

DATED

6 May

2005

GEORGE WIMPEY NORTH LONDON LIMITED (1)

and

PERSIMMON HOMES LIMITED (2)

and

WELWYN HATFIELD DISTRICT COUNCIL (3)

AGREEMENT

Pursuant to

Section 106 of the Town and Country Planning Act 1990

relating to

Land at Chequersfield, Welwyn Garden City

Company Solicitor

Persimmon plc

Persimmon House

Brooklands Business Park

Weybridge

Surrey

KT13 0YP

Ref: CJB/TV/Chequersfield

THIS AGREEMENT is dated 6 May 2005 and is made between

- (1) **GEORGE WIMPEY NORTH LONDON LIMITED** whose registered office is at St David's Court Union Street Wolverhampton West Midlands WV1 3JE (Company registration Number 1160327) ("the First Owner")
- (2) **PERSIMMON HOMES LIMITED** whose registered office is at Persimmon House, Fulford, York YO19 4FE (Company Registration Number 361750) ("the Second Owner")
- (3) **WELWYN HATFIELD DISTRICT COUNCIL** of Council Offices The Campus Welwyn Garden City Hertfordshire AL8 6AE ("the Council")

NOW THIS AGREEMENT WITNESSES as follows:-

1. DEFINITIONS AND INTERPRETATION

In this Agreement unless the Context otherwise requires:-

- | | |
|---------------------------------|---|
| "the Act" | means the Town and Country Planning Act 1990 and any statutory re-enactment thereof |
| "the Application" | means the planning application number N6/2004/1483/DE made by the Owner to develop the Application Site |
| "the Application Site" | means the land edged red on the Plan as the same is registered in H M Land Registry with Title Absolute under Title Number HD42820 |
| "the Development" | means the development of the Application Site proposed by the Application or permitted by the Planning Permission (as such expression is hereinafter defined) or carried out substantially in accordance with the Planning Permission |
| "the Maintenance Regime" | means the regime for the maintenance of the Virtual Gas Curtain as attached to this Agreement at Appendix 1 subject to any amendments agreed between the Owner the Council and the Environment Agency all acting reasonably |
| "the Monitoring Program" | means the gas monitoring program as set out at Appendix 2 subject to such amendments as may be agreed from time to time between the Owner and the Council |

2. RECITALS

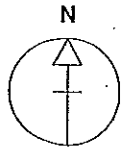
- 2.1 The First Owner is the registered proprietor of the freehold interest in the Application Site subject to a Collaboration Agreement and Deed of Trust made between the First Owner and the Second Owner and both dated 7 November 2003 (collectively "the Collaboration Agreement") and the First Owner and the Second Owner warrant that they are capable of entering into this Deed and have obtained all necessary consents to do so
- 2.2 The Council is the local planning authority for the area in which the Application Site is situated and is the Authority entitled to enforce the obligations contained in this Agreement
- 2.3 The Owner has by the Planning Application applied to the Council for planning permission to develop the Application Site
- 2.4 The Owner intends to partition the Application Site (between the First Owner and the Second Owner) and develop the Application Site pursuant to the Collaboration Agreement
- 2.5 The First Owner and the Second Owner acknowledge that they are aware that land situated to the north of the Application Site and known as the former Mater Dei School has for many years been used as a landfill and is land which is contaminated and such contamination is capable of affecting the Application Site. The First Owner and the Second Owner having obtained independent specialist accordingly propose the construction of the Virtual Gas Curtain to prevent contamination of the Application Site and acknowledge that the purpose of this Agreement (which is executed by the Council as Planning Authority pursuant to Section 106 of the Act) is to provide for the future maintenance and monitoring of the Virtual Gas Curtain. The First Owner and the Second Owner agree that their execution of this Agreement shall not relieve them of any liability as owners of and developers of the Application Site
- 2.6 The Council has resolved to grant the Planning Permission subject to the Owner entering into this Agreement under Section 106 of the Act without which planning permission would not be granted

3. ENABLING PROVISIONS

This Agreement is made pursuant to Section 106 of the Act section 111 of the Local Government Act 1972 and all other enabling powers



TITLE NUMBER
HD428200



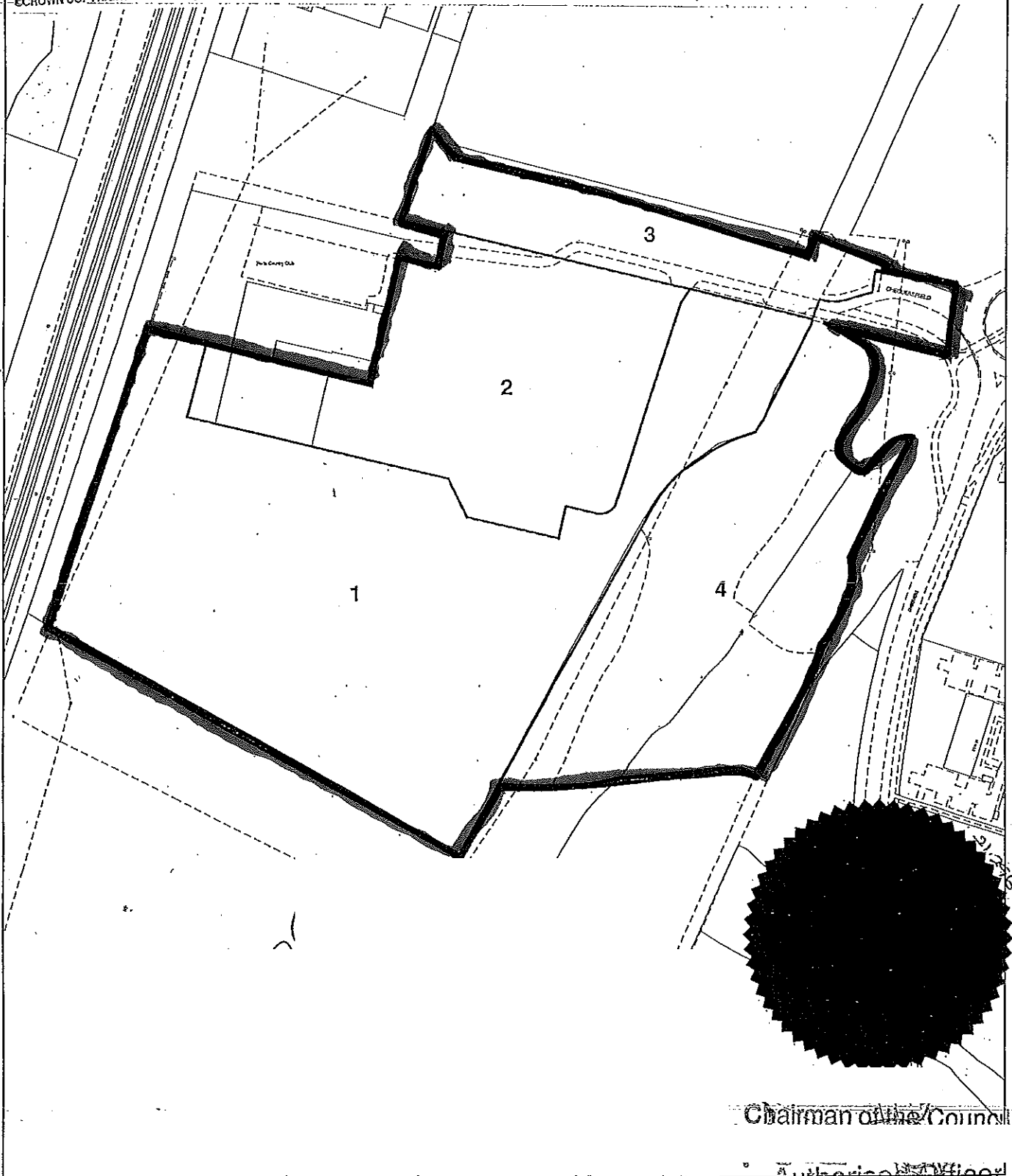
HERTFORDSHIRE : WELWYN HATFIELD

ORDNANCE SURVEY MAP REFERENCE:

TL23118E

SCALE 1:2500 Reduced from 1/1250

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Chairman of the Council

Authorised Officer

This title plan shows the general position of the boundaries: it does not show the exact line of the boundaries. Measurements scaled from this plan may not match measurements between the same points on the ground. For more information see Land Registry Public Guide 7 - Title Plans.

This official copy shows the state of the title plan on 8 September 2004 at 15:01:09. It may be subject to distortions in scale.

Under s.67 of the Land Registration Act 2002, this copy is admissible in evidence to the same extent as the original.

Issued on 8 September 2004.

This title is dealt with by the Stevenage District Land Registry.



- 5.2 that following the incorporation of the Management Company the Owner will procure that the Management Company enters into a Deed of Covenant with the Council pursuant to this Agreement to observe and perform the Maintenance Regime and the Monitoring Program
- 5.3 not to transfer the freehold or leasehold interest in any residential unit or units forming part of the Development except by way of a transfer or lease to which the Management Company is a party and in which (subject to the payment of the relevant service charge by the transferee or lessee) the Management Company covenants to observe and perform the Maintenance Regime and the Monitoring Program
- 5.4 that in the event of default by the Management Company in observing and performing the Maintenance Regime and/or the Monitoring Program the Owner will at its sole expense either observe and perform the Maintenance Regime and/or the Monitoring Program (as applicable) or procure the observance and performance of the Maintenance Regime and the Monitoring Program (as applicable)

6 LIABILITY

- 6.1 This Agreement shall not bind successors in title where such successors own (whether leasehold or freehold) any individual residential unit
- 6.2 No party shall be liable for any breach of the covenants restrictions or obligations contained in this Deed that occur after that party has parted with its interest in that part of the Application Site in respect of which the breach occurs but without prejudice to the continuing liability of the First Owner and the Second Owner under clause 2.5 hereof

7 ISSUE OF PLANNING PERMISSION

The Council covenants with the Owner that it will issue the Planning Permission within 7 days from the date of this Agreement

8 COSTS


The Owner agrees with the Council to pay its reasonable legal costs incurred in preparing and entering into this Agreement

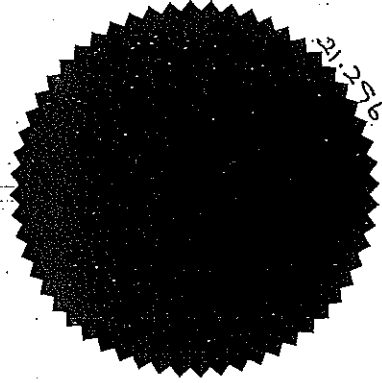
9 NOTICES

All notices served pursuant to this Agreement shall be in writing and shall be deemed served if delivered or sent to the parties concerned at the addresses herein

THE COMMON SEAL of
WELWYN HATFIELD DISTRICT COUNCIL
was hereunto affixed in the presence of :-

Chairman of the Council

 Authorised Officer



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7 Maintenance

The virtual curtain system is designed to be maintenance free. The curtain bollards will fall within land to be maintained by the estate management companies or housing associations. These bodies will be placed under positive legal obligations to maintain the equipment at all future times. This will cover eventualities such as vandalism of the bollards.

The contract wording for the ongoing maintenance scheme will be submitted to the local authority for formal approval (such approval not to be unreasonably withheld or delayed). This will include:

- a design and function summary of the system;
- Specification and required maintenance of the above ground Virtual Gas Curtain system components
- Any 'as built' drawings showing the actual positions of the virtual curtain wall and vents.
- Provision for the ongoing monitoring of landfill gases. (behind the virtual gas curtain)

The technical specification for the maintenance of the Virtual Curtain System is provided as Appendix J.

Appendix J

Maintenance for Virtual Gas Curtain System

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Maintenance of the Virtual Gas Curtain System at Chequersfield, Welwyn Garden City

Background

The housing development at the former Holy Trinity School site is located adjacent to the former Chequersfield Landfill Site. Such landfill sites represent sources of landfill gases (e.g. carbon dioxide and methane) that can migrate within soil to surrounding areas such as the adjoining residential properties. Accumulation of these gases within buildings can potentially lead to risks of explosions and/or asphyxiation. To mitigate against such potential risks, an in ground gas protection system (Virtual Gas Curtain) has been installed between the landfill site and the residential development. The location of the gas protection system is shown on the attached Vertase Drawing No. D430/F.

Virtual Gas Curtain Design Summary

The Virtual Gas Curtain system comprises 354mm wide x 150mm thick preformed geo-composite vent nodes along the northern site boundary and 400mm wide x 50mm thick vent nodes around the Herts Country Club. The vent nodes have been inserted using high frequency vibro method to 6.5m below ground level. The nodes terminate into a ventilation duct located at least 1m below ground level (2m below roads). The vent duct comprises a 354mm wide x 150mm pre-formed geo-composite (same as large diameter nodes). All vent nodes and ducting is encapsulated within a non-woven needle-punched geotextile filter fabric. The vent ducting is connected to a series of vent inlet and outlet stainless steel bollards positioned at 5m centers along northern boundary and 15m centers around the Herts Country Club.

The layout of the virtual gas curtain is shown on the attached Vertase Drawings D430/I (northern boundary) and D430/L (Herts Country Club).

Maintenance

The virtual curtain system is designed to be maintenance free. The in ground components of the system are expected to have a life expectancy in excess of 60 years and the above ground components a life expectancy in excess of 25 years. Within these timeframes, the risk associated with migration of landfill gases from the Chequersfield Landfill is expected to reduce to a level whereby in ground gas protection will no longer be required¹.

The only ongoing maintenance requirements for the curtain system is to ensure that the above ground vents are free from debris and do not succumb to damage or vandalism.

Quarterly checks should be carried out to ensure the vent inlets and outlets are kept free from litter and falling debris. Any bollards damaged or removed by vandalism or vehicle impact should be replaced. Replacement bollards need to have an appropriate concrete foundation and should be connected to the below ground pipework.

¹ This would need to be confirmed through further assessment by a suitably qualified environmental specialist.



Specifications of the Virtual Curtain System's components are presented in Appendix A and Appendix B. Replacement materials (if required) that meet these specifications can be sourced from:

SEL Environmental
22 Tottington Road
Bury
Lancashire
BL8 1LH

Tel. 01204 885555

Vertase Ltd can also be contacted to carry out any repair or replacement works to either the underground or above ground components of the curtain.

Vertase Ltd
330 Bristol Business Park
Coldharbour Lane
Bristol
BS16 1EJ

Tel. 0117 974 9180

Appendix A
Specification for Below Ground Components of the
Virtual Gas Curtain System

The physical properties for the underground components of the curtain that are required to achieve the necessary gas dilution and dispersion are presented in the tables below.

Ducting and Vent Nodes at Northern Boundary

Properties	Test Method	Unit	Value
Nominal Thickness		mm	150
Material			polypropylene
Ultimate Compressive Strength at Yield		Kn/m ²	715
Intrinsic Permeability (k)	DoE approved method	Sq.m	min.1.9x10 ⁻⁵
Forchheimer Term (c)	DoE approved method	s/m	<12.0

Vent Nodes at Herts Country Club

Properties	Test Method	Unit	Value
Nominal Thickness		mm	50
Material			Polypropylene
Crush resistance at 5% deflection		Kn/m ²	400
Intrinsic Permeability (k)	DoE approved method	Sq.m	min.1.9x10 ⁻⁵
Forchheimer Term (c)	DoE approved method	s/m	<12.0

Polypropylene outperforms almost all other plastic materials in terms of chemical resistance². The saturated olefinic chains yield resistance to most oils and solvents as well as water based chemicals, soaps and moderate acids and bases.

Polypropylene is a chemically static thermoplastic polymer (C₃ H₆) and does not lose plasticisers like some other plastics so it does not leach chemicals into the environment. It is non-toxic, will not biodegrade and does not react with most chemicals. It is widely accepted in the chemical industry for pipework, tanks and corrosion resistant parts and is used in parts for cars. It is used to manufacture membranes that are used to line landfills.

It is resistant to most chemicals that are likely to be present in landfill leachate or landfill gas at this site such as hydrocarbons, phenols, acids, metals, grease and pesticides^{3,4,5} at the concentrations and temperatures likely to be encountered within a typical landfill leachate or landfill gas. (Note contact with some chemicals that can be present as components of landfill leachate can cause surface crazing and material swelling, but polypropylene has no known solvent at room temperature). The adverse effects are reported for pure solutions and/or elevated temperature conditions that do not reflect the exposure conditions that the materials will be subjected to when exposed to leachate.

² Bastion K (1998). *Polypropylene offers more for less*. Plastics moulding and fabricating, May/June 1998.

³ Dow Chemical Company 2002, *Chemical resistance data of various materials to selected automotive fluids*.

⁴ Propoly of America Inc 2002, *Chemical resistance of polypropylene*.

⁵ Lamtec Corporation 2002, *Chemical resistance of polypropylene*

Geotextile Fabric

Properties	Test Method	Unit	Value
Tensile strength			
Strip test 20 cm	BS6096.1	KN/m	8.2
Elongation at max. load at 5% elongation	BS6096	KN/m	3.35
Wide width 50 cm	NF-G 38 014	KN/m	8.8
Elongation at max. load		31%	43
Grab strength	DIN S 3858	N	565
Grab strength	ASTM 1682	N	700
	mod 200 mm		
Elongation at max. load		> 60%	> 60
Puncture resistance (CBR)			
Max. load	BS6906/4	N	1270
Displacement		mm	50
Burst strength	ASTM D-3786	Kn/m ²	1350
Trapezoidal Tear Strength	ASTM D-1117	N	370
Cone Drop Test			
Hole diameter	BS 6906/6	mm	29
Permeability Coefficient 'K'			
under 2 kN/m ²	EMPA/ITF/	10-4ms-1	7
under 200 kN/m ²	DF.V00RST	10-4ms-1	5
Permittivity			
under 2 kN/m ²	EMPA/ITF/	S-1	1.5
under 200 kN/m ²		S-1	1.2
Flow Rate at 10 cm head	BS 6906/3	l/m ² s	100
Transmissivity			
under 20 kN/m ²	EMPA	10-7m2s-1	5
under 200 kN/m ²		10-7m2s-1	1.5
Max Pore Size			
Dry sieving (090)	BS6906/2	μm	160
Wet sieving (095)	EMPA Franzius	μm	160
Hydrodynamic sieving (095)	NF-G 38-017	μm	160

Appendix B
Specification for Above Ground Components (Vent Bollards) of the
Virtual Gas Curtain System

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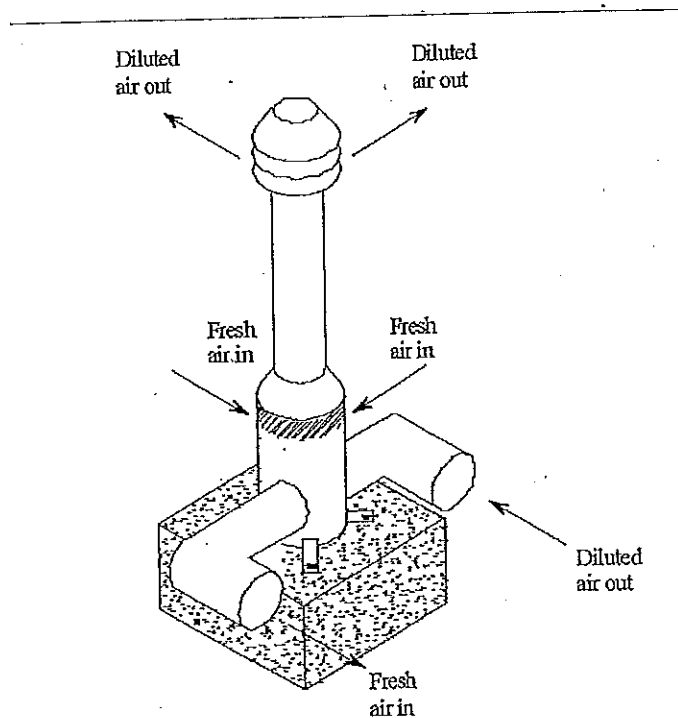


The above ground gas venting bollards comprise a 150mm air outlet pipe completed with a bee-hive vent head. The vent head provides a minimum of 18,000 sq.mm venting area and terminates a minimum of 900mm above finished ground level.

The lower half of the 150mm diameter vent pipe is surrounded by a 215mm diameter outer pipe. The outer vent pipe acts as an air inlet facility and is perforated with a series of 6mm wide x 56mm long slots to provide a nett inlet perforated area of 18,000sq.mm. The slotted section of outer pipe shall terminate approximately 150mm above finished ground level. The outer vent pipe shall be tapered in to the 150mm diameter pipe and welded to create a closure.

The outer pipe has a 150mm diameter 90 degree spur. The inner 150mm vent pipe is fitted a 90 degree spur at its base which is fabricated such that it passes through the outer pipe which is sealed around it.

The base of the outer pipe is provided with three equally-spaced tabs 90mm long x 40mm wide. Each tab incorporates a hole to accommodate an M16 anchor bolt. The whole assembly is fabricated in 2mm thickness Grade 304 stainless steel.



All bollards Grade 304
stainless steel

0 Ongoing Monitoring Program

In February 2004, Vertase installed a further six landfill gas monitoring wells at the site. The location of these is shown on Drawing No. D430/N presented in Appendix A. Additional monitoring of these wells is currently underway and will continue before, during and immediately after the proposed remedial works.

Vertase shall undertake landfill gas monitoring from existing on-site STATS wells and the additional Vertase wells as follows:

- Prior to remediation and construction works,
- During remediation works, after installation of the gas cut off curtain, and for a period of two years, on completion.
- The results of this gas monitoring will be reported to Welwyn Hatfield District Council, Environmental Health Department as well as the estate management company on a quarterly basis.
- Further ongoing monitoring on a quarterly basis must be undertaken by suitably qualified environmental engineers nominated by the estate management company, results of this gas monitoring will be reported to Welwyn Hatfield District Council, Environmental Health Department on a quarterly basis. Vertase could continue ongoing monitoring the site after the initial two year period based on agreements with the estate management company.

Monitoring results will be included within a final contract completion report. It is not proposed to carry out any groundwater monitoring.

These works are in addition to the on going monitoring being carried out by STATS. It is understood that STATS are currently carrying out groundwater monitoring to determine natural attenuation of contaminants leaching from the landfill into groundwater. As part of this monitoring STATS require access to some of the boreholes across the former Holy Trinity School site. Two of these boreholes (BH52 and BH55) are within the footprint of a proposed dwelling and have been relocated as part of the proposed works. Details of any well decommissioning and/or relocation are being covered within separate correspondence between Welwyn Hatfield Council, The Environment Agency, STATS and Vertase.

APR 14 2005 14:57

WELWYN HATFIELD DISTRICT COUNCIL

No 58 F. 2



WELWYN HATFIELD COUNCIL

Council Offices, Welwyn Garden City, Herts, AL8 6AE
Telephone: Welwyn Garden (01707)357000

TOWN AND COUNTRY PLANNING ACT 1990

PLANNING DECISION NOTICE - PERMISSION

NB/2004/1483/DE

RESERVED MATTERS APPLICATION FOLLOWING OUTLINE PERMISSION
CG/0482/1988/OP, FOR THE ERECTION OF 300 HOUSES AND FLATS, ACCESS
ROADS, GARAGES AND PARKING COURTYARDS,

at: LAND AT CHEQUERSFIELD, WELWYN GARDEN CITY

Agent Name And Address

TETLOW KING
LONE BARN STUDIOS,
STANBRIDGE LANE,
ROMSEY
HAMPSHIRE
SO51 0HE

Applicant Name And Address

GEORGE WIMPEY N/LONDON LTD
PERSIMMON HOMES (T/VALLEY)
C/O McCLEAN HOUSE,
BLUE COATS AVENUE,
HERTFORD
HERTS
SG14 1PB

In pursuance of their powers under the above mentioned Act and the Orders and Regulations for the time being in force thereunder, the Council hereby **PERMIT** the development proposed by you in your application received with sufficient particulars on 01/10/2004 and shown on the plan(s) accompanying such application, subject to the following conditions:

1. Before construction works commence on site, full details or samples of the materials to be used in the external construction of the development hereby permitted shall be submitted to and approved in writing by the Local Planning Authority.

REASON

To ensure that the external appearance of the development is not detrimental to the character of the locality.

2. The landscaping scheme approved as part of this consent shall be implemented and completed in all respects by no later than the planting season following completion of the development unless a longer period is specifically authorised by the Local Planning Authority in writing, and any trees or plants which within a period of 5 years from completion of the development die, are removed or become seriously damaged or diseased, shall be replaced in the next planting season with others of similar size and species, unless the Local Planning Authority gives written consent to any variation.

APR 14 2003 14:57

WELWYN HATFIELD DISTRICT COUNCIL

No 15 58 F. 3

Continuation...

REASON

In order to enhance the appearance of the development.

3. Before any other works on site are commenced in relation to the development permitted, a one metre high chestnut pale fence, or other suitable barrier shall be erected around the outer limit of the crown spread of all trees on site shown to be retained on the approved plan. This fencing shall be retained in this position until the whole of the development is completed. During this period no materials whatsoever shall be stored, fires started or service trenches dug within these enclosed areas without the written consent of the Local Planning Authority.

REASON

To ensure that the existing trees shown to be retained, are safeguarded during building operations.

4. Prior to the occupation of 50% of the dwellings at the site children's play equipment, details of which shall be first submitted to and agreed in writing by the Local Planning Authority shall be provided at the site and thereafter retained in the agreed form.

REASON

In order to ensure adequate children's play facilities are provided at the site

5. Prior to the commencement of development at the site details shall be submitted to and agreed in writing by the local Planning Authority of the type of glazing and mechanical ventilation to be fitted to the bedrooms and living rooms serving units E, F, G and H and flat FOG2 (plot 128) as identified on drawing PLO40709 SL01 Rev A. The development shall thereafter be constructed and retained in accordance with the approved details.

REASON

To protect and safeguard the residential amenities of the occupiers of the properties from noise.

6. Development shall not commence until details of on site drainage works have been submitted to and approved by the local planning authority in consultation with the sewerage undertaker. No works which result in the discharge of foul or surface water from the site shall be commenced until the on site drainage works referred to above have been completed.

REASON

To ensure that the foul and/or surface water discharge from the site shall not be prejudicial to the existing sewerage system

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WELWYN HATFIELD DISTRICT COUNCIL

NO 15 08 F. 4

Continuation...

7. Notwithstanding the details shown on the drawings hereby approved, details of the boundary treatments proposed around and within the site shall be submitted to and agreed in writing by the Local Planning Authority and the details so agreed shall be provided at the site prior to the first occupation of any of the dwellings and shall be maintained hereafter in perpetuity.

REASON

In order to ensure that the boundary treatments do not have a harmful impact upon the character and appearance of the area and that the privacy of the occupiers of the development is safeguarded

INFORMATIVE

Increase flow from the development may lead to sewerage flooding. Impact studies of the existing infrastructure will be required in order to determine the magnitude of any new additional capacity required in the system and a suitable connection point. The developer will be required to fund this. Early contact with Thames Water is recommended

With regard to surface water drainage it is the responsibility of a developer to make proper provision for drainage to ground, water course or surface water sewer. It must not be allowed to drain into the foul sewer as this is a major contributor to sewer flooding. Thames Water recognises the environmental and economic benefits of surface water source control, and encourages its appropriate application to the overall benefit of our customers

In the disposal of surface water, Thames Water will recommend that the applicant:

- a) looks to ensure that new connections to the public sewerage system do not pose an unacceptable threat of surcharge, flooding or pollution;
- b) checks that the proposals are in line with the advice from DEFRA, which encourages wherever practicable, disposal 'on site' without recourse to the public sewerage system; for example in the form of soakaways or infiltration areas on free draining soils;
- c) looks to ensure the separation of foul and surface water sewerage on all new developments.

Where the disposal of surface water is other than to a public sewer, the Applicant should ensure that approval for the discharge has been obtained from the appropriate authorities.

With regard to surface water, it is recommended that the Applicant should ensure that storm flows are attenuated or regulated into the receiving network e.g. through On/Off-site storage

5-APR-2005 14:57

WELWYN HATFIELD DISTRICT COUNCIL

Continuation...

REASON FOR APPROVAL

It is considered that the proposed development does not have an unacceptably harmful impact on residential amenity or the character of the area in which it is located, as the development proposed is in keeping with the character and appearance of the area in terms of scale and design, does not result in unacceptable overlooking or loss of privacy and does not have any unacceptably dominating impact with regard to neighbouring uses. The proposed development has also been considered acceptable in terms of highway safety and the provision of parking

SUMMARY OF RELEVANT DEVELOPMENT PLAN POLICIES

Hertfordshire Structure Plan Review 1991-2011:

Policy 1, Policy 6, Policy 10, Policy 25, Policy 29, Policy 38, Policy 45

Hertfordshire Structure Plan Alterations 2001-2015 (Deposit Draft Feb 2003):

Policy 6, Policy 10, Policy 25, Policy 29, Design and Quality of Development

Welwyn Hatfield District Plan Alterations no 1 1998:

BEV 5, GEN Criteria 1, GEN Criteria 3, GEN Criteria 4, RES Criteria 17

Welwyn Hatfield Review District Plan Deposit Draft, June 2002:

Policy SD1, Policy R1, Policy R2, Policy R14, Policy R17, Policy M1, Policy M6, Policy M19, Policy H1, Policy H6, Policy H7, Policy H8, Policy OS3, Policy D1, Policy D2

Supplementary Design Guidance

Supplementary Design Guidance

APPROVED PLAN NUMBER(S):

PL040709 LP.01 received 1st October 2004 & PL040709 SL01A received 29th November 2004 & PL040709 SL030/N received 14th October 2004 & PL040709 SLB.01 received 18th October 2004 & PL040709 MAT01B 29th November 2004 & PL040709 FEA received 1st October 2004 & PL040709 FP.A received 1st October 2004 & PL040709 FEA received 1st October 2004 & PL040709 FP.1B received 1st October 2004 & PL040709 FP.2B received 1st October 2004 & PL040709 FPE.C received 1st October 2004 & PL040709 FPE.D received 1st October 2004 & PL040709 FPE.EFG received 1st October 2004 & PL040709 FPE.H received 1st October 2004 & PL040709 FP.H received 1st October 2004 & PL040709 FPE.I received 1st October 2004 & PL040709 FP.J1 received 1st October 2004 & PL040709 FP.J2 received 1st October 2004 & PL040709 FE.K received 1st October 2004 & PL040709 FP.K1 received 1st October 2004 & PL040709 FP.K2 received 1st October 2004 &

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WELWYN HATFIELD DISTRICT COUNCIL

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 received 16th November 2004 & JBA 03/216-05A received 16th November 2004 & JBA
 03/216-06 received 9th November 2004

Date:

Chris Conway
Chief Planning and Environmental Health Officer

0 Proposed Gas Protection

The principal gas protection works shall be the installation of a gas cut off Virtual Curtain System installed along the northern boundary of the former school site and adjacent to the Herts Country Club that shall intercept the potential gas migrating strata.

1 Virtual Curtain System

The system comprises vent nodes that are driven into the ground using a method that minimises the amount of excavation required. The individual nodes are connected to a geocellular collector duct system wrapped in a membrane, with a vent stack and bollard inlet/outlet arrangement at calculated centres. The principle of this system is the utilisation of the forced dilution principle to create a zone of low pressure that attracts and dilutes ground borne gases to acceptable levels. This avoids the risk of ground gas or groundwater accumulation against membrane or bentonite barriers that is normally associated with the more traditional systems.

The fresh airflow through the collection duct will normally give an equilibrium concentration at the outlet vents of 1% carbon dioxide or methane (this is reduced to 0.25%v/v where necessary). Discrete inlet and outlet combination bollards provide the venting. The inlets would be at ground level within the outlet bollard/stack for the adjacent section.

The gas ventilation barrier has been designed following the principles outlined by Wilson and Shuttleworth in a paper published in Ground Engineering in January 2002. This has been refined by ARUP Research and Development who have developed a 2D analytical model for the system.

This type of gas cut off curtain has several site-specific advantages. The installation generates absolutely minimal, potentially contaminated, construction arisings. Groundwater control is not necessary and because the vertical 'nodes' are spaced intermittently along the length of the curtain, it has only a minimal immediate effect, and negligible long-term effect, on the local hydrogeology that is of particular importance on this site.

3.2 Design Summary

The proposed location of virtual curtain system is shown on Drawing No D430/N in Appendix A and extends along the northern boundary of the proposed development site and behind the Herts Country Club to the northwest. The detailed design layout for the proposed virtual curtain system is presented as Drawing D430/J in Appendix H and is summarised in Table 6.2 below.

Table 6.2: Design Layout of Virtual Curtain System

Item	Northern Boundary	Adjacent to Herts Country Club
Design Parameters	Methane – 58%, Flow Rate – 12l/hr, pressure 62Pa, Factor of Safety - 2	Methane – 2%, Flow Rate – 5l/hr, pressure 62Pa, Factor of Safety – 2
Nodes	Use 150mm by 354mm Permavoid high capacity vent nodes driven to a toe depth of 6.5m depth below finish ground level.	Use 50mm by 410mm geocomposite vent nodes driven to a toe depth of 6.5m depth below finish ground level.
	Spacing of nodes at 0.708m centres	Spacing of nodes at 2.5m centres
	Terminate at 1.0m below ground level except at service ingress points	Terminate at 1.0m below ground level (no service ingress points here).
Vent duct	150mm high by 354mm wide Permavoid ventilation duct. Base of duct at 1.0m below ground level.	150mm high by 354mm wide Permavoid ventilation duct. Base of duct at 1.0m below ground level.
Vents	0.9m high steel bollards at 5m centres with internal mesh flame guards	0.9m high steel bollards at 15m centres with internal mesh flame guards

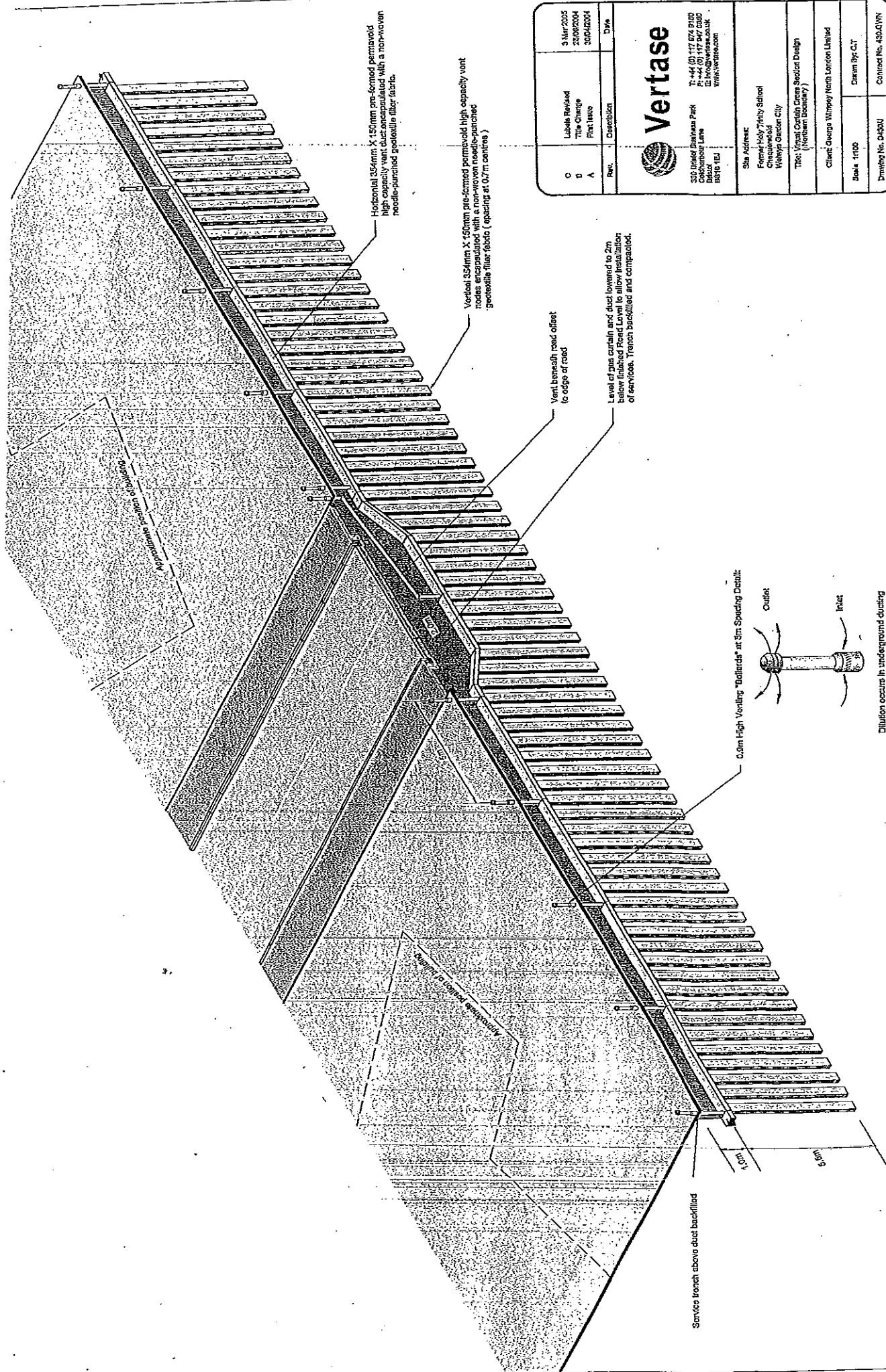
The design parameters selected for the gas curtain at the northern boundary of the site are based on concentrations currently or historically detected at the centre of the landfill itself. This regime far exceeds that detected in the vicinity of the proposed northern boundary curtain (i.e. southern extent of landfill) and is considered to provide a significant safety margin on any potential gas scenario that could arise at the northern boundary curtain, and is based on current known land end use

Reduced design parameters have been used for the section of curtain that lies adjacent to the Herts Country Club D430/L in Appendix H. This is due to the absence of any significant gas concentrations or flow rates in this area and the distance between the site at this point and the landfill.

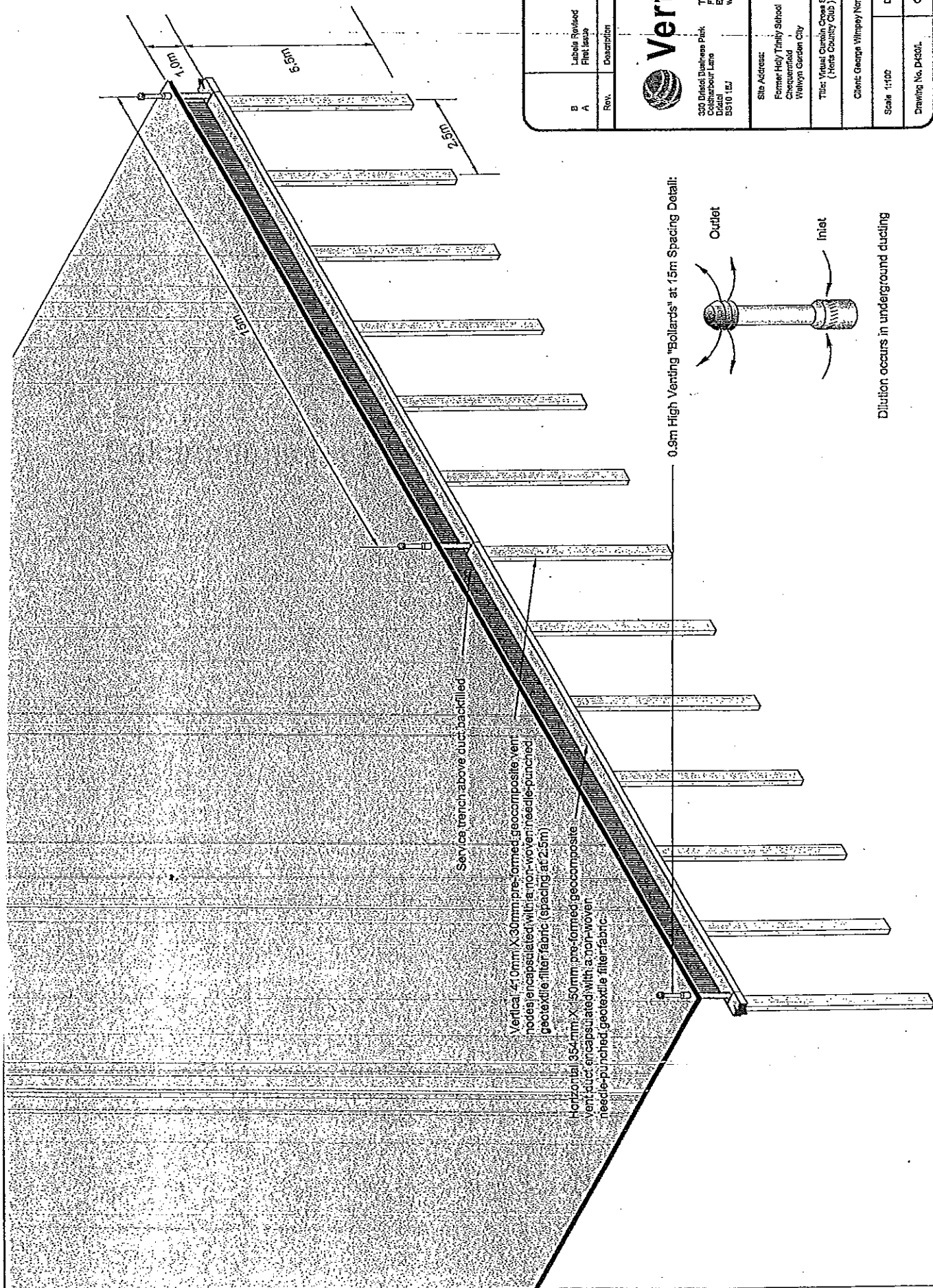
The design calculations are summarised within Appendix I. The specifications for the various components of the curtain are provided in the maintenance schedule in Appendix J.

Appendix H

Detailed Design of Virtual Curtain



<div> <div>C</div> <div>B</div> <div>A</div> </div>	Labels Revised	3 Mar 2005
	Title Change	25/09/2004
	First Issue	30/04/2004
Rev.	Description	Date
<div> <div> </div> <div> Vertase 330 United Business Park Cranston Road Chesham, Bucks HP80 1ED Tel: +44 (0) 1757 674 0100 Fax: +44 (0) 1757 647 0800 Email: info@vertase.co.uk www.vertase.co.uk </div> </div>		
<div> <div> Site Address: Former Holy Trinity School Cranston Road Watlington, Oxford OX12 9JY </div> <div> Client: The Visual Curtain Crete Section Design (Northern boundary) </div> </div>		
<div> <div> Client: Gange Watlington North London Limited </div> <div> Scale: 1:100 </div> </div>		
<div> <div> Drawn by: G.T. </div> <div> Contract No.: 430-01YN </div> </div>		
<div> <div> Drawing No.: D-000 </div> </div>		



B	Labels Revised	3 Mar 2005
A	First Issue	23/06/2004
Rev.	Description	Date
Vertase 330 Driest Dunhwaik Park Colchesterport Lane Driest SS10 1LW T: +44 (0) 117 074 0190 F: +44 (0) 117 647 0800 E: info@vertase.co.uk www.vertase.com		
Site Address: Former Holy Trinity School Chaucerfield Welwyn Garden City		
Title: Visual Cumlin Cross Section Design (Herts County Club)		
Client: George Wimpey North London Limited		
Scale: 1:100	Drawn By: C.T.	
Drawing No. D4301.	Contract No. 486.GWN	

Appendix I

Calculations for Detailed Virtual Curtain Design

Project Information

Name	Location		Reference	
Chequersfield, Welwyn Garden City	Herts			0
		Vertase Limited	Calculation by	SAW
		Virtual/cutrain	Checked by	SAW

Design Parameters

Design gas regime	Gas to be analysed	Methane
	Design gas concentration	2 %
	Design flow rate	5 l/hr
	Design gas pressure	62 Pa
	Are design parameters max, average, etc ?	Assumed
	Overall FOS required	2

Barrier	Total length of barrier	128 m
	Type of collection duct	Geocomposite
	Height: difference between inlet and outlet	0.9 m
	Length: vented by each inlet/outlet, L	15 m
	Height: of outlets	0.9 m
	Sensitivity of site	High

Geocomposite reinforcement nodes	Width of Geocomposite strips to be used
Thickness of nodes	0.41 m
Spacing of nodes, S	0.03 m
Depth of nodes below top of duct, D	2.5 m
Driving pressure up nodes	6.5 m
Intrinsic permeability of nodes	62 Pa
Darcy permeability of ground	1.15E-05 m ²
	1.00E-05 m/s

Wind	Category of terrain	Urban
	Type of exposure	Sheltered inland
	Proportion of time wind speed is exceeded	60
	Wind direction	South west
	Value of mean wind speed U_{50}	4 m/s

Discharge coefficient for sharp edges, (Cd)	0.61
Pressure coefficient, (ΔC_p)	0.6

Version 3.2

14/06/2004:

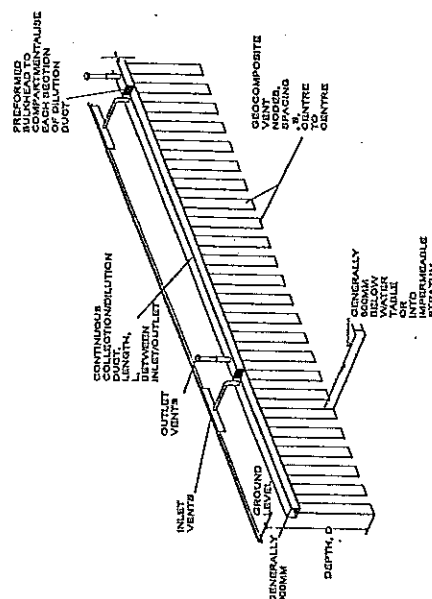
Design Information

Definition of assessment criteria	Likely source	Domestic/municipal landfill site
	Generation potential	High
	Range and No of monitoring results	> 12 readings > 6 months
	Are results consistent with source?	Yes
	Is desk study, SI and monitoring adequate?	Yes

Results

Flow results	Required air flow through vent duct	4.491E-04	m ³ /s
Ventilation requirements	Equilibrium concentration in duct	0.25	%
	Overall factor of safety	2.00	
	Total area of ventilation required, (Aw)	1680	mm ² based on overall fos
Pipes	Type of vent		
	Vent bollard 150mm diameter		
Exhaust systems	Number of inlet vents required in length L	1	No
	Type of vent		
	Vent bollard 150mm diameter		
	Rotating cowls?	No	
	Number of outlet vents required in length L	1	No

Vent capacity acceptable?



Based on BS 5925:1991, CIRIA Report 149 (1995), Wilson and Card (1999) and Wilson and Shuttleworth (2002)

Design for geocomposite gas migration barrier

Drive in vertical strips of geocomposite connected to dilution duct.

Project Information

Site	Chequersfield, Welwyn Garden City
Location	Herts
Client	Vertase
Structural Role	Virtual curtain
Reference	SAW
Calculation	SAW
Checked by	SAW

Design Parameters

Design regime	Gas to be analysed	Methane
Design gas concentration	Design gas concentration	58 %
Design flow rate	Design flow rate	12 l/hr
Design gas pressure	Design gas pressure	62 Pa
Are design parameters max, average, etc?	Are design parameters max, average, etc?	Maximum
Overall FOS required	Overall FOS required	2

Barrier	Total length of barrier	220 m
Type of collection duct	Type of collection duct	Permavoid
Height difference between inlet and outlet	Height difference between inlet and outlet	1 m
Length vented by each inlet/outlet, L	Length vented by each inlet/outlet, L	45 m
Height of outlets	Height of outlets	1 m
Sensitivity of site	Sensitivity of site	High

Geocomposite (e) Nodes	Width of Geocomposite strips to be used	0.354 m
Thickness of nodes	Thickness of nodes	0.15 m
Spacing of nodes, S	Spacing of nodes, S	0.708 m
Depth of nodes below top of duct, D	Depth of nodes below top of duct, D	5.5 m
Driving pressure up nodes	Driving pressure up nodes	62 Pa
Intrinsic permeability of nodes	Intrinsic permeability of nodes	1.15E-05 m ²
Darcy permeability of ground	Darcy permeability of ground	1.00E-05 m/s

Wind	Category of terrain	Urban
Type of exposure	Type of exposure	Sheltered Inland
Proportion of time wind speed is exceeded	Proportion of time wind speed is exceeded	60
Wind direction	Wind direction	South west
Value of mean wind speed U ₀	Value of mean wind speed U ₀	4 m/s

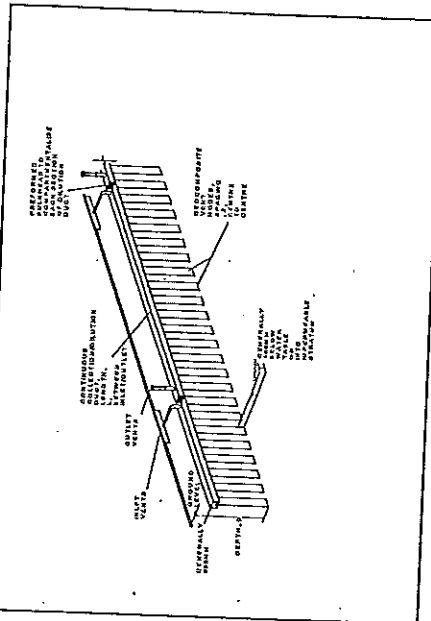
Ventilation	Discharge coefficient for sharp edges, (Cd)	0.61
Pressure coefficient, (Cp)	Pressure coefficient, (Cp)	0.6

Design Information

Design regime	Likely source	Domestic/municipal landfill site
Design gas pressure	Generation potential	High
Are results consistent with source?	Range and No of monitoring results	> 12 readings > 6 months
Is desk study, SI and monitoring adequate?	Are results consistent with source?	Yes
	Is desk study, SI and monitoring adequate?	Yes

Flow regime	Required air flow through vent duct	1.302E-02 m ³ /s
Equilibrium	Equilibrium concentration in duct	0.25 %
Requirements	Overall factor of safety	2.00
Results	Total area of ventilation required, (Aw)	36050 mm ² based on overall fof
Type of vent	Type of vent	Vent bollard 150mm diameter
Number of inlet vents required in length L	Number of inlet vents required in length L	3 No
Type of vent	Type of vent	Vent bollard 150mm diameter
Rotating cowls?	Rotating cowls?	No
Number of outlet vents required in length L	Number of outlet vents required in length L	3 No

Vent capacity acceptable?	Vent capacity acceptable?	Yes
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Based on BS 5925:1991, CIRIA Report 149 (1995), Wilson and Card (1999) and Wilson and Shuttleworth (2002)