Cellulose (%)	SINGLE(8.4)
Decomposition (%)	SINGLE(98.0)
Liquid cartons	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Card packaging	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Other card	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Wood	
Domestic	SINGLE(2.3)
Civic Amenity	SINGLE(11.2)
Commercial	SINGLE(3.3)
Industrial	SINGLE(5.0)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(21.0)
Hemi-Cellulose (%)	SINGLE(11.0)
Decomposition (%)	SINGLE(75.0)
Textiles	
Domestic	SINGLE(2.5)
Civic Amenity	SINGLE(2.3)
Commercial	SINGLE(1.1)
Industrial	SINGLE(0.3)
Water (%)	SINGLE(25.0)
Cellulose (%)	SINGLE(20.0)
Hemi-Cellulose (%)	SINGLE(20.0)
Decomposition (%)	SINGLE(50.0)
Disposable nappies	
Domestic	SINGLE(2.5)
Civic Amenity	SINGLE(2.9)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Other misc. combustibles	
Domestic	SINGLE(0.2)
Civic Amenity	SINGLE(4.2)
Commercial	SINGLE(10.4)
Industrial	SINGLE(17.7)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Garden waste	
Domestic	SINGLE(12.0)
Civic Amenity	SINGLE(32.1)
Commercial	SINGLE(9.8)
Industrial	SINGLE(4.7)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(25.7)
Hemi-Cellulose (%)	SINGLE(13.0)
Decomposition (%)	SINGLE(62.0)
Other putrescible	
Domestic	SINGLE(19.2)
Civic Amenity	SINGLE(14.8)
Commercial	SINGLE(10.4)
Industrial	SINGLE(6.8)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(55.4)
Hemi-Cellulose (%)	SINGLE(7.2)
Decomposition (%)	SINGLE(76.0)
10mm fines	

Domestic	SINGLE(3.1)
Civic Amenity	SINGLE(1.2)
Commercial	SINGLE(1.9)
Industrial	SINGLE(0.5)
Water (%)	SINGLE(40.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Sewage sludge	
Sewage Sludge	SINGLE(100.0)
Water (%)	SINGLE(70.0)
Cellulose (%)	SINGLE(14.0)
Hemi-Cellulose (%)	SINGLE(14.0)
Decomposition (%)	SINGLE(75.0)
Composted organic material	
Composted Organic Material	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	UNIFORM(7.47, 9.59)
Hemi-Cellulose (%)	UNIFORM(7.47, 9.59)
Decomposition (%)	SINGLE(57.0)
Incinerator ash	
Commercial	SINGLE(0.2)
Industrial	SINGLE(25.5)
Incinerator Ash	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Hemi-Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Decomposition (%)	SINGLE(57.0)
Non degradable	
Domestic	SINGLE(43.3)
Civic Amenity	SINGLE(28.0)
Commercial	SINGLE(34.1)
Industrial	SINGLE(30.7)
Inert	SINGLE(100.0)
Water (%)	SINGLE(0.0)
Cellulose (%)	SINGLE(0.0)
Hemi-Cellulose (%)	SINGLE(0.0)
Decomposition (%)	SINGLE(0.0)
Calcium Sulphate (%)	
Domestic	TRIANGULAR(0.2, 0.35, 2.3)
Civic Amenity	TRIANGULAR(0.2, 0.35, 2.3)
Composted Organic Material	TRIANGULAR(0.2, 0.35, 2.3)
Incinerator Ash	TRIANGULAR(0.2, 0.35, 2.3)
Residues from MRF	TRIANGULAR(0.2, 0.35, 2.3)
Recycling Schemes	TRIANGULAR(0.2, 0.35, 2.3)
Chemical Sludge	TRIANGULAR(0.2, 0.35, 2.3)
Industrial Liquid Waste	TRIANGULAR(0.2, 0.35, 2.3)
Iron (%)	
Domestic	TRIANGULAR(0.3, 4.8, 8.2)
Civic Amenity	TRIANGULAR(0.3, 4.8, 8.2)
Commercial	TRIANGULAR(0.3, 4.8, 8.2)
Industrial	TRIANGULAR(0.3, 4.8, 8.2)
Inert	TRIANGULAR(0.3, 4.8, 8.2)
Liquid Inert	TRIANGULAR(0.3, 4.8, 8.2)
Sewage Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Composted Organic Material	TRIANGULAR(0.3, 4.8, 8.2)
Incinerator Ash	TRIANGULAR(0.3, 4.8, 8.2)
Residues from MRF	TRIANGULAR(0.3, 4.8, 8.2)
Recycling Schemes	TRIANGULAR(0.3, 4.8, 8.2)
Chemical Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Industrial Liquid Waste	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 1	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 2	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 3	TRIANGULAR(0.3, 4.8, 8.2)
2011	England 2010-2013 waste streams
2012	England 2010-2013 waste streams
2013	England 2013-2020 waste streams
Newspapers	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(48.5)
Hemi-Cellulose (%)	SINGLE(9.0)
Decomposition (%)	SINGLE(35.0)
Magazines	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(42.3)
Hemi-Cellulose (%)	SINGLE(9.4)
Decomposition (%)	SINGLE(46.0)
Other paper	
Domestic	SINGLE(9.9)
Civic Amenity	SINGLE(3.3)
Commercial	SINGLE(28.8)
Industrial	SINGLE(8.8)
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(87.4)
Hemi-Cellulose (%)	SINGLE(8.4)
Decomposition (%)	SINGLE(98.0)

Liquid cartons	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Card packaging	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Other card	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Wood	
Domestic	SINGLE(1.5)
Civic Amenity	SINGLE(11.2)
Commercial	SINGLE(3.3)
Industrial	SINGLE(5.0)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(21.0)
Hemi-Cellulose (%)	SINGLE(11.0)
Decomposition (%)	SINGLE(75.0)
Textiles	
Domestic	SINGLE(1.7)
Civic Amenity	SINGLE(2.3)
Commercial	SINGLE(1.1)
Industrial	SINGLE(0.3)
Water (%)	SINGLE(25.0)
Cellulose (%)	SINGLE(20.0)
Hemi-Cellulose (%)	SINGLE(20.0)
Decomposition (%)	SINGLE(50.0)
Disposable nappies	
Domestic	SINGLE(1.7)
Civic Amenity	SINGLE(2.9)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Other misc. combustibles	
Domestic	SINGLE(0.2)
Civic Amenity	SINGLE(4.2)
Commercial	SINGLE(10.4)
Industrial	SINGLE(17.7)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Garden waste	
Domestic	SINGLE(8.0)
Civic Amenity	SINGLE(32.1)
Commercial	SINGLE(9.8)
Industrial	SINGLE(4.7)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(25.7)
Hemi-Cellulose (%)	SINGLE(13.0)
Decomposition (%)	SINGLE(62.0)
Other putrescible	
Domestic	SINGLE(12.8)
Civic Amenity	SINGLE(14.8)
Commercial	SINGLE(10.4)
Industrial	SINGLE(6.8)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(55.4)
Hemi-Cellulose (%)	SINGLE(7.2)
Decomposition (%)	SINGLE(76.0)
10mm fines	
Domestic	SINGLE(2.1)
Civic Amenity	SINGLE(1.2)
Commercial	SINGLE(1.9)
Industrial	SINGLE(0.5)
Water (%)	SINGLE(40.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Sewage sludge	
Sewage Sludge	SINGLE(100.0)
Water (%)	SINGLE(70.0)
Cellulose (%)	SINGLE(14.0)
Hemi-Cellulose (%)	SINGLE(14.0)
Decomposition (%)	SINGLE(75.0)
Composted organic material	
Composted Organic Material	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	UNIFORM(7.47, 9.59)

Hemi-Cellulose (%)	UNIFORM(7.47, 9.59)
Decomposition (%)	SINGLE(57.0)
Incinerator ash	
Commercial	SINGLE(0.2)
Industrial	SINGLE(25.5)
Incinerator Ash	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Hemi-Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Decomposition (%)	SINGLE(57.0)
Non degradable	
Domestic	SINGLE(62.1)
Civic Amenity	SINGLE(28.0)
Commercial	SINGLE(34.1)
Industrial	SINGLE(30.7)
Inert	SINGLE(100.0)
Water (%)	SINGLE(0.0)
Cellulose (%)	SINGLE(0.0)
Hemi-Cellulose (%)	SINGLE(0.0)
Decomposition (%)	SINGLE(0.0)
Calcium Sulphate (%)	
Domestic	TRIANGULAR(0.2, 0.35, 2.3)
Civic Amenity	TRIANGULAR(0.2, 0.35, 2.3)
Composted Organic Material	TRIANGULAR(0.2, 0.35, 2.3)
Incinerator Ash	TRIANGULAR(0.2, 0.35, 2.3)
Residues from MRF	TRIANGULAR(0.2, 0.35, 2.3)
Recycling Schemes	TRIANGULAR(0.2, 0.35, 2.3)
Chemical Sludge	TRIANGULAR(0.2, 0.35, 2.3)
Industrial Liquid Waste	TRIANGULAR(0.2, 0.35, 2.3)
Iron (%)	
Domestic	TRIANGULAR(0.3, 4.8, 8.2)
Civic Amenity	TRIANGULAR(0.3, 4.8, 8.2)
Commercial	TRIANGULAR(0.3, 4.8, 8.2)
Industrial	TRIANGULAR(0.3, 4.8, 8.2)
Inert	TRIANGULAR(0.3, 4.8, 8.2)
Liquid Inert	TRIANGULAR(0.3, 4.8, 8.2)
Sewage Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Composted Organic Material	TRIANGULAR(0.3, 4.8, 8.2)
Incinerator Ash	TRIANGULAR(0.3, 4.8, 8.2)
Residues from MRF	TRIANGULAR(0.3, 4.8, 8.2)
Recycling Schemes	TRIANGULAR(0.3, 4.8, 8.2)
Chemical Sludge	TRIANGULAR(0.3, 4.8, 8.2)
Industrial Liquid Waste	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 1	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 2	TRIANGULAR(0.3, 4.8, 8.2)
User Defined 3	TRIANGULAR(0.3, 4.8, 8.2)
2014	England 2013-2020 waste streams
2015	England 2013-2020 waste streams
2016	England 2013-2020 waste streams
2017	England 2013-2020 waste streams
2018	England 2013-2020 waste streams
2019	England 2013-2020 waste streams
2020	England 2020+ waste streams
Newspapers	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(48.5)
Hemi-Cellulose (%)	SINGLE(9.0)
Decomposition (%)	SINGLE(35.0)
Magazines	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(42.3)
Hemi-Cellulose (%)	SINGLE(9.4)
Decomposition (%)	SINGLE(46.0)
Other paper	
Domestic	SINGLE(6.9)
Civic Amenity	SINGLE(3.3)
Commercial	SINGLE(28.8)
Industrial	SINGLE(8.8)
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(87.4)
Hemi-Cellulose (%)	SINGLE(8.4)
Decomposition (%)	SINGLE(98.0)
Liquid cartons	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Card packaging	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)
Decomposition (%)	SINGLE(64.0)
Other card	
Water (%)	SINGLE(30.0)
Cellulose (%)	SINGLE(57.3)
Hemi-Cellulose (%)	SINGLE(9.9)

Decomposition (%)	SINGLE(64.0)
Wood	
Domestic	SINGLE(1.1)
Civic Amenity	SINGLE(11.2)
Commercial	SINGLE(3.3)
Industrial	SINGLE(5.0)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(21.0)
Hemi-Cellulose (%)	SINGLE(11.0)
Decomposition (%)	SINGLE(75.0)
Textiles	
Domestic	SINGLE(1.2)
Civic Amenity	SINGLE(2.3)
Commercial	SINGLE(1.1)
Industrial	SINGLE(0.3)
Water (%)	SINGLE(25.0)
Cellulose (%)	SINGLE(20.0)
Hemi-Cellulose (%)	SINGLE(20.0)
Decomposition (%)	SINGLE(50.0)
Disposable nappies	
Domestic	SINGLE(1.2)
Civic Amenity	SINGLE(2.9)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Other misc. combustibles	
Domestic	SINGLE(0.1)
Civic Amenity	SINGLE(4.2)
Commercial	SINGLE(10.4)
Industrial	SINGLE(17.7)
Water (%)	SINGLE(20.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Garden waste	
Domestic	SINGLE(5.6)
Civic Amenity	SINGLE(32.1)
Commercial	SINGLE(9.8)
Industrial	SINGLE(4.7)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(25.7)
Hemi-Cellulose (%)	SINGLE(13.0)
Decomposition (%)	SINGLE(62.0)
Other putrescible	
Domestic	SINGLE(9.0)
Civic Amenity	SINGLE(14.8)
Commercial	SINGLE(10.4)
Industrial	SINGLE(6.8)
Water (%)	SINGLE(65.0)
Cellulose (%)	SINGLE(55.4)
Hemi-Cellulose (%)	SINGLE(7.2)
Decomposition (%)	SINGLE(76.0)
10mm fines	
Domestic	SINGLE(1.4)
Civic Amenity	SINGLE(1.2)
Commercial	SINGLE(1.9)
Industrial	SINGLE(0.5)
Water (%)	SINGLE(40.0)
Cellulose (%)	SINGLE(25.0)
Hemi-Cellulose (%)	SINGLE(25.0)
Decomposition (%)	SINGLE(50.0)
Sewage sludge	
Sewage Sludge	SINGLE(100.0)
Water (%)	SINGLE(70.0)
Cellulose (%)	SINGLE(14.0)
Hemi-Cellulose (%)	SINGLE(14.0)
Decomposition (%)	SINGLE(75.0)
Composted organic material	
Composted Organic Material	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	UNIFORM(7.47, 9.59)
Hemi-Cellulose (%)	UNIFORM(7.47, 9.59)
Decomposition (%)	SINGLE(57.0)
Incinerator ash	
Commercial	SINGLE(0.2)
Industrial	SINGLE(25.5)
Incinerator Ash	SINGLE(100.0)
Water (%)	SINGLE(30.0)
Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Hemi-Cellulose (%)	TRIANGULAR(0.5, 0.7, 1.5)
Decomposition (%)	SINGLE(57.0)
Non degradable	
Domestic	SINGLE(73.5)
Civic Amenity	SINGLE(28.0)
Commercial	SINGLE(34.1)

Industrial		SINGLE(30.7)
Inert		SINGLE(100.0)
Water (%)		SINGLE(0.0)
Cellulose (%)		SINGLE(0.0)
Hemi-Cellulose (%)		SINGLE(0.0)
Decomposition (%)		SINGLE(0.0)
Calcium Sulphate (%)		
Domestic		TRIANGULAR(0.2, 0.35, 2.3)
Civic Amenity		TRIANGULAR(0.2, 0.35, 2.3)
Composted Organic Material		TRIANGULAR(0.2, 0.35, 2.3)
Incinerator Ash		TRIANGULAR(0.2, 0.35, 2.3)
Residues from MRF		TRIANGULAR(0.2, 0.35, 2.3)
Recycling Schemes		TRIANGULAR(0.2, 0.35, 2.3)
Chemical Sludge		TRIANGULAR(0.2, 0.35, 2.3)
Industrial Liquid Waste		TRIANGULAR(0.2, 0.35, 2.3)
Iron (%)		
Domestic		TRIANGULAR(0.3, 4.8, 8.2)
Civic Amenity		TRIANGULAR(0.3, 4.8, 8.2)
Commercial		TRIANGULAR(0.3, 4.8, 8.2)
Industrial		TRIANGULAR(0.3, 4.8, 8.2)
Inert		TRIANGULAR(0.3, 4.8, 8.2)
Liquid Inert		TRIANGULAR(0.3, 4.8, 8.2)
Sewage Sludge		TRIANGULAR(0.3, 4.8, 8.2)
Composted Organic Material		TRIANGULAR(0.3, 4.8, 8.2)
Incinerator Ash		TRIANGULAR(0.3, 4.8, 8.2)
Residues from MRF		TRIANGULAR(0.3, 4.8, 8.2)
Recycling Schemes		TRIANGULAR(0.3, 4.8, 8.2)
Chemical Sludge		TRIANGULAR(0.3, 4.8, 8.2)
Industrial Liquid Waste		TRIANGULAR(0.3, 4.8, 8.2)
User Defined 1		TRIANGULAR(0.3, 4.8, 8.2)
User Defined 2		TRIANGULAR(0.3, 4.8, 8.2)
User Defined 3		TRIANGULAR(0.3, 4.8, 8.2)
2021		England 2020+ waste streams
2022		England 2020+ waste streams
2023		England 2020+ waste streams
2024		England 2020+ waste streams
Justification:	[Changed]	Default GasSim2 waste stream compositions used for relevant year of waste inputs

Trace Gases

No Combustion Products Selected

Cell 1

Infiltration		SINGLE(668.0)
Justification:	[Changed]	From Design Statement

Waste Input

Year		AmountDepositied (t)
2009		UNIFORM(9.81E+04, 1.47E+05)
2010		UNIFORM(9.81E+04, 1.47E+05)
2011		SINGLE(0.0)
2012		SINGLE(0.0)
2013		SINGLE(0.0)
2014		SINGLE(0.0)
2015		SINGLE(0.0)
2016		SINGLE(0.0)
2017		SINGLE(0.0)
2018		SINGLE(0.0)
2019		UNIFORM(9.81E+04, 1.47E+05)
2020		UNIFORM(9.81E+04, 1.47E+05)
2021		SINGLE(0.0)
2022		SINGLE(0.0)
2023		SINGLE(0.0)
2024		SINGLE(0.0)
Justification:	[Changed]	Timing based on Site Development Plan; Input rates assume 2,616,425 available void space over 16 years; min input rate based on waste density of 600 kg/m3; max based on waste density of 900 kg/m3

Waste Breakdown

2009		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2010		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		

Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2020		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2021		
2022		
2023		
2024		
Justification:	[Default]	Default Value

Trace Gases

Source Gases		Concentration [mg/m3]
Odour Units (Predicted)		TRIANGULAR(5.00E+04, 1.25E+05, 2.50E+05)
Justification:	[Default]	Default Value
VOC Halflife		NORMAL(4.11, 1.56)
Justification:	[Default]	Default Value

Waste Moisture Content

Moisture Content		Average
Justification:	[Changed]	Assumed average
Waste Density		UNIFORM(0.8, 1.2)
Justification:	[Default]	Default Value
Leachate Head		SINGLE(1.0)
Justification:	[Default]	Default Value
Hydraulic Conductivity		LOGUNIFORM(1.00E-09, 1.00E-05)
Justification:	[Default]	Default Value

Engineered Controls

Cap		Single Clay
Cap Thickness		SINGLE(1.0)
Cap Hydraulic Conductivity		SINGLE(1.00E-08)
Justifications		
Cap	[Changed]	From Design Statement
Cap Thickness	[Changed]	From Design Statement
Cap Hydraulic Conductivity	[Changed]	From Design Statement
liner		Composite
First Layer:		
Liner Thickness		SINGLE(0.5)
Liner Hydraulic Conductivity		SINGLE(1.00E-09)
Second Layer:		
Liner 2 Thickness		SINGLE(0.0015)
Liner 2 Hydraulic Conductivity		LOGUNIFORM(1.00E-15, 1.00E-13)
Justifications		
Liner	[Changed]	From Design Statement
Liner Thickness	[Changed]	From Design Statement
Liner Hydraulic Conductivit	[Changed]	From Design Statement
Justification:	[Changed]	Soil depth above cap = 0.15m, from Design Statement
Methane Oxidation %		TRIANGULAR(10.0, 25.0, 46.0)
Justification:	[Changed]	GasSim2 calculation
Soil Depth		SINGLE(0.15)
% Fissures		SINGLE(10.0)
Land Raise Depth		SINGLE(23.0)

Geosphere

Ground Surface (mAOD)		105
Water Table (mAOD)		92
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)

Cell 2

Infiltration		SINGLE(668.0)
Justification:	[Changed]	From Design Statement

Waste Input

Year		AmountDepositied (t)
2009		SINGLE(0.0)
2010		SINGLE(0.0)
2011		UNIFORM(9.81E+04, 1.47E+05)
2012		UNIFORM(9.81E+04, 1.47E+05)
2013		SINGLE(0.0)
2014		SINGLE(0.0)
2015		SINGLE(0.0)
2016		SINGLE(0.0)
2017		SINGLE(0.0)
2018		SINGLE(0.0)
2019		SINGLE(0.0)
2020		SINGLE(0.0)
2021		UNIFORM(9.81E+04, 1.47E+05)
2022		UNIFORM(9.81E+04, 1.47E+05)
2023		SINGLE(0.0)
2024		SINGLE(0.0)
Justification:	[Changed]	See cell 1

Waste Breakdown

2009
2010

2011		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2012		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2022		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2023		
2024		
Justification:	[Default]	Default Value

Trace Gases

Source Gases		Concentration [mg/m3]
Odour Units (Predicted)		TRIANGULAR(5.00E+04, 1.25E+05, 2.50E+05)
Justification:	[Default]	Default Value
VOC Halflife		NORMAL(4.11, 1.56)
Justification:	[Default]	Default Value

Waste Moisture Content

Moisture Content		Average
Justification:	[Changed]	Assumed average
Waste Density		UNIFORM(0.8, 1.2)
Justification:	[Default]	Default Value
Leachate Head		SINGLE(1.0)
Justification:	[Default]	Default Value
Hydraulic Conductivity		LOGUNIFORM(1.00E-09, 1.00E-05)
Justification:	[Default]	Default Value

Engineered Controls

Cap		Single Clay
Cap Thickness		SINGLE(1.0)
Cap Hydraulic Conductivity		SINGLE(1.00E-08)
Justifications		
Cap	[Changed]	From Design Statement
Cap Thickness	[Changed]	From Design Statement
Cap Hydraulic Conductivity	[Changed]	From Design Statement
liner		Composite
First Layer:		
Liner Thickness		SINGLE(0.5)
Liner Hydraulic Conductivity		SINGLE(1.00E-09)
Second Layer:		
Liner 2 Thickness		SINGLE(0.0015)
Liner 2 Hydraulic Conductivity		LOGUNIFORM(1.00E-15, 1.00E-13)
Justifications		
Liner	[Changed]	From Design Statement
Liner Thickness	[Changed]	From Design Statement
Liner Hydraulic Conductivit	[Changed]	From Design Statement
Justification:	[Changed]	Soil depth above cap = 0.15m, from Design Statement
Methane Oxidation %		TRIANGULAR(10.0, 25.0, 46.0)
Justification:	[Changed]	GasSim2 calculation
Soil Depth		SINGLE(0.15)
% Fissures		SINGLE(10.0)
Land Raise Depth		SINGLE(26.0)

Geosphere

Ground Surface (mAOD)		108
Water Table (mAOD)		92
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)

Cell 3

Infiltration		SINGLE(668.0)
Justification:	[Changed]	From Design Statement

Waste Input

Year	AmountDepositied (t)
2009	SINGLE(0.0)
2010	SINGLE(0.0)
2011	SINGLE(0.0)

2012		SINGLE(0.0)
2013		UNIFORM(9.81E+04, 1.47E+05)
2014		UNIFORM(9.81E+04, 1.47E+05)
2015		SINGLE(0.0)
2016		SINGLE(0.0)
2017		SINGLE(0.0)
2018		SINGLE(0.0)
2019		SINGLE(0.0)
2020		SINGLE(0.0)
2021		SINGLE(0.0)
2022		SINGLE(0.0)
2023		UNIFORM(9.81E+04, 1.47E+05)
2024		UNIFORM(9.81E+04, 1.47E+05)
Justification:	[Changed]	See cell 1

Waste Breakdown

2009
2010
2011
2012
2013

Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)

2014

Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)

2015
2016
2017
2018
2019
2020
2021
2022
2023

Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)

2024

Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
Justification:	[Default]	Default Value

Trace Gases

Source Gases		Concentration [mg/m3]
Odour Units (Predicted)		TRIANGULAR(5.00E+04, 1.25E+05, 2.50E+05)
Justification:	[Default]	Default Value
VOC Halflife		NORMAL(4.11, 1.56)
Justification:	[Default]	Default Value

Waste Moisture Content

Moisture Content		Average
Justification:	[Changed]	Assumed average
Waste Density		UNIFORM(0.8, 1.2)
Justification:	[Default]	Default Value
Leachate Head		SINGLE(1.0)
Justification:	[Default]	Default Value
Hydraulic Conductivity		LOGUNIFORM(1.00E-09, 1.00E-05)
Justification:	[Default]	Default Value

Engineered Controls

Cap		Single Clay
Cap Thickness		SINGLE(1.0)
Cap Hydraulic Conductivity		SINGLE(1.00E-08)
Justifications		
Cap	[Changed]	From Design Statement
Cap Thickness	[Changed]	From Design Statement
Cap Hydraulic Conductivity	[Changed]	From Design Statement
liner		Composite
First Layer:		
Liner Thickness		SINGLE(0.5)
Liner Hydraulic Conductivity		SINGLE(1.00E-09)
Second Layer:		
Liner 2 Thickness		SINGLE(0.0015)
Liner 2 Hydraulic Conductivity		LOGUNIFORM(1.00E-15, 1.00E-13)
Justifications		
Liner	[Changed]	From Design Statement
Liner Thickness	[Changed]	From Design Statement
Liner Hydraulic Conductivit	[Changed]	From Design Statement
Justification:	[Changed]	Soil depth above cap = 0.15m, from Design Statement
Methane Oxidation %		TRIANGULAR(10.0, 25.0, 46.0)
Justification:	[Changed]	GasSim2 calculation

Soil Depth		SINGLE(0.15)
% Fissures		SINGLE(10.0)
Land Raise Depth		SINGLE(28.0)

Geosphere

Ground Surface (mAOD)		110
Water Table (mAOD)		92
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)

Cell 4

Infiltration		SINGLE(668.0)
Justification:	[Changed]	From Design Statement

Waste Input

Year	AmountDepositied (t)
2009	SINGLE(0.0)
2010	SINGLE(0.0)
2011	SINGLE(0.0)
2012	SINGLE(0.0)
2013	SINGLE(0.0)
2014	SINGLE(0.0)
2015	UNIFORM(9.81E+04, 1.47E+05)
2016	UNIFORM(9.81E+04, 1.47E+05)
2017	UNIFORM(9.81E+04, 1.47E+05)
2018	UNIFORM(9.81E+04, 1.47E+05)
2019	SINGLE(0.0)
2020	SINGLE(0.0)
2021	SINGLE(0.0)
2022	SINGLE(0.0)
2023	SINGLE(0.0)
2024	SINGLE(0.0)

Justification:	[Changed]	See cell 1

Waste Breakdown

2009		
2010		
2011		
2012		
2013		
2014		
2015		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2016		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2017		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2018		
Domestic		SINGLE(66.0)
Commercial		SINGLE(17.0)
Industrial		SINGLE(16.0)
Inert		SINGLE(1.0)
2019		
2020		
2021		
2022		
2023		
2024		
Justification:	[Default]	Default Value

Trace Gases

Source Gases		Concentration [mg/m3]
Odour Units (Predicted)		TRIANGULAR(5.00E+04, 1.25E+05, 2.50E+05)
Justification:	[Default]	Default Value
VOC Halflife		NORMAL(4.11, 1.56)
Justification:	[Default]	Default Value

Waste Moisture Content

Moisture Content		Average
Justification:	[Changed]	Assumed average
Waste Density		UNIFORM(0.8, 1.2)
Justification:	[Default]	Default Value
Leachate Head		SINGLE(1.0)
Justification:	[Default]	Default Value
Hydraulic Conductivity		LOGUNIFORM(1.00E-09, 1.00E-05)
Justification:	[Default]	Default Value

Engineered Controls

Cap		Single Clay
Cap Thickness		SINGLE(1.0)
Cap Hydraulic Conductivity		SINGLE(1.00E-08)

Justifications

Cap	[Changed]	From Design Statement
Cap Thickness	[Changed]	From Design Statement
Cap Hydraulic Conductivity	[Changed]	From Design Statement
liner		Composite
First Layer:		
Liner Thickness		SINGLE(0.5)
Liner Hydraulic Conductivity		SINGLE(1.00E-09)
Second Layer:		
Liner 2 Thickness		SINGLE(0.0015)
Liner 2 Hydraulic Conductivity		LOGUNIFORM(1.00E-15, 1.00E-13)
Justifications		
Liner	[Changed]	From Design Statement
Liner Thickness	[Changed]	From Design Statement
Liner Hydraulic Conductivit	[Changed]	From Design Statement
Justification:	[Changed]	Soil depth above cap = 0.15m, from Design Statement
Methane Oxidation %		TRIANGULAR(10.0, 25.0, 46.0)
Justification:	[Changed]	GasSim2 calculation
Soil Depth		SINGLE(0.15)
% Fissures		SINGLE(10.0)
Land Raise Depth		SINGLE(21.0)

Geosphere

Ground Surface (mAOD)		103
Water Table (mAOD)		92
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)

Site Characteristics

Proportion to CO2 [%]		SINGLE(50.0)
Justification:	[Default]	Default Value
Proportion to CH4 [%]		SINGLE(50.0)
Justification:	[Default]	Default Value

Cellulose Decay Rates

		Dry	Average	Wet
Slow		SINGLE(0.013)	SINGLE(0.046)	SINGLE(0.076)
Moderate		SINGLE(0.046)	SINGLE(0.076)	SINGLE(0.116)
Fast		SINGLE(0.076)	SINGLE(0.116)	SINGLE(0.694)
Justification:	[Default]	Default Value		

Gas Plant

Engine 1		Spark Ignition Engine	
2009 to 2159		480 to 600	Downtime [%]: UNIFORM(3.0, 5.0)
Justification:	[Changed]	Not Justified	
Destruction Efficiency CH4	[Default]	Default Value	
Destruction Efficiency H2	[Default]	Default Value	
Properties	[Changed]	GasSim2 default or typical values	
Engine 2		Spark Ignition Engine	
2009 to 2159		480 to 600	Downtime [%]: UNIFORM(3.0, 5.0)
Justification:	[Changed]	Not Justified	
Destruction Efficiency CH4	[Default]	Default Value	
Destruction Efficiency H2	[Default]	Default Value	
Properties	[Changed]	GasSim2 default or typical values	
Flare1		Flare	
2009 to 2159		50 to 2000	Downtime [%]: UNIFORM(3.0, 5.0)
Justification:	[Changed]	Not Justified	
Destruction Efficiency CH4	[Default]	Default Value	
Destruction Efficiency H2	[Default]	Default Value	
Properties	[Changed]	GasSim2 default or typical values	
Engine/Flare Order	[Changed]	Use engines first, if sufficient LFG	

Trace Gas Plant

Odour Units (Predicted)			
Spark Ignition Engine:		non-combustion products	SINGLE(99.0)
Dual Fuel Engine:		non-combustion products	SINGLE(99.0)
Other Plant:		non-combustion products	SINGLE(99.0)
Flare:		non-combustion products	SINGLE(99.0)
Justification:	[Changed]	Odour emissions only	

Global Impact

Bulk Gases

Global Warming Potential		
Carbon Dioxide [t]:		1
Methane [t carbon dioxoide]:		21
Hydrogen [t carbon dioxide]:		0
Justification:	[Default]	Default Value
Ozone Depletion Potential		
Carbon Dioxide [t trichlorofluoromethane]:		0
Methane [t trichlorofluoromethane]:		0
Hydrogen [t trichlorofluoromethane]:		0
Justification:	[Default]	Default Value

Trace Gases

Gas	Global Warming Potential	
Odour Units (Predicted)	0	0

Lateral Migration

Bulk Gases

Air Diffusion Coefficients		
CO2 Dispersivity		SINGLE(0.1613)
CH4 Dispersivity		SINGLE(0.2192)
H2 Dispersivity		#UNDEFINED?
Justification:	[Default]	Default Value
Geosphere		
Cell		Cell 1
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)
Cell		Cell 2
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)
Cell		Cell 3
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)
Cell		Cell 4
Geosphere Moisture Content		UNIFORM(2.0, 8.0)
Geosphere Porosity		UNIFORM(15.0, 30.0)
Justification:	[Changed]	Typical values
Trace Gases		
Gas		Air Diffusion Coefficient
Odour Units (Predicted)		#UNDEFINED?
Justification:	[Default]	Default Value

Exposure

Scenario:	Residential without Plant Uptake
Year:	2009
Distance from boundary [m]:	0
Direction:	North East
Emissions to model:	1,1,1,2-Tetrafluorochloroethane
Gas Viscosity [N.hr/m2]:	0.000000005
Henry's law constant:	0
Soil Type:	Loam
Soil Organic Matter [%]:	5
Wind speed above ground surface in ambient mixing zone [cm/s]:	12
Depth below ground to contaminated source zone [cm]:	1
Building Characteristics	
Area of walls in living space [m2]:	186
Area of windows [m2]:	20
Area of floor [m2]:	74.1
Height of Living space [m]:	5.4
Air exchange rate (total exchanges per hour)	1
Perimeter of building [m]:	34.4
Air pressure inside house [Pa]:	101321.5
Area of house walls in cellar [m2]:	6.88
Height of subfloor void [m]:	0.5
Air pressure inside subfloor void [Pa]:	101325
Temperature inside house [C]:	565
Floor resistance [NH/m3]:	27.8
Average height of all openings [m]:	2

Building Materials

Material	Total Porosity [cm3/cm3]	Air-filled porosity [cm3/cm3]	Thickness [m]
Hardcore	0.5	0.25	0.1
Blinding Sand	0.5	0.5	0.05
Concrete	0.068	0.034	0.1
Insulating layer (floors)	0.9	0.9	0.05
Brick (external walls)	0.5	0.25	0.1
Lightweight block (walls)	0.068	0.068	0.1
Insulating layer (walls)	0.9	0.9	0.055
Plasterboard (ceiling)	0.068	0.068	0.0125
Insulating layer (roof)	0.9	0.9	0.1
Screed (over beam/block floor)	0.068	0.068	0.05
Suspended timber floor	0.2	0.2	0.03
Justification: [Default]	Default Value		

HEALTH IMPACT ASSESSMENT FOR PROPOSED LANDFILL SITE AT PARRY'S QUARRY, NR ALLTAMI, FLINTSHIRE

1.0 INTRODUCTION

This Health Impact Assessment (HIA) has been produced at the request of the Planning department at Flintshire County Council (FCC) following the submission of a planning application for a proposed mixed solid (non hazardous) waste landfill at Parry's Quarry, Alltami, Flintshire.

The HIA outlines potential impacts upon the health of land users in the site vicinity associated with the proposals.

Health Impact Assessment is defined by the Welsh Impact Assessment Support Unit (WHIASU) as a combination of procedures, methods and tools by which a project may be judged regarding its potential effects on the health of a population and the distribution of those effects within the population.

The assessment comprises the following:

- Review of relevant literature sources regarding health impacts associated with waste management and landfilling activities;
- Review of relevant legislation and policies regarding landfill sites;
- Identification of potential site specific health impacts associated with the proposals; and
- Assessment of potential health impacts and discussion of site design and operational procedures.

The main potential health impacts associated with landfill sites are atmospheric emissions relating to the production of landfill gas, emissions of dust and particulates and combustion products from gas utilisation plants. Other impacts may occur as a result of increase noise levels and the contamination of water resources principally from the production of leachate.

2.0 LITERATURE REVIEW

A number of studies have been undertaken regarding the impacts of waste management and landfill operations on human health. The most recent and comprehensive review of scientific evidence regarding the environmental and health effects associated with waste management operations in the UK was commissioned by DEFRA (2004). The report was prepared by Enviros Consulting Ltd and the University of Birmingham with Risk and Policy Analyst Ltd, the Open University and Maggie Thurgold and was peer reviewed by the Royal Society. A number of other studies have been undertaken in the UK, a majority of which were reviewed by the Department for Environment Farming and Rural Affairs (DEFRA). Other studies undertaken following the publication of the DEFRA report are briefly outlined along with their conclusions.

DEFRA (2004): Review of Environmental and Health Effects of Waste Management

The report "*examines the waste options for treating municipal solid waste*," and also looks at "*what the currently available scientific evidence can tell us about their environmental and health effects.*"

The report mainly comprises a review of relevant literature sources regarding emissions, health and environmental impacts associated with various waste management options. Information collated as part of the study was used to estimate emissions associated with the various options per tonne of waste processed and to identify the main health effects.

A source, pathway and receptor relationship is outlined within the report for various waste management activities. The table identifies three potential pathways of exposure for emissions from landfill sites i.e.; air, water and land.

The information from the report is summarised for the various issues considered; characteristics of emissions, health impacts emissions, epidemiological research and quantified health and environmental risks, review of public perception issues and study conclusions.

Emissions
Available information on emissions to air, land and water have been collated with UK data being utilised where available. Sources of information include returns to the Environment Agency (EA) for the pollution inventory, the results of research undertaken by the EA and DEFRA, data from operators, other published research and a National Society for Clean Air (NSCA) report.

Atmospheric Emissions
Information including emissions monitoring data for landfill sites and EA and other guidance information was used to estimate atmospheric releases from the following:

- Fugitive releases (i.e. releases through cracks in the site cap, from uncapped areas of waste and purposes built vents);
- Releases from flares; and
- Releases from gas utilisation.

Emissions to Sewer, Groundwater and Surface water
Emissions to sewer, groundwater and surface water are considered in relation to the production of leachate within landfill sites. The report indicates that although the production of leachate is now limited in modern landfill sites and leachate management systems ensure that a majority of leachate produced is collected for treatment and/ or disposal there may still be a small but finite seepage into the ground through liner leakage etc.

Leachate emissions are quantified in the report on the basis of the following:
- Concentrations of substances in leachate;
- Leachate collected for treatment;
- Leachate discharged to land or groundwater; and
- Emissions to sewer and surface water.

Health Impacts and Emissions

A quantitative risk assessment considering the impact of atmospheric emissions on human health is presented. Atmospheric modelling (using ADMS) and "dose-response functions" have been used to estimate the health consequences associated with exposure to various substances. Health effects considered are:

- Deaths brought forward- *"deaths occurring sooner than would otherwise occur from other causes"*;
- Respiratory hospital emissions;
- Cardiovascular hospital emissions; and
- Additional cases of cancer.

Emissions from various processes are considered including a landfill site accepting 75,000 tonnes of waste per year releasing emissions from three 1MW landfill gas engines, and fugitive emissions of uncaptured gas (this scenario is considered to be the most appropriate and similar to Parry's Quarry).

The consideration of health impacts associated with emissions for landfills indicates the following:

- One death brought forward every 1000 years (reliable to a factor of 30)
- Impacts on human health per tonne of waste deposited are lower as the site size increases

In addition, a summary table is presented of the estimated health impacts due to emissions to air per tonne of waste processed. The table is reproduced below with the inputs for the various categories of landfill sites considered. Note that the report highlights that the estimates made are of poor quality, but provide an indication of the scale of likely health effects.

Table 1- Information regarding Estimated Health Impacts due to Emissions to Air (per tonne of waste processed) (from Table 4.5 DETR, 2004)

Health Impact (per tonne of waste)	Type of Landfill site Considered					
	Small & flare	Medium & flare	Large & flare	Small & engine	Medium & engine	Large & engine
Deaths brought forward	2.47×10^{-8}	1.5×10^{-8}	4.9×10^{-9}	2×10^{-8}	1.2×10^{-8}	2.9×10^{-9}
Respiratory admissions	4×10^{-8}	2.4×10^{-8}	8×10^{-9}	1.9×10^{-7}	1.1×10^{-7}	2.7×10^{-8}
Cardio-vascular admissions	2.07×10^{-9}	1.3×10^{-9}	4.3×10^{-10}	1.7×10^{-7}	1×10^{-9}	2.5×10^{-10}
Additional cancer cases	4.8×10^{-11}	4.8×10^{-11}	4.8×10^{-11}	5.2×10^{-11}	5×10^{-11}	4.9×10^{-11}

Epidemiological Research

The epidemiological research comprises a review of health effect studies and calculation of potential health effects associated with atmospheric emissions using estimated "dose-response functions".

The literature review collates information regarding single and multi studies site.

The collation of literature regarding studies on single sites in the UK undertaken by Redfearn and Roberts (2002) includes numerous studies of the Nant-y-Gwyddon landfill site in Wales. The studies identified health effects associated with the landfill site including morality, hospital admissions, cancer birth defects, self reported symptoms such as headaches, sore throats, feeling sick etc and sarcoidosis. The outcomes of the studies were analysed with respect to demonstration of excess risk. The DEFRA report indicates that although the studies considered indicate potential excess risks associated with some of the health effects assessed such as birth defects, self reported symptoms and sarcoidosis, the results do not necessarily infer adverse health impacts associated with landfill sites.

The key UK study of multiple sites is considered within the DEFRA report, to be work undertaken by the Small Area Health Statistics Unit (Elliot *et al*, 2001). The study considered all 9565 known landfills in the UK that were operational between 1982 and 1997 and assessed and compared public health both within a 2km radius of landfill sites and beyond this limit to determine if there was any increase in cancers and the following birth defects:

- Neural tube defects;
- Cardiovascular defects;
- Hypospadias and epispadias;
- Abdominal wall defects;
- Gastroschisis and exomphalos;
- Stillbirths;
- Low birth weight; and
- Very low birth weight.

The results showed increases in some of the birth defects within the 2 km radius but the study was not able to conclude whether the observed increases were due to exposure to emissions from landfill, or to some other cause or a combination of causes. The study also reported that some of the health outcomes considered occurred at a lower rate after the site opened than before it opened which indicates that factors other than the landfill sites were at least contributing to the observed increases. The DEFRA report concludes that "*further work is required to determine the true significance of the findings*".

The study also examined a number of cancer outcomes including childhood and adult leukaemias, hepatobiliary cancers and cancers of the bladder and brain. The results indicated no excess risk for those living within a 2km radius of landfill sites for the various cancer types studied.

Estimates of the increments in adverse health outcomes for populations within 2Km of a landfill site are provided within the report and are considered to be the best currently available. These are reproduced as Appendix 1.

Quantified Health and Environmental Risks and Review of Public Perception Issues

Atmospheric emissions from various waste management activities are compared with those from other widespread activities in the UK such as power production, road transport, agriculture and domestic, based on information from the National Atmospheric Emissions Inventory 2000. Some of the conclusions regarding emissions from landfill sites compared with other activities are as follows:

- Largest source of methane emissions in the UK is the agricultural sector, with waste management accounting for approximately 27% of emissions in 2000
- National UK emissions of NO_x and PM_{10} from Municipal Solid Waste (MSW) management are approximately equivalent to emissions from traffic using a motorway of 200Km and 120Km length respectively.

Potential health impacts associated with waste management activities are also compared with other activities. Health impacts in the UK per year associated with emissions to air from all landfill sites are provided and are summarised in the following table compared with health impacts from other common activities

Table 2- Comparison of health Impacts from waste Management, other causes of disease and common activities (adapted from DETR, (2004) Table 6.6 and 6.7)

Activity	Health Impact and numbers per year		
	Deaths brought forward	Hospital admissions	Cancers
Landfill emissions to air in the UK	0.4	0.9- respiratory 0.03- cardiovascular	0.0013
Incineration emissions to air	0.15	4- respiratory 0.0010- cardiovascular	0.0005
Skin cancer	-	-	6,000
Lung cancer (due to passive smoking)	-	-	Several hundred
Health Impacts due to air pollution	11,600	14,000	-
Accidents in the home	4,300	168,300	-
Accidents in the workplace	736	500,000	-
Road traffic accidents	3,409	320000	-
Natural or environmental factors (e.g. excessive cold)	191	-	-
Choking on food	246	-	-
Injury from fireworks	-	1017	-

Conclusions

The conclusions with respect to birth defects (*congenital anomalies)* and landfill sites is that although there is evidence to suggest a link between a slight increase in the occurrence of these defects in children born to mothers living close to a landfill site, there is insufficient evidence to ascertain whether landfill sites cause or contribute to the apparent clustering of birth defects.

Furthermore the report states that there is no "*consistent evidence that people living close to landfill sites suffer worse health than people in other areas.*

The atmospheric modelling undertaken indicated that "*emissions to air from MSW management are not likely to give rise to significant increases in the adverse health effects studied."*

The report did not investigate the potential health impacts associated with the release of substances to groundwater and surface water from landfill sites. However, the report concludes that as all drinking water is treated prior to consumption, the

impacts associated with the consumption of contaminated groundwater and surface water is considered to be of lower significance.

Russell. D. (2005). Landfill- a health risk?
This is a short article regarding the health risks associated with landfill written by the head of the Chemical Hazards and Poisons division of the Health Protection Agency in Cardiff. In the article Russell, considers that although other reviews have concluded that there is evidence linking landfill sites with ill health effects "*on balance the scientific evidence remains inconclusive*". Existing studies considered as part of the review include work undertaken regarding the potential impacts of the Nantygwyddon site and the SAHSU and the EUROHAZCON study.

The SAHSU study comprised the review of data for the 9565 landfills in the UK. The EUROHAZCON study considered various landfill sites across Europe handling both hazardous and chemical waste.

It is considered that as none of the existing studies included measurements of concentrations of contaminants within air, water and soils, there is no evidence that communities were actually exposed. Russell further argues that community studies may have been exposed to chemicals from other industrial processes. The author indicates that future studies need to include environmental sampling in order to strengthen the findings of the epidemiological studies.

In addition, one of the major limitations of existing epidemiological studies is the use of geographical proximity to landfill sites and exposure. This is considered to be a crude way of measuring exposure with more sophisticated measures outlined including the use of wind rose data, environmental monitoring and biological sampling.

Palmer *et al* (2005): Risk of Congenital Anomalies after the Opening of Landfill Sites.
The paper presents the results of research examining whether residents living close to 24 landfill sites in Wales experienced increased rates of congenital abnormalities before and after the opening of landfill sites. The study was designed to test the null hypothesis "*opening of new landfills in Wales was not associated with increased rates of congenital anomalies in nearby residents by comparing rates before and after landfills opened*"

Data regarding statutorily notifiable congenital anomalies was obtained for the periods 1983 to 1987 and 1998 to 2000. Information regarding new landfill sites that opened in Wales from 1985 licensed to accept commercial, industrial and household waste was obtained from EA Wales (EAW), further information was obtained regarding sites licensed to accept chemical waste and sites where containment, gas control was applied.

The information was then used to calculate the distance between the Mother's residence at the time of birth and the centre of the landfill site, with findings reported within a 2km distance but also considered for distances of up to 3Km in line with previous studies. The results of study found that the "*ratio of observed to expected rates on congenital anomalies increased by about 40%*" for data from populations within a 2Km radius of landfill sites that opened between 1983 and 1997, but this was not shown in the data collected for the years spanning 1998 to 2000.

The report concludes that other socioeconomic and lifestyle factors should be considered along with potential exposure to other contaminants such as those emitted from industrial sites.

3.0 LANDFILL REGULATIONS AND REGULATORY REQUIREMENTS

The Landfill (England and Wales) Regulations 2002 set out a number of requirements which must be followed by site operators. The Regulations implement the Landfill Directive (1999/31/EC) the aim of which is to prevent or reduce, as far as possible, the negative effects of landfilling waste on the environment and human health. Further controls over the operations at the site will be provided through the requirement to secure Integrated Pollution Prevention Control (IPPC) permit for the operations prior to their commencement.

Some of the main requirements of the Regulations with respect to the protection of human health are summarised below:

- ***Waste acceptance*** - Provision of Waste Acceptance Criteria (WAC) and Waste Acceptance Procedures (WAP) to ensure that the correct wastes are deposited and that appropriate controls are in place;
- ***Groundwater protection*** - Sites must meet the requirements of the Groundwater Directive to ensure that there is no risk of unacceptable discharge, that leachate is collected , extracted and treated to an appropriate standard and that an appropriate geological barrier and liner is provided to provide protection of the soil, groundwater and surface water environments;
- ***Landfill gas management***- Appropriate measures must be taken to control the accumulation and migration of landfill gas;
- ***Nuisance*** - Measures must be taken to minimise nuisance including the generation of odour, litter and dust generation; and
- ***Monitoring*** - The requirements for monitoring are set out within the Regulations, the IPPC Sector Guidance Note: IPPC S5.02 and additional guidance notes covering specific issues such as landfill gas and noise. Monitoring is required to ensure compliance with the permit conditions, relevant environmental assessment levels and that the site is not having a detrimental impact on nearby sensitive receptors for the following:
    - Site topography and settling levels;
    - Leachate groundwater and surface water;
    - Landfill gas;
    - Noise; and
    - Odour.

The Regulations and development of monitoring protocols and procedures at the site will therefore prevent many of the impacts which could potentially impinge upon public health.

4.0 POTENTIAL HEALTH IMPACTS AND RISK ASSESSMENT

Potential sources of health impacts associated with landfill sites have been identified through site knowledge and experience and literature review as follows:

- Atmospheric emissions including:
    - Organic particles such as bio-aerosols;

  - Inorganic particles ("dust");
  - Landfill gas emissions;
  - Emissions from landfill gas combustion;
  - Odorous compounds; and
  - Emissions from transportation.
- Contamination of water resources including surface waters and groundwaters resulting from the production and discharge of leachate and potential spillage of oils and hydrocarbons from site plant.
- Noise and vibration from site plant, equipment, lorries and gas utilisation plant.

A risk assessment has been undertaken to assess the potential for any impacts on the health of local residents associated with the proposed Parry's Quarry landfill site. A source-pathway-receptor framework has been used for the identification and assessment of risks relating to potential impacts on human health associated with atmospheric emissions, discharges to water and noise as follows:

- **Source**: The source of the potential health impact (i.e. the source of the emissions to air and water and noise)
- **Pathway:** The route or mechanism by which the target or receptor can come into contact with the source.
- **Receptor**: Receptor that may be impacted by the source

A conceptual model has been produced summarising the source, pathway and receptor relationships at the site and identifying measures that will be implemented at the site in order to reduce any potential impacts associated with the specific operations. The model is presented as Appendix 2.

The source, pathway and target relationships have been identified using information contained within the assessments provided within the Environmental Statement, specifically Chapters 7, 9 and 10; Hydrology and Hydrogeology, Noise and Vibration and Air Quality respectively.

The source, pathway and receptor characteristics are described in the following paragraphs.

4.1 Source Characteristics

The source characteristics are identified within the conceptual model on the basis of atmospheric emissions, noise and discharges to water as these are considered the principal mechanisms or routes via which impacts on human health from the landfill site may occur.

Atmospheric Emissions
Sources of atmospheric emissions include the production of landfill gases, dust and particulates, and exhaust emissions from gas flares and engines.

The main source of atmospheric emissions (landfill gas) is produced as a result of the fermentation and biodegradation of organic material within the landfill site. The main bulk landfill gases are as follows; methane, carbon dioxide, oxygen, nitrogen, hydrogen, carbon monoxide, water vapour and numerous trace compounds.

Dust and particulates may be produced as a result of the following:

- Re-suspension of dust particles from the movement of vehicles along surfaced roads (i.e. the internal access road);
- Wind scouring of deposited wastes prior to capping;
- Wind scouring of loose particles from materials stockpiles; and
- Tipping of dry materials.

Direct releases of combustion products from the gas utilisation plant comprising a flare and up to three engines may occur as a result of incomplete combustion. Exhaust emissions may include:

- Carbon dioxide;
- Carbon monoxide;
- Nitrogen oxides;
- Hydrogen chloride;
- Hydrogen fluoride;
- Particulates; and
- Non-methane Volatile Organic Compounds.

Water borne Emissions

The main sources of aqueous emissions comprise the generation of leachate and the potential for the leakage of oils, fuels and hydrocarbons from plant and equipment used on site.

Leachate is generated when soluble components are dissolved or leached out of the waste materials by percolating water. The quality and quantity of leachate produced varies on the basis of the composition and solubility of the waste materials. Over the lifetime of the landfill site the leachate will change in composition as a result of the biodegradation of the waste materials.

Earthmoving vehicles and other mechanical plant used on site in the preparation of cells and delivery of wastes may provide a source of contaminating liquids including fuel, lubrication, hydraulic fluids and other hydrocarbons. Emissions to water resources may occur as a result of spillage and leakage from sumps and hydraulic pipes.

Noise

The main sources of noise comprise equipment associated with cell preparation activities and the redistribution and compactions of wastes, lorry movements and the operation of the gas utilisation plant.

Noise associated with equipment used for cell preparation, redistribution and compaction of wastes will include engine and exhaust noise and reversing bleepers and possibly waste being placed within the cells.

The lorries will be travelling at low speed along the internal site roads thus the main noise will include that from engines and exhausts.

The main noise sources associated with gas flares include turbulent air flow, low frequency noise associated with combustion and from the injection of smoke suppressants. The main noise from the gas utilisation plant will be from the engines.

4.2 Pathway Characteristics

The pathway characteristics are the means by which the receptors may come into contact with the potential sources of health impact. The main routes of transport are outlined below:

Atmospheric Emissions

- Wind scouring;
- Atmospheric diffusion; and
- Inhalation.

Water-borne Emissions

- Soil drainage waters and surface contact via skin;
- Surface runoff via overland flow and surface contact via skin; and
- Discharge into Alltami Brook and Wepre Brooks Brook and contact via skin and possibly by ingestion.

Noise

- Airborne and structural noise propagation

4.3 Receptor Characteristics

There is no definitive evidence of the extent of the area surrounding a landfill site where health impacts may occur. The study undertaken by Palmer *et al* (2005) considering landfill sites in Wales reported that previous studies have not identified any differences between the health impacts at distances of 2 or 3Km from site centres. On this basis they assumed a distance of 2Km from the centroid of sites for the reporting of results.

The study undertaken by Briggs *et al* (2001), considers exposure classification for studies regarding health impacts and landfill sites. They report that previous studies have investigated heath impacts within 2 to 5Km and 3 to 7Km radius from sites. They indicate that detectable increases in air pollution and soil gases may be restricted to a few hundred metres from a site perimeter. A WHO workshop regarding exposure from landfill sites concluded that impacts from atmospheric pollutants are likely to be restricted to a 1Km radius from sites with water borne pollutants extending to a radius of 2Km. On the basis of this review the Elliot *et al* (2001) adopted a radius of 2Km.

The actual area subject to exposure will vary on the basis of various local conditions. This includes for example local topography and wind speed and direction which influences the dilution and dispersion of atmospheric pollutants.

The potential for noise impact is influenced by topography and the properties of ground cover and the presence of buildings and other potential obstructions between the noise source and receptor.

Water borne pollutants are influenced by local hydrology and hydrogeology and site topography.

The areas within a 1Km and 2Km radius from the centre of the landfill site are identified on Figure 1.

The plan indicates that there are a limited number of receptors within a 1Km radius of the site including the following:

- Residential properties located along the A494 to the south east and south west of the site;
- Residential properties along Green Lane to the east of the site;
- Offices, industrial units and commercial premises on the industrial estate located to the east, south east and north of the site;
- Service station, hotel and restaurants located to the east of the site within the A55 service area; and
- Individual farm buildings located to the north, south and east of the site.

The 2Km radius line indicates a number of potentially sensitive receptors as follows:

- Properties within Northop located to the north and north west of the site;
- Properties located in Northop/ Connah's Quay located off Wepre Lane to the north east of the site;
- Properties in Ewloe Green and Ewloe located to the east of the site;
- Properties in Buckley Mountain and Buckley to the south of the site; and
- Industrial estate to the south of the site.

In addition there are individual residential properties including farms located within a 2Km radius of the site.

4.4 Assessment

The potential for impacts on human health resulting from atmospheric emissions, water borne contaminants and noise emissions have been assessed considering the source, pathway receptor relationships, measures to be implemented at the site to control emissions, information from the Environmental Statement and information from the DEFRA (2004) report.

Atmospheric Emissions

There are various potential sources of atmospheric emissions at the site and pathways via which receptors may be impacted by these. However, a number of measures will be incorporated that will help to prevent and reduce any potential effects on human health.

In the first instance the potential for the generation of dust and particulates will be prevented through the implementation of measures such as the provision of a hard surface on the internal haul road, a speed limit on the road, positioning of material stockpiles to avoid nearby sensitive receptors and undertaking any materials handling operations within enclosed areas.

In certain conditions i.e. very dry and windy conditions, the generation of dust and particulates may be unavoidable. Under such circumstances, measures to control any dust generated to reduce the impacts of dust deposition will be implemented. Such controls include the use of windbreak netting, covering and damping down of material stockpiles, use of road sweepers.

The potential for dust deposition in areas to the east of the site will be minimised by the dense band of deciduous trees lining the former railway line. This band of trees will act during the major part of the year (spring, summer and autumn months) to filter out a proportion of any aerially transported particulates.

The release of landfill gas will be managed through the provision of an engineered cap and liner system and the gas collection and utilisation plant. In addition, daily

cover will be provided over recently tipped wastes. This will ensure that gas release is minimised as far as reasonably practicable.

Exhaust emissions from the gas utilisation plant will be minimised through the regular maintenance and servicing of the equipment to ensure that it is operating to optimum efficiency. In addition, operational and stack monitoring will be undertaken at the site in line with EA guidance. The monitoring will determine the magnitude of emissions from the plant and will ensure that these do not reach unacceptable levels.

The DEFRA report indicates health effects associated with atmospheric emissions from landfill sites include; deaths brought forward, respiratory hospital emissions, cardiovascular hospital emissions, additional cancer cases and birth defects. Data indicating the potential for various health effects (excluding birth defects) for different sizes and types of landfill sites based on the tonnes of waste processed from the emission of gases from the landfill surface and from the combustion of landfill gas is provided within the report. The data has been used to calculate the potential for those health effects for the Parry's Quarry site. For the basis of the calculations, a medium landfill site with engine is considered to be the most representative. The calculations were based on an annual input of 100,000 tonnes of waste per annum over a 16 year lifetime.

Table 3- Potential Health Effects per tonne of waste processed (based on DEFRA, 2004, Table 4.5)

Potential Health Effect	Medium Landfill & engine
Deaths brought forward per tonne of waste	0.00192
Respiratory emissions per tonne of waste	0.0176
Cardio-vascular admissions per tonne of waste	0.00016
Additional cancer cases per tonne of waste	0.000008

The calculations indicate that the potential for any health effects resulting from the landfill sites are extremely small. However, DEFRA note that the quality of the information on which the potential health effects is based is considered to be limited.

Further information from the DEFRA report presented within the literature review (Section 3) compares the potential for health effects associated with landfill sites and other industrial operations and activities. The information indicates that the potential for the health impacts identified as deaths brought forward, hospital emissions and cancers are extremely small in comparison to all activities considered.

Furthermore the report considers that the public perception of the health risks associated with living in close proximity to landfill sites are worse than the actual potential impacts based on scientific evidence.

The DEFRA study concludes that although there is evidence that there is a slight increase in the occurrence of birth defects living close to landfill sites, evidence is insufficient to determine whether the presence of the landfill sites are the cause of the defects. Other literary sources published following the DEFRA study draw similar conclusions.

On the basis that the site will be constructed to the best engineering standard minimising the potential for the release of landfill gas and emissions associated with the gas utilisation plant, it is considered by inference that the health impacts associated with the site would be lower than those associated with an older site.

Water borne emissions

The main potential impacts for water borne emissions result for the potential for oil and hydrocarbon contamination and the generation and discharge of leachate.

The potential for the contamination of underlying groundwater and aquifers is regulated by the Groundwater Regulations which require management of listed substances to prevent the discharge of List I and II substances to groundwater. The EA (2003) indicate that even though leakage from well engineered landfill sites in the short term is unlikely to result in a significant impact on water resources, over time all sites will leak to some extent.

Measures to help prevent any impacts associated with the production of leachate include the provision of a fully engineered design with the provision of a leachate collection and management system. The leachate management will ensure that all leachate produced is collected and discharged to foul sewer to prevent uncontrolled discharge to water courses. Capping and cell restoration will be undertaken as soon as possible following the completion of filling within cells thus minimising water ingress and the production of leachate.

Potential impacts associated with the use of fuels and hydrocarbons on site will be minimised through the provision of secure storage areas with adequate bunding. Spillages and leakage of oils and fuels from equipment used on site will be minimised through ensuring that all plant is properly maintained and that site staff are adequately trained . Grit traps and oil separators will also be provided to ensure that in the event that spillages do occur they are prevented from entering surface water courses.

The DEFRA study did not directly consider health impacts associated with the potential contamination of water resources associated with landfill sites, but concluded that they are of a lower significance than atmospheric emissions. As measures will be taken on site to prevent the contamination of any water resources and to manage any spillages that do occur, it is not considered that water borne contaminants will have a significant impact on human health.

Noise

The main potential impacts resulting from increase noise from the landfill site is disturbance and intrusion.

A number of noise control methods will be implemented at the site to reduce the potential impacts associated with noise from site activities. Noise from equipment used in the cell preparation and construction activities includes the specification of the quietest equipment available and implementation of an equipment maintenance programme. The gas utilisation plant will be selected and designed to minimise noise and silencers and the enclosure of the plant will be considered as necessary.

Measures to reduce the noise from lorry movements includes the provision of surfacing on the internal haul road and a speed limit.

Potential disturbance and intrusion associated with noise from site activities will be minimised through the provision of an acoustic screen along the southern boundary. A fence to be constructed along the northern boundary of the site will also help to reduce noise levels beyond the site boundary.

The noise assessment undertaken as part of the Environmental Statement indicated the following:

- Temporary and minor-moderate day time noise disturbance to residents at Parry's Cottages and a temporary and minor noise disturbance to workers at the Flintshire Council Offices during the construction phase of the development.
- After erection of an acoustic barrier along the southern boundary of the site, an impact of only negligible to minor significance is anticipated during the site preparation stages of the development at Parry's Cottages.
- After erection of the acoustic screen around the southern boundary of the site it is anticipated that there will be an impact of only minor significance on local residents

Overall it is concluded that there will be no significant noise and vibration effects on local residents living near the development site.

5.0 CONCLUSIONS

A number of reviews regarding the potential health effects associated with landfill sites have been undertaken. The more recent and authoritative review in the UK was published by DEFRA in 2004. The DEFRA report indicates that the main potential effects on health associated with landfills sites includes atmospheric emissions, water borne emissions and noise.

The DEFRA report concludes that there is no consistent evidence that people living close to landfill sites suffer worse health than people in other areas. The review of epidemiological research indicates that there is evidence to suggest a link between a slight increase in the occurrence of birth defects and children born to mothers living close to a landfill site, but most studies conclude that further research is required to confirm this link.

Studies and articles published following the DEFRA report suggest that more sophisticated monitoring and sampling is required in future studies in order to strengthen the findings, along with a consideration of other factors such as lifestyle and socioeconomic information.

A site specific risk assessment has been undertaken considering a source, pathway and receptor framework for the identification of risks associated with water borne emissions, noise and atmospheric emissions. The potential sources of emissions have been identified and assessed with respect to the potential for impact and the control measures to be implemented to minimise these.

Sources of potential atmospheric emissions include the generation of landfill gas resulting from waste degradation, dust and particulates and exhaust emissions from the gas utilisation plant.

Atmospheric emissions at the site will be minimised in the first instance through the implementation of measures to reduce dust generation, the provision of an engineered cap and liner, gas collection system and utilisation plant. A full monitoring programme will be implemented at the site including landfill gas and emissions from the gas utilisation plant to ensure that these do not reach unacceptable levels. It is concluded that the site engineering and design and implementation of monitoring and

measures to reduce any emissions will minimise atmospheric emissions and thus any health impacts associated with these.

The main sources of water borne emissions include leachate generation and the potential for oil and hydrocarbon contamination. As with atmospheric emissions the potential for impacts associated with leachate generation will be minimised as a result of the cap and liner and the provision of a leachate collection system. Controls will e implemented to reduce the potential for any oil and hydrocarbon contamination. As such, it is not considered that water borne contamination will have a significant impact on human health.

Potential noise sources have been identified as plant used on site for cell preparation and waste compaction activities, the gas utilisation plant and lorry movements delivering waste to the site. On the basis of the implementation of noise control measures including the construction of a fence and acoustic barrier, it is concluded that there will e no significant noise and vibration effects on local residents.

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APPENDIX 2- SITE CONCEPTUAL MODEL FOR HEALTH IMPACT ASSESSMENT AT PARRY'S QUARRY

This conceptual model has been prepared in relation to potential health risks associated with the Parry's Quarry Landfill site relating to the operations at the site (i.e impacts associated with the collection end the delivery of the waste to the site are not included). The model identifies the sources of potential risk along with the pathways via which receptors may be exposed to the risk. The controls in place at the site to prevent potential health risks and thus "break" any potentiel linkages are identified. The location of potential receptors including nearby residential properties, offices, commercial and industrial land users are identified on Figure 1.

SOURCE/ EMISSIONS	PATHWAY	RECEPTOR	SITE CONTROLS
Atmospheric Emissions			
Dust generated as a result of: • Wind scouring of deposited wastes and material stockpiles prior to capping • Tipping of dry materials • Re suspension of deposited particles on internal roads and areas of hardstanding	• Airborne deposition of emissions • Inhalation	• Residential properties • Employees at FCC offices and adjacent industrial estate • Other adjacent land users including the Holiday Inn and restaurants to the east of the site	• Provision of hard surface on internal haul road, use of road sweeper and speed limit • Majority of tipping will be undertaken within a void and therefore sheltered from external winds • Locating stockpiles away from sensitive receptors and provision of windbreak netting as necessary • On site materials handling in enclosed areas as necessary
Landfill gas produced as a result of the degradation of wastes within the site including CH_4, CO_2 and numerous trace compounds: • Release of landfill gas through the site surface • Waste within landfill site prior to capping			• Provision of engineered cap and liner system • Gas collection wells routed to gas flare and engines resulting in collection and destruction or utilisation of gas to prevent gas migration)
Exhaust emissions from gas flares and engines as a result of incomplete combustion including CO_2, CO, NO_x, SO_2 and other trace components	• Atmospheric emissions from the gas utilisation plant in the north east corner of the site		• Operational and stack monitoring in line with the requirements of TGN05 and TGN08 to determine magnitude of emissions and ensure these do not reach unacceptable levels • Maintenance and servicing of flares and engines in line with legislative requirements and manufacturer recommendations

SOURCE/ EMISSIONS	PATHWAY	RECEPTOR	SITE CONTROLS
Water Emissions			
Emissions to water resulting from leachate generated as a result of the leaching of soluble components from waste materials including NH_3, heavy metals and organic compounds	Leakage from site resulting in leaching of contaminants into underlying groundwater and minor aquifer	• Local residents • Site users • Adjacent industrial and commercial properties	• Engineered design in accordance with Landfill Regulations • CQA of construction process • Leachate collection and management system • Minimisation of time before capping and restoration of cells to minimise water ingress and thus leachate production • Down gradient groundwater monitoring to ensure contamination of groundwaters and underlying aquifer not occurring • Leakage monitoring
	Leakage from site resulting in leaching of contaminants and surface run off into surface waters including Alltami Brook and Wepre Brook		• Engineered design in accordance with Landfill Regulations • CQA of construction process • Leachate collection and management system and immediate disposal to sewer • Minimisation of time before capping and restoration of cells to minimise water ingress and thus leachate production • Collection of leachate- thus intercepting leachate prior to reaching surface waters • Leakage monitoring
Spillage and leakage of oils and fuels from plant engaged in earthworks and construction activities including cell preparation	Leaching of oils and hydrocarbons into underlying site groundwaters and minor aquifer	• Local residents • Site users • Adjacent industrial and commercial properties	• Proper maintenance of plant • Storage of chemicals and fuels in secure areas with hardstanding and adequate bunding • Management plant and training of site staff to enable identification of potential impacts whilst plant is operational • Provision of grit traps and oil separators in site drainage
	Leaching of contaminants and surface run off into surface waters including Alltami Brook and Wepre Brook		

SOURCE/ EMISSIONS	PATHWAY	RECEPTOR	SITE CONTROLS
Noise			
Equipment associated with site preparation and construction activities	Airborne and structural noise propagation	• Residential properties • Employees at FCC offices and adjacent industrial estate • People staying at the Holiday Inn hotel	• Noise control methods to be implemented at the site • Noisy activities to be scheduled to avoid disturbance to local residents • Specification of quietest plant available and maintenance programme to maintain and improve noise muffling system on plan and equipment • Acoustic screen along southern boundary and fence along northern boundary
Lorry movements			• Hard metalled surface cover on internal road • Speed limit on internal haul road • Restriction of site operational hours • Acoustic screen along southern boundary and fence along northern boundary
Equipment used for the redistribution and compaction of waste			• Restriction of site operational hours • Specification of quietest plant available • Landfill maintenance programme including maintaining and improving noise muffling system on site plant and equipment • Acoustic screen along southern boundary and fence along northern boundary
Operation of gas flare and engines			• Provision of acoustic screen along the southern boundary of the site and a fence along the northern boundary • Careful design and plant selection to minimise noise • Fitting of silencers and enclosure of plant is necessary.