Appendix 1 Letter from Dublin Waste management Steering group dated 06 June 2008

.

RPS

ENGINEERS IRELAND
cpd ACCREDITED COMPANY

RPS Consulting Engineers, West Pier Business Campus, Dun Laoghaire, Co Dublin, Ireland
T +353 (0)1 488 2900 F +353 (0)1 283 5676 E ireland@rpsgroup.com W www.rpsgroup.com/ireland

Ms Margaret Heavey
Greenstar
Fassaroe
Bray
Co Wicklow

6th June, 2008

Our Ref: MDR0303Lt0391
File Ref: 611

Re: Waste Disposal Capacity Assessment

Dear Margaret,

Fingal County Council, acting on behalf of the four local authorities for the Dublin Region, i.e. Dublin City Council, Fingal County Council, South Dublin County, Council and Dun Laoghaire Rathdown County Council, is currently examining the requirement to secure commercial arrangements to acquire waste disposal capacity in the short to medium term for the non-hazardous household and commercial waste arisings generated within the Dublin Region.

Waste disposal capacity will be required to cater for approximately 500,000 tonnes per annum in the short term potentially reducing to approximately 150,000 to 300,000 tonnes per annum in the medium term.

Commercial and contractual arrangement will be defined following initial disposal capacity assessments.

We would appreciate an opportunity to discuss this further with you. Should you wish to discuss or require any additional information do not hesitate to contact the undersigned.

Yours sincerely

CAROL CONNERY

For RPS

CC/cc

Appendix 2 EPA Waste Licence W0146-01 and Planning Permissions 01/5006 and NA/60336

Headquarters,
P.O. Box 3000,
Johnstown Castle Estate
County Wexford, Ireland

WASTE LICENCE
LANDFILL FOR NON-HAZARDOUS WASTE

Waste Licence Register Number:	146-1
Licensee:	Celtic Waste Limited
Location of Facility:	Knockharley Landfill, Knockharley, Navan, County Meath (includes townlands of Tuiterath and Flemingstown).

INTRODUCTION

This introduction is not part of the licence and does not purport to be a legal interpretation of the licence.

This licence is for the operation and development of a landfill at a greenfield site at Knockharley, Navan, County Meath (includes townlands of Tuiterath and Flemingstown). The waste for disposal consists of residual, non-hazardous household, commercial and industrial waste arising in the north-east.

The waste intake is limited to 175,000 tonnes of waste per annum and the facility has an operating life of approximately 14 years. The proposed facility covers an area of 135 hectares. The landfill, which will be positioned in the centre of the site, will cover approximately 25 hectares of this area. The licence requires a buffer zone i.e. an area where no waste will be deposited between the landfill and the nearest residences. A 50m band of this area, inside the facility boundary, will be planted with woodland.

The facility consists of the landfill, an administration building, leachate lagoon, surface water pond, weighbridges, wheelwash and a landfill gas collection and flaring system. These associated infrastructure are necessary so as to control the emissions from the facility. Infrastructure to control emissions to the environment must meet BAT standards. There are no direct discharges of effluent to surface water or groundwater. Leachate will be tankered off-site to a Sanitary Authority waste water treatment plant.

The licensee must manage and operate the facility to ensure that the activities do not cause environmental pollution. The licensee has to carry out regular environmental monitoring and submit all monitoring results, and a wide range of reports on the operation and management of the facility, to the Agency.

The conditions of this licence set out in detail the legal constraints under which Celtic Waste Limited is allowed to operate and manage the Knockharley Facility.

Table of Contents

Page No.

DECISION & REASONS FOR THE DECISION

Reasons for the Decision

The Environmental Protection Agency (the Agency) is satisfied, on the basis of the information available, that the requirements of Section 40(4) of the Waste Management Act, 1996 have been complied with in respect of the application for a waste licence for the activities listed hereunder in Part I.

In reaching this decision the Agency has considered the application and supporting documentation received from the applicant, all submissions and objections received from other parties, the report of its inspector and the Chairperson of the Oral Hearing Report.

Part I Activities Licensed

In pursuance of the powers conferred on it by the Waste Management Act, 1996, the Agency, under Section 40(1) of the said Act hereby grants this Waste Licence to Celtic Waste Limited, Burton Court, Burton Hall Road, Sandyford, Dublin 18 to carry on the waste activities listed below at the proposed Knockharley Landfill, Knockharley, Navan, Co. Meath (Includes Townlands of Tuiterath and Flemingstown) subject to twelve conditions, with the reasons therefor and the associated schedules attached thereto set out in the licence.

Licensed Waste Disposal Activities, in accordance with the Third Schedule of the Waste Management Act 1996

Class 1.	**Deposit on, in or under land (including landfill):**
	This activity is limited to the deposit of non-hazardous wastes specified in Condition 1.4 in lined cells that are on, in and under land.
Class 4.	**Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons:**
	This activity is limited to the storage of leachate in a lagoon prior to disposal off-site at a suitable waste water treatment plant and the use of a surface water pond to control the quality and quantity of the surface water run-off from the site.
Class 5.	**Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.**
	This activity is limited to the deposition of non-hazardous waste into lined cell(s).
Class 6.	**Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1. to 10. of this Schedule:**
	This activity is limited to possible future biological pre-treatment of leachate subject to the agreement of the Agency.
Class 13.	**Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.**
	This activity is limited to the temporary storage on-site of unacceptable waste in the waste quarantine area prior to transport to another site.

Licensed Waste Recovery Activities, in accordance with the Fourth Schedule of the Waste Management Act 1996

Class 4.	**Recycling or reclamation of other inorganic materials:**
	This activity is limited to the use of recycled construction and demolition waste as cover and/or construction material at the site.
Class 9.	**Use of any waste principally as a fuel or other means to generate energy:**
	This activity is limited to the utilisation of landfill gas.
Class 11.	**Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule:**
	This activity is limited to the use of construction and demolition waste on-site.
Class 13.	**Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced:**
	This activity is limited to the storage of construction and demolition waste on site prior to reuse.

INTERPRETATION

All terms in this licence should be interpreted in accordance with the definitions in the Waste Management Act, (the Act), unless otherwise defined in this section.

Adequate lighting	20 lux measured at ground level.
Agreement	Agreement in writing.
Annually	At approximately twelve monthly intervals.
Attachment	Any reference to Attachments in this licence refers to attachments submitted as part of the waste licence application.
Application	The application by the licensee for this waste licence.
Appropriate facility	A waste management facility, duly authorised under relevant law and technically suitable.
Biodegradable waste	Any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food, garden waste, sewage sludge, paper and paperboard.
Buffer Zone	The zone between the area within which no waste shall be deposited and the boundary of the facility.
Condition	A condition of this licence.
Construction and Demolition Waste	All wastes which arise from construction, renovation and demolition activities.
Containment boom	A boom which can contain spillages and prevent them from entering drains or watercourses.
Cover material	Bricks, crushed concrete, tarmac, earth, soil, sub-soil, stone, rock or other similar natural materials or other cover material the use of which has been agreed with the Agency.
Daily Cover	Is the term used to describe material spread (about 150mm if soil cover is used) over deposited waste at the end of each day. Synthetic materials may also be used. Its objective is to minimise odour, the amount of litter generated and to control flies and access to the waste by birds and vermin. Where soils are used for daily cover, it is recommended that they be removed at the start of the day and subsequently reused as much as possible
Daytime	8.00 a.m. to 10.00 p.m.
Documentation	Any report, record, result, data, drawing, proposal, interpretation or other document in written or electronic form which is required by this licence.
Drawing	Any reference to a drawing or drawing number means a drawing or drawing number contained in the application, unless otherwise specified in this licence.
Emergency	Those occurrences defined in Condition 9.4
Emission Limits	Those limits, including concentration limits and deposition levels established in *Schedule C: Emission Limits*, of this licence

European Waste Catalogue (EWC)	A harmonised, non-exhaustive list of wastes drawn up by the European Commission and published as Commission Decision 94/3/EC and any subsequent amendment published in the Official Journal of the European Community.
Footprint	Area where waste is deposited of in lined cells
Green waste	Waste wood (excluding timber), plant matter such as grass cuttings, and other vegetation.
Hours of Operation	7.30 to 18.30 Monday to Saturday.
Hours of Waste Acceptance	8.00 to 18.00 Monday to Saturday.
Inert waste	Waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.
Intermediate Cover	Refers to placement of material (minimum 300mm if soil is used) for a period of time prior to restoration or prior to further disposal of waste.
Landfill	Refers to the area of the facility where the waste is disposed of by placement on the ground or on other waste.
Landfill Gas	Gases generated from the landfilled waste.
LEL (Lower Explosive Limit)	The lowest percentage concentration by volume of a mixture of flammable gas with air which will propagate a flame at 25^{o}C and atmospheric pressure.
Licence	A Waste Licence issued in accordance with the Act.
Licensee	Celtic Waste Limited.
List I/II Organics	Substances classified pursuant to EC Directives 76/464/EEC and 80/68/EEC.
Liquid Waste	Any waste in liquid form and containing less than 2% dry matter. Any waste tankered to the facility.
Maintain	Keep in a fit state, including such regular inspection, servicing and repair as may be necessary to adequately perform its function.
Mobile Plant	Self-propelled machinery used for the emplacement of wastes or for the construction of specified engineering works.
Monthly	A minimum of 12 times per year, at approximately monthly intervals.
Night-time	10.00 p.m. to 8.00 a.m.
Recyclable Materials	Those waste types, such as cardboard, batteries, gas cylinders, etc, which may be recycled.
Residual Waste	Residual waste means the fraction of waste remaining after the treatment of waste.

Quarterly	At approximately three monthly intervals.
Sample(s)	Unless the context of this licence indicates to the contrary, samples shall include measurements by electronic instruments.
SCADA system	Supervisory Control and Data Acquisition system.
Sludge	The accumulation of solids resulting from chemical coagulation, flocculation and/or sedimentation after water or wastewater treatment with between 2% and 14% dry matter.
Specified Emissions	Those emissions listed in *Schedule C: Emission Limits* of this licence.
Specified Engineering Works	Those engineering works listed in *Schedule B: Specified Engineering Works* of this licence.
Treated Sludge	Sludge which has undergone biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use.
Treatment	Treatment means the physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery.
Trigger Level	A parameter value specified in the licence, the achievement or exceedance of which requires certain actions to be taken by the licensee.
White Goods	Refrigerators, cookers, ovens and other similar appliances.
EPA Working Day	Refers to the following hours; 9.00 a.m. to 5.30 p.m. Monday to Friday inclusive.
Working Face	The area of the site in which waste other than cover material or material for the purposes of the construction of specified engineering works is being deposited.

PART II CONDITIONS

CONDITION 1 SCOPE OF THE LICENCE

1.1. Waste activities at the facility shall be restricted to those listed and described in Part I: Activities Licensed and authorised by this licence.

1.2. For the purposes of this licence, the facility is the area of land outlined in bold red on Drawing No. 2000-144-01-01 entitled Landfill Layout and Figure B2.2 Location Map of the application. Any reference in this licence to "facility" shall mean the area thus outlined in red.

1.3. This licence is for the purposes of waste licensing under the Waste Management Act 1996 only and nothing in this licence shall be construed as negating the licensee's statutory obligations or requirements under any other enactments or regulations.

1.4. Municipal Waste, Commercial Waste and Industrial Waste may be disposed of at the facility subject to the maximum quantities and other constraints listed in *Schedule A: Waste Acceptance*, of this licence.

1.5. No hazardous wastes or liquid wastes shall be disposed of at the facility.

1.6. The licensee shall ensure that all waste accepted at the facility is subject to treatment. This provision may not apply to inert wastes for which treatment is not technically feasible nor to any other waste for which such treatment does not contribute to the objectives of the Landfill Directive as set out in Article 1 of the Directive by reducing the quantity of the waste or the hazards to human health or the environment.

1.7. Whole used tyres (other than bicycle tyres and tyres with an outside diameter greater than 1400mm) shall not be disposed of at the facility from 16 July 2003. Shredded tyres shall not be disposed of at the facility from 16 July 2006.

1.8. Waste Acceptance Hours and Hours of Operation

1.8.1. Landfill

1.8.1.1 Waste shall only be accepted at the facility for disposal at the landfill between the hours of 8.00 to 18.00 Monday to Saturday inclusive.

1.8.1.2 The facility shall only be operated during the hours of 7.30 to 18.30 Monday to Saturday inclusive.

1.8.1.3 Waste shall not be accepted at the landfill on Bank Holidays.

1.9 The following shall constitute an incident for the purposes of this licence:

a) an emergency;

b) any emission which does not comply with the requirements of this licence;

c) any trigger level specified in this licence which is attained or exceeded;

d) any indication that environmental pollution has, or may have, taken place and

e) any rejected load of waste.

1.10 Where the Agency considers that a non-compliance with any condition of this licence has occurred, it may serve a notice on the licensee specifying:

1.10.1 That only those wastes as specified, if any, in the notice are to be accepted at the facility after the date set down in the notice;

1.10.2 That the licensee shall undertake the works stipulated in the notice, and/or otherwise comply with the requirements of the notice as set down therein, within the time-scale contained in the notice; and

1.10.3 That the licensee shall carry out any other requirement specified in the notice.

When the notice has been complied with, the licensee shall provide written confirmation that the requirements of the notice have been carried out. No waste, other than that which is stipulated in the notice, shall be accepted at the facility until written permission is received from the Agency.

1.11 Every plan, programme or proposal submitted to the Agency for its agreement pursuant to any Condition of this licence shall include a proposed timescale for its implementation. The Agency may modify or alter any such plan, programme or proposal in so far as it considers such modification or alteration to be necessary and shall notify the licensee in writing of any such modification or alteration. Every such plan, programme or proposal shall be carried out within the timescale fixed by the Agency but shall not be undertaken without the agreement of the Agency. Every such plan, programme or proposal agreed by the Agency shall be covered by the conditions of this licence.

REASON: To clarify the scope of this licence.

CONDITION 2 MANAGEMENT OF THE FACILITY

2.1 Facility Management

2.1.1 The licensee shall employ a suitably qualified and experienced facility manager who shall be designated as the person in charge. The facility manager or a nominated, suitably qualified and experienced, deputy shall be present on the facility at all times during its operation.

2.1.2 Both the facility manager and deputy, and any replacement manager or deputy, shall successfully complete both the FAS waste management training programme (or equivalent agreed with the Agency) and associated on site assessment appraisal within twelve months of appointment.

2.1.3 The licensee shall ensure that personnel performing specifically assigned tasks shall be qualified on the basis of appropriate education, training and experience, as required and shall be aware of the requirements of this licence.

2.2 Management Structure

2.2.1 Prior to the commencement of waste activities the licensee shall submit written details of the management structure of the facility to the Agency. Any proposed replacement in the management structure shall be notified in advance in writing to the Agency. Written details of the management structure shall include the following information

a) the names of all persons who are to provide the management and supervision of the waste activities authorised by the licence, in particular the name of the facility manager and any nominated deputies;

b) details of the responsibilities for each individual named under a) above; and

c) details of the relevant education, training and experience held by each of the persons nominated under a) above.

2.3 Environmental Management System (EMS)

2.3.1 The licensee shall establish and maintain an EMS. The licensee shall three months prior to the commencement of waste activities at the facility submit to the Agency for its agreement a proposal for a documented Environmental Management System (EMS) for the facility. Following the agreement of the Agency, the licensee shall establish and maintain such a system. The EMS shall be updated on an annual basis with amendments being submitted to the Agency for its agreement.

2.3.2 The EMS shall include as a minimum the following elements:

2.3.2.1 Schedule of Environmental Objectives and Targets

The objectives should be specific and the targets measurable. The Schedule shall address a five-year period as a minimum. The Schedule shall include a time-scale for achieving the objectives and targets and shall comply with any other written guidance issued by the Agency.

2.3.2.2 Environmental Management Plan (EMP)

The EMP shall include, as a minimum, the following:

(i) the items specified to be contained in an Environmental Management Plan in the Landfill Operational Practices Manual published by the Agency;

(ii) methods by which the objectives and targets will be achieved and the identification of those responsible for achieving those objectives and targets;

(iii) any other items required by written guidance issued by the Agency.

2.3.2.3 Corrective Action Procedures

The Corrective Action Procedures shall detail the corrective actions to be taken should any of the procedures detailed in the EMS not be followed.

2.3.2.4 Awareness and Training Programme

The Awareness and Training Programme shall identify training needs, for personnel who work in or have responsibility for the licensed facility.

2.4 Communications Programme

2.4.1 The licensee shall establish and maintain a Communications Programme to inform and involve the local community and to ensure that members of the public can obtain information at the facility, at all reasonable times, concerning the environmental performance of the facility. This shall be established three months prior to the commencement of waste activities at the facility.

REASON: To make provision for the proper management of the activity on a planned basis having regard to the desirability of ongoing assessment, recording and reporting of matters affecting the environment.

CONDITION 3 FACILITY INFRASTRUCTURE

3.1 The licensee shall establish all infrastructure referred to in this licence prior to the commencement of the licensed activities or as required by the conditions of this licence.

3.2 Specified Engineering Works

3.2.1 The licensee shall submit proposals for all Specified Engineering Works, as defined in *Schedule B: Specified Engineering Works*, of this licence to the Agency for its agreement at least two months prior to the intended date of commencement of any such works. No such works shall be carried out without the prior agreement of the Agency.

3.2.2 All specified engineering works shall be supervised by a competent person(s) and that person, or persons, shall be present at all times during which relevant works are being undertaken.

3.2.3 Following the completion of all specified engineering works, the licensee shall complete a construction quality assurance validation. The validation report shall be made available to the Agency on request. The report shall include the following information:

a) a description of the works;

b) as-built drawings of the works;

c) records and results of all tests carried out (including failures);

d) drawings and sections showing the location of all samples and tests carried out;

e) daily record sheets/diary;

f) name(s) of contractor(s)/individual(s) responsible for undertaking the specified engineering works;

g) name(s) of individual(s) responsible for supervision of works and for quality assurance validation of works;

h) records of any problems and the remedial works carried out to resolve those problems; and

i) any other information requested in writing by the Agency.

3.3 Facility Notice Board

3.3.1 The licensee shall provide and maintain a Facility Notice Board on the facility so that it is legible to persons outside the main entrance to the facility. The minimum dimensions of the board shall be 1200 mm by 750 mm.

3.3.2 The board shall clearly show:

a) the name and telephone number of the facility;

b) the normal hours of opening;

c) the name of the licence holder;

d) an emergency out of hours contact telephone number;

e) the licence reference number; and

f) where environmental information relating to the facility can be obtained.

3.4 Facility Security

3.4.1 Security and stockproof fencing, gates and infrastructure shall be installed and maintained as described in Section 3.1.6 ‘Site Security’ of the EIS. The locations shall be as shown on Drawing No’s. 2000-144-01-11 ‘Fencing Details’ and 2000-144-01-12

'Security & Fencing Layout' unless otherwise agreed with the agency. The base of the fencing shall be set in the ground.

3.4.2 The licensee shall remedy any defect in the gates and/or fencing as follows:

a) a temporary repair shall be made by the end of the working day; and,

b) a repair to the standard of the original gates and/or fencing shall be undertaken within three working days.

3.4.3 Prior to the acceptance of waste at the facility Closed Circuit Television (CCTV) shall be installed as described in Section 3.1.6 'Site Security' of the EIS.

3.5 Facility Roads, Access Roads and Hardstanding

3.5.1 Effective site roads shall be provided and maintained to ensure the safe movement of vehicles within the facility. The proposed internal road network system and hardstanding areas shall be provided and maintained.

3.5.2 The proposed access road from the N2 shall be constructed prior to the commencement of construction of the remainder of the facility.

3.5.3 Access to and from the facility shall only be from the N2.

3.5.4 The licensee shall consult with the roads authority on the prohibition of construction, waste disposal or leachate vehicles using the R150 road or the county road CR384 north and east of the facility en route to or from the facility.

3.6 Facility Office

3.6.1 Prior to the commencement of waste activities at the facility the licensee shall provide and maintain an office at the facility. The office shall be constructed and maintained in a manner suitable for the processing and storing of documentation.

3.6.2 The licensee shall provide and maintain a working telephone and a method for electronic transfer of information at the facility.

3.7 Waste Inspection and Quarantine Areas

3.7.1 A Waste Inspection Area and a Waste Quarantine Area shall be provided and maintained at the facility.

3.7.2 These areas shall be constructed and maintained in a manner suitable, and be of a size appropriate, for the inspection of waste and subsequent quarantine if required. The waste inspection area and the waste quarantine area shall be clearly identified and segregated from each other.

3.7.3 Drainage from these areas shall be directed to the leachate lagoon.

3.8 Weighbridge

3.8.1 Prior to the commencement of waste activities at the facility the licensee shall provide and maintain two weighbridges at the facility.

3.9 Wheel Cleaning

3.9.1 Prior to the commencement of construction of the facility the licensee shall establish and maintain a dry wheel shake and wheelwash at the facility.

3.9.2 The wheel cleaner units shall be inspected on a daily basis and drained as required. Silt, stones and other accumulated material shall be removed as required from the wheel cleaner units. Prior to the construction of the leachate lagoon accumulated liquid in the wheel cleaner units shall be tankered off-site to an appropriate facility. Following construction of the leachate lagoon dirty water from the wheel cleaner shall be pumped to the lagoon.

3.10 Waste Water Treatment Plant

3.10.1 The licensee shall provide and maintain a Wastewater Treatment plant at the facility for the treatment of domestic wastewater arising on-site.

3.10.2 The outlet from the treatment plant shall discharge to the leachate lagoon.

3.10.3 During construction all wastewater arising on site shall be collected and disposed of off-site at a suitable Waste Water Treatment Plant unless otherwise agreed with the Agency.

3.11 Tank and Drum Storage Areas

3.11.1 The licensee shall provide and maintain a bunded fuel storage area at the facility.

3.11.2 All tank and drum storage areas shall be rendered impervious to the materials stored therein.

3.11.3 All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

(a) 110% of the capacity of the largest tank or drum within the bunded area; or

(b) 25% of the total volume of substance which could be stored within the bunded area.

3.11.4 All drainage from bunded areas shall be diverted for collection and safe disposal.

3.11.5 All inlets, outlets, vent pipes, valves and gauges must be within the bunded area.

3.11.6 The integrity and water tightness of all the bunds, tanks and containers and their resistance to penetration by water or other materials stored therein shall be tested and demonstrated by the licensee and shall be reported to the Agency following their installation and prior to their use as a fuel storage area. This testing shall be carried out by the licensee at least once every three years thereafter and reported to the Agency on each occasion. The licensee shall also maintain a record on the storage of fuels at the facility. A written record of all integrity tests and any maintenance or remedial work arising from them shall be maintained by the licensee.

3.11.7 All tanks and containers, including tankers used to transport leachate from the facility, shall be labelled to clearly indicate their contents.

3.12 Landfill Lining:

3.12.1 The landfill liner shall comprise:

(i) a composite liner consisting of a 1m layer of compacted soil with a hydraulic conductivity of less than or equal to $1x10^{-9}$m/s, (or equivalent to be agreed with the Agency) overlain by a 2mm thick high density polyethylene (HDPE) layer;

(ii) a geotextile protection layer placed over the HDPE layer;

(iii) a 500mm thick drainage layer placed over the geotextile layer with a minimum hydraulic conductivity of 1 x 10^{-3} m/s, of pre-washed, uncrushed, granular, rounded stone (16 - 32mm grain size) incorporating leachate collection drains;

(iv) the side walls shall be designed and constructed to achieve an equivalent protection.

3.12.2 The liner system for the two leachate storage lagoons and the surface water pond shall comprise the following: a composite liner consisting of at minimum a basal soil/clay layer of at least 1m in thickness with a permeability of less than $1x10^{-9}$m/s overlain by a 2mm thick high density polyethylene (HDPE) layer unless otherwise agreed in advance with the Agency.

3.12.3 The liner detailed design and its construction shall be in accordance with the guidelines provided in the Agency's Landfill Manual, Landfill Site Design.

3.12.4 Formation levels of the cells shall be as shown on Drawing No. 2000 –144-01-06 'Landfill Section' of the EIS.

3.13 Buffer Zone

3.13.1 A Buffer Zone, in which no waste shall be landfilled, shall be provided and maintained within the facility.

The Buffer Zone shall be a minimum of 100m between the landfill footprint (area being filled with waste) and the facility boundary.

3.14 Leachate Management Infrastructure

3.14.1 Effective leachate management infrastructure shall be provided and maintained at the facility as described in Section 3.1.3.9 'Leachate Collection System and Management Plan' of the EIS.

3.14.2 The licensee shall provide and maintain leachate storage lagoons at the facility to facilitate the storage of leachate abstracted/collected from the waste

3.14.3 The location of the leachate storage lagoons shall be as detailed on Drawing No. 2000-144-01-01 'Landfill Layout' unless otherwise agreed with the Agency.

3.14.4 All structures for the storage and/or treatment of leachate shall be fully enclosed except for inlet and outlet piping.

3.14.5 All leachate management structures on-site shall be inspected and certified fit for purpose on an annual basis by an independent and appropriately qualified chartered engineer. Any remedial works recommended in this report must be implemented immediately.

3.15 Landfill Gas Management

3.15.1 Landfill gas management at the facility shall be carried out as described in Section 3.1.4 Gas Management of the EIS submitted with the application unless the licence conditions require otherwise.

3.15.2 A Landfill Gas Flare and associated infrastructure shall be installed on the facility within six months of the date on which waste is first disposed of at the facility.

i) The flare shall be of an enclosed type design and shall comply with the emission limits in *Schedule C: Emission Limits*, of this licence.

ii) The relocation of the gas flaring system to the west of the facility shall be investigated prior to the final location being agreed with the Agency. The report of the investigation will accompany the proposal for installation of

landfill gas management infrastructure required under Condition 3.2.1 and shall include the results of modelling carried out on the expected level of emissions.

3.15.3 Flare unit efficiency shall be tested upon installation, upon commencement of landfill gas combustion and once every three years thereafter.

3.15.4 The licensee shall maintain all gas wells, pipework, valves, pumps, flares and other infrastructure that form part of the landfill gas management scheme in a safe and fully operational manner.

3.15.5 Until the operation of the landfill gas flare, passive landfill gas management at the facility shall be carried out. Landfill gas management and infrastructure shall meet the recommendations outlined in the Agency Manuals on 'Landfill Site Design' and "Landfill Operational Practices".

3.15.6 All buildings constructed on the facility shall have regard to the guidance given in the Department of Environment 1994 publication "Protection of New Buildings and Occupants from Landfill Gas" and any subsequent revisions.

3.15.7 The licensee shall submit an assessment, within twelve months of the date of grant of the licence, on whether the utilisation of landfill gas as an energy resource is feasible. If feasible such a system shall be installed within a timeframe agreed with the Agency. This assessment shall include proposals regarding the utilisation of heat energy from this plant at other premises / facilities at and in the vicinity of the facility and the feasibility of using landfill gas as a fuel for on-site vehicles.

3.15.8 The licensee shall install continuous carbon monoxide monitors on the outlets of the gas engine(s).

3.16 Surface Water Management

3.16.1 Effective surface water management infrastructure shall be provided and maintained at the facility during construction, operation, restoration and aftercare of the facility.

3.16.2 Surface water management infrastructure shall be provided and maintained at the facility. As a minimum, the infrastructure shall be capable of the following:

a) the prevention of contaminated water and leachate discharges into surface water drains and courses; and

b) the collection/diversion of run off arising from capped and restored areas, incorporating adequately sized swales.

3.16.3 Following consultation with the Eastern Regional Fisheries Board and within three months of the date of grant of licence the licensee shall submit to the Agency for agreement a proposal for the surface water arrangements on-site. The Proposal shall include drawings for the diversion of the on-site stream around the landfill and the diversion of the stream to the surface water pond as per Condition 9.4.5.

3.16.4 The surface water ponds, surface water management infrastructure and stream diversions shall be constructed and operational prior to the commencement of other construction works.

3.16.5 The surface water from all roads, hardstanding areas and all areas of the facility where surface water has the potential to become contaminated shall be directed to the surface water pond.

3.16.6 The design and capacity of the surface water pond shall ensure that it is capable of fulfilling the requirements of this licence and dealing with all surface water run-off from potentially contaminated areas of the facility. The surface water pond shall be

constructed and maintained at the location as shown in Drawing No. 2000-114-01-05 'Leachate Lagoon and Storm Water Pond Details' unless otherwise agreed with the Agency.

3.16.7 The inlet to the surface water pond shall be fitted with a Class I Full Oil Interceptor.

The discharge from the surface water pond shall be controlled by an actuated penstock that will prevent surface water discharging in the event that monitoring should indicate contamination of the surface water.

3.17 Groundwater Management

3.17.1 Effective groundwater management infrastructure shall be provided and maintained at the facility during construction, operation, restoration and aftercare of the facility. As a minimum, the infrastructure shall be capable of the following:

a) the protection of the groundwater resources from pollution by the waste activities; and

b) the protection of other infrastructure, such as the liner, from any adverse effects caused by the groundwater.

3.18 A perimeter berm shall be constructed at the facility as described in Section 4.10.3 'Mitigation, Construction Aspects' of the EIS.

3.19 Telemetry

3.19.1 Prior to the commencement of waste activities a telemetry system shall be installed and maintained at the facility. This system shall include leachate re-circulation details for agreement with the Agency. All facility operations linked to the telemetry system shall also have a manual control which will be reverted to in the event of break in power supply or during maintenance.

3.20 Monitoring Infrastructure

3.20.1 Landfill Gas

(i) The construction of the monitoring boreholes shall be phased so as to match the phased development of cells. The licensee shall install landfill gas monitoring infrastructure at the following locations.

(a) perimeter monitoring boreholes at 50m intervals around the periphery of the landfill footprint,

(b) site office and all other site buildings; and

(c) a minimum of two monitoring boreholes per hectare within the waste mass.

(ii) Prior to the commencement of waste disposal activities, the licensee shall install a permanent continuous gas monitoring system with an alarm in the site office and in any other enclosed structures at the facility.

3.20.2 Groundwater

(i) Prior to the commencement of waste disposal activities, the licensee shall install the following borehole monitoring points to allow for the sampling and analyses of groundwater:

a) MW1d, MW2d, MW3d, MW5d, MW6d, MW7d and MW16d as detailed in Table J.1 and Figure J.1 'Suggested Monitoring Locations' of the EIS.

3.20.3 Leachate

(i) Prior to the commencement of waste disposal activities, the licensee shall install leachate monitoring points in each active cell and in each leachate storage lagoon to allow for the sampling and analyses of leachate.

3.20.4 Replacement of Infrastructure

(i) Monitoring infrastructure which is damaged or proves to be unsuitable for its purpose shall be replaced within three months of it being damaged or recognised as being unsuitable.

3.21 Meteorological Monitoring

3.21.1 Prior to the commencement of waste activities the licensee shall provide and maintain a meteorological station at the facility capable of monitoring the parameters listed in Schedule D.6: Meteorological Monitoring of this licence.

3.22 The licensee shall consult with Bord Gáis prior to construction or development work within 100m of the gas pipeline.

3.23 Within three months of the date of grant of this licence and prior to commencement of construction works, the licensee shall submit to the Agency for its agreement, a proposal after consulting Dúchas and the Department of Agriculture and Food on the relocation of badgers, newts, frogs, bats and barn owls within the facility. Timetables for removal of trees and preliminary development work shall be in accordance with the requirements of the Wildlife Act 1996.

REASON: To provide appropriate infrastructure for the protection of the environment.

CONDITION 4 RESTORATION AND AFTERCARE

4.1. Within eighteen months of the date of grant of this licence, the licensee shall submit to the Agency for its agreement a detailed Restoration and Aftercare Plan for the facility. The Restoration and Aftercare Plan shall have regard to the guidance published in the Agency's Landfill Manual on "Landfill Restoration and Aftercare". The licensee shall restore the facility on a phased basis. In particular the plan shall include:

a) Potential restoration options;
b) The proposed consultation process in relation to the restoration options for the facility; and
c) Proposals for nature conservation and woodland restoration.

4.2. The final profile/height of the facility shall be a maximum of 74mOD Malin and be domed in shape. The licensee shall submit a map showing the final contour layout within three months of the date of grant of licence.

4.3. Final Capping

4.3.1. The final capping shall consist of the following:

a) top soil (150 -300mm);

b) subsoils, such that total thickness of top soil and subsoils is at least 1m;

c) drainage layer of 0.5m thickness having a minimum hydraulic conductivity of $1x10^{-4}$ m/s or an equivalent geosynthetic layer;

d) compacted mineral layer of a minimum 0.6m thickness with a permeability of less than $1x10^{-9}$ m/s or a geosynthetic material (e.g. GCL) or similar that provides equivalent protection; and

e) gas collection layer of natural material (minimum 0.3m) or a geosynthetic layer.

4.4. The licensee shall maintain a stockpile of capping materials at the facility containing the requisite volume of capping materials for a six-month period. If using geosynthetic material, the licensee shall ensure that adequate secure supplies are available.

4.5. No material or object that is incompatible with the proposed restoration of the facility shall be present within one metre of the final soil surface levels.

4.6. Where tree planting is to be carried out above waste-filled areas, a synthetic barrier shall be used to augment the clay cap in accordance with the EPA Manual on Landfill Restoration And Aftercare.

4.7. Soil Storage

4.7.1. All soils shall be stored to preserve the soil structure for future use.

REASON: To provide for the restoration of the facility.

CONDITION 5 FACILITY OPERATIONS AND WASTE MANAGEMENT

5.1 Wastes shall not be deposited in any cell or part of the landfill without the prior agreement of the Agency.

5.2 Waste shall only be accepted at the facility from holders of waste collection permits under the Waste Management (Collection) Permits Regulations 2000. The licensee must maintain copies of these waste permits on-site.

5.3 Waste Acceptance and Characterisation Procedures

5.3.1 Prior to commencement of waste acceptance at the facility, the licensee shall submit to the Agency for its agreement and approval written procedures for the acceptance and handling of all wastes. These procedures shall detail the treatment of waste required prior to acceptance at the facility and shall also include methods for the characterisation of waste in order to distinguish between inert, non-hazardous and hazardous wastes. The procedures shall take into account the European Council decision of 19 December 2002 establishing the criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC on the landfill of waste.

5.4 All wastes shall be checked at the working face. Any wastes not suitable for acceptance shall be removed for recovery or disposal at an appropriate alternative facility. Such waste shall be stored in the Waste Quarantine Area only. No waste shall be stored in the Waste Quarantine Area for more than one month.

5.5 The licensee shall ensure that inert waste accepted at the facility is subject to pre-treatment where technically feasible and appropriate.

5.6 Working Face

5.6.1 Unless the prior agreement of the Agency is given, the following shall apply at the landfill:

a) only one working face shall exist at the landfill at any one time for the deposit of waste other than cover or restoration materials; and

b) the working face of the landfill shall be no more than 2.5 metres in height after compaction, no more than 25 metres wide and have a slope no greater than 1 in 3.

5.6.2 All waste deposited at the working face shall be compacted, using a steel wheeled compactor, and covered as soon as is practicable and at any rate prior to the end of the working day.

5.6.3 The working face, or faces, shall each day at the end of the day, be covered with suitable material.

5.7 Daily and Intermediate Cover

5.7.1 Daily and Intermediate capping material shall be as described in Section 3.1.5.1 'Intermediate Capping' of the EIS. Daily cover should be 150mm in depth while intermediate capping should be 300mm in depth unless otherwise agreed with the Agency.

5.7.2 The working face of the operational cell shall, at the end of each day, be covered with suitable material to minimise any nuisances occurring.

5.7.3 Any cover material at any location within the facility which is eroded, washed off or otherwise removed shall be replaced by the end of the working day.

5.8 Landscaping

5.8.1 Landscaping of the facility as described in Section 4.10 'Landscape and Visual Aspects' and associated figures of the EIS shall commence within the first planting season from the date of grant of this licence.

5.8.2 Apart from the removal of hedgerow to facilitate the facility entrance, the existing hedgerow network which forms the boundary of the facility shall be retained by the licensee as indicated in Section 4.10 'Landscape and Visual Aspects' of the EIS. Prior to the removal of hedgerow at the entrance and following consultation with Dúchas, the licensee shall submit to the Agency for agreement a proposal on the removal of hedgerow at the facility.

5.8.3 The Licensee shall submit a report, as part of the AER, on the implementation of the landscaping programme. In particular the report shall outline progress in meeting objectives outlined in Section 4.10.3 of the EIS, planting, die back rate and enhancement of natural biodiversity.

5.9 Operational Controls

5.9.1 The landfill shall be filled in accordance with the seven phase sequence outlined in Sections 3.1.3 as specified in the EIS.

5.9.2 All large hollow objects and other large articles deposited at the facility shall be crushed, broken up, flattened or otherwise treated.

5.9.3 Wastes once deposited and covered shall not be excavated, disturbed or otherwise picked over with the exception of works associated with the construction and installation of the landfill gas collection system only with the prior agreement from the Agency.

5.9.4 Completed areas of the landfill shall be profiled so that no depressions exist in which water may accumulate.

5.9.5 Filled cells shall be permanently capped within twelve months of the cells having been filled to the required level.

5.9.6 Scavenging shall not be permitted at the facility.

5.9.7 Gates shall be locked shut when the facility is unsupervised.

5.9.8 The licensee shall provide and use adequate lighting during the operation of the facility in hours of darkness.

5.9.9 Fuels shall only be stored at appropriately bunded locations on the facility.

5.9.10 All tanks and drums shall be labelled to clearly indicate their contents.

5.9.11 No smoking shall be allowed on the facility (other than in the administration/office block as shown on Drawing No. 2000-144-01-02 "Site Facilities Services Layout").

5.10 Off-site Disposal and Recovery

5.10.1 Waste sent off-site for recovery or disposal shall only be conveyed by a waste contractor agreed by the Agency.

5.10.2 All waste transferred from the facility shall only be transferred to an appropriate facility agreed by the Agency.

5.10.3 All waste removed off-site for recovery or disposal shall be transported from the facility to the consignee in a manner which will not adversely affect the environment.

5.11 Leachate Management

5.11.1 The licensee shall submit details for agreement with the Agency on any proposals for the pre-treatment of leachate on-site prior to carrying out such an activity. The details shall include information on the proposed leachate treatment system including its operational criteria, the proposed standards for treated leachate and a timescale for the construction and commissioning of the system.

5.11.2 Leachate levels in the waste shall not exceed a level of 1.0m over the top of the liner at the base of the landfill.

5.11.3 The level of leachate in the pump sumps shall be continuously monitored.

5.11.4 Unless otherwise agreed with the Agency leachate stored in the leachate storage lagoon shall be disposed of by tankering off-site in fully enclosed road tankers and discharging to an agreed Sanitary Authority Waste Water Treatment Plant as per Condition 6.7.1. The frequency of leachate removal from the leachate lagoon shall be such that a minimum freeboard of 0.75m shall be maintained in the leachate lagoon at all times.

5.12 Leachate Re-circulation

5.12.1 Re-circulation of leachate or other contaminated water shall not be undertaken without the prior agreement of the Agency and shall only be undertaken within cells which have been lined and capped to the satisfaction of the Agency.

5.13 Noise

5.13.1 In order to mitigate against noise emissions from the facility the licensee shall:

a) Construct an earth berm, three metres in height, around the perimeter of the waste disposal cells;

b) Plant a 50 metre wide band of woodland plantation inside the entire facility boundary where it does not interfere with overhead powerlines;

c) Impose vehicle speed limits on all internal site roads; and

d) Fit all heavy machinery used on-site with acoustic panels in the engine bays and acoustic mufflers (exhaust silencers).

5.14 Maintenance

5.14.1 All treatment/abatement and emission control equipment shall be calibrated and maintained, in accordance with the instructions issued by the manufacturer/supplier or installer. Written records of the calibrations and maintenance shall be made and kept by the licensee.

5.14.2 The licensee shall maintain and clearly label and name all sampling and monitoring locations.

5.14.3 The wheel-wash shall be inspected on a daily basis and drained as required. Silt, stones and other accumulated material shall be removed as required from the wheel-wash and disposed of at the working face or to a skip.

REASON: To provide for appropriate operation of the facility to ensure protection of the environment.

CONDITION 6 EMISSIONS

6.1. No specified emission from the facility shall exceed the emission limit values set out in Schedule C: *Emission Limits,* of this licence. There shall be no other emissions of environmental significance.

6.2. The licensee shall ensure that the activities shall be carried out in a manner such that emissions do not result in significant impairment of, or significant interference with the environment beyond the facility boundary.

6.3. Landfill Gas

6.3.1. The following are the trigger levels for landfill gas emissions from the facility measured in any service duct or manhole on, at or immediately adjacent to the facility and/or at any other point located outside the body of the waste:

a) Methane, greater than or equal to 1.0% v/v; and

b) Carbon dioxide, greater than or equal to 1.5% v/v.

6.3.2. The concentration limits for emissions to atmosphere specified in this licence shall be achieved without the introduction of dilution air and shall be based on gas volumes under standard conditions of :-

a) in the case of landfill gas flare:

Temperature 273 K, pressure 101.3 kPa, dry gas at 3% oxygen; and

b) in the case of landfill gas combustion plant:

Temperature 273 K, pressure 101.3 kPa, dry gas; at 5% oxygen.

6.3.3. Emission limits for landfill gas emissions to atmosphere in this licence shall be interpreted in the following way:-

6.3.3.1. Continuous monitoring

(i) No 24 hour mean value shall exceed the emission limit value.

(ii) 97% of all 30 minute mean values taken continuously over an annual period shall not exceed 1.2 times the emission limit value.

(iii) No 30 minute mean value shall exceed twice the emission limit value.

6.3.3.2 Non-Continuous Monitoring

(i) For any parameter where, due to sampling/analytical limitations, a 30 minute sample is inappropriate, a suitable sampling period should be employed and the value obtained therein shall not exceed the emission limit value.

(ii) For all other parameters, no 30 minute mean value shall exceed the emission limit value.

(iii) For flow, no hourly or daily mean value shall exceed the emission limit value.

6.4. Emissions to Surface Water

6.4.1. Surface water emissions from the surface water pond shall only be made to the adjacent stream at a location agreed in advance by the Agency.

6.4.2. No raw leachate, treated leachate or contaminated surface water shall be discharged to the adjacent stream or any part of the Nanny River catchment.

6.4.3. No substance shall be discharged in a manner, or at a concentration which, following initial dilution causes tainting of fish or shellfish.

6.5. There shall be no direct emissions to groundwater.

6.6. Prior to the acceptance of waste at the facility, the licensee shall submit to the Agency four sets of groundwater monitoring results and establish trigger levels in accordance with the requirements of Directive 1999/31/EC.

6.7. Disposal of Leachate

6.7.1 Prior to accepting waste at the facility, the licensee must submit to the Agency for agreement details of an agreement between the licensee and a Sanitary Authority for accepting leachate from the facility at a waste water treatment plant.

6.8 Trigger Levels for PM_{10}

6.8.1 The trigger level for PM_{10} from the facility measured at any location on the boundary of the facility is:

a) PM_{10} greater than $50\mu g/m^3$ for a daily sample.

6.9 Noise Emissions

6.9.1 There shall be no clearly audible tonal component or impulsive component in the noise emissions from the facility at the facility boundary.

6.10 The licensee shall, not later than twelve months after the initial receipt of waste at this facility, submit proposals including timeframes to the Agency for agreement to undertake an

independent odour assessment. The odour assessment shall include but is not limited to the identification and quantification of any significant odour sources, an assessment of the suitability and adequacy of the control system(s) for odour sources and timescale for the assessment.

6.11 The licensee shall, not later than two months from the date of undertaking the odour assessment submit to the Agency an odour assessment report that shall make recommendations as appropriate. Any such recommendations arising out of the report shall be implemented within a timescale to be approved by the Agency.

6.12 Air Emission

The licensee shall install a continuous VOC monitor with directional information at the school (if agreed) otherwise at a location on a site agreed with the Agency. This requirement will be reviewed by the Agency on an annual basis.

REASON: To control emissions from the facility and provide for the protection of the environment

CONDITION 7 NUISANCE CONTROL

7.1 The licensee shall ensure that vermin, birds, flies, mud, dust, litter and odours do not give rise to nuisance at the facility or in the immediate area of the facility. Any method used by the licensee to control any such nuisance shall not cause environmental pollution.

7.2 The road network in the vicinity of the facility shall be kept free from any debris and deposited waste caused by vehicles entering or leaving the facility. Any such debris or deposited waste shall be removed without delay.

7.3 Litter Control

7.3.1 Litter fencing and netting shall be installed and maintained around the perimeter of the active tipping area prior to the disposal of any waste in any cell. The netting shall meet the guidance provided in the Agency's Manual on "Landfill Operational Practices". The height of the netting shall be minimised so as to not cause visual intrusion and the netting shall be kept tidy. Litter trapped in the netting shall be removed as soon as practicable. Portable litter nets/screens shall also be used at the active tipping face.

7.3.2 All litter control infrastructure shall be inspected on a daily basis. The licensee shall remedy any defect in the litter netting as follows:

a) a temporary repair shall be made by the end of the working day; and,

b) a repair to the standard of the original netting shall be undertaken within three working days.

7.3.3 All loose litter or other waste, placed on or in the vicinity of the facility, other than in accordance with the requirements of this licences, shall be removed, subject to the agreement of the landowners, immediately and in any event by 10.00am of the next working day after such waste is discovered.

7.3.4 The licensee shall ensure that all vehicles delivering waste to and removing waste and materials from the facility are appropriately covered.

7.4 Dust Control

7.4.1 From the commencement of construction of the facility the Dust Control Measures outlined in Sections 3.3.3, 4.2.2.1 and 4.2.3.1 Dust Emissions of the EIS shall be implemented at the facility.

7.4.2 In dry weather, site roads and any other areas used by vehicles shall be sprayed with water as and when required to minimise airborne dust nuisance.

7.4.3 All stockpiles shall be adequately contained to minimise dust generation.

7.5 Prior to exiting the facility, all waste vehicles shall use the wheelwash.

7.6 Bird Control

7.6.1 Birds shall be prevented from gathering on and feeding at the facility by the use of birds of prey and/or other bird scaring techniques. The birds of prey and/or other techniques shall be in place on the facility at least two weeks prior to any waste being disposed of and shall maintain their presence every day, from before dawn to after dark, until the waste activities cease and all the waste is capped to the written satisfaction of the Agency.

7.6.2 Within six months of commencement of waste activities, the licensee shall submit to the Agency for its agreement, an assessment of the effectiveness of the bird control measures at the facility. This assessment shall include, where required:

a) proposals for additional bird control measures;

b) method for assessing the effectiveness of such additional measures; and,

c) timescales for the implementation of such measures.

7.7 Vermin Control

7.7.1 The licensee shall apply the vermin control measures outlined in Section 3.3.7 'Vermin Control' of the EIS. Notwithstanding these measures, prior to the commencement of waste activities, the licensee shall submit to the Agency for its agreement a programme for the control and eradication of insect and rodent infestations at the facility. The programme should include as a minimum the following:

(a) details on the insecticides(s) and rodenticides(s) to be used;

(b) operator training;

(c) mode and frequency of application and measurers to contain sprays at the facility boundary;

(d) details on the precautions (including supporting documentation) to be taken to minimise the secondary poisoning of birds and other species from the use of the insecticides and rodenticides proposed;

(e) copies of any comments received from Dúchas on the vermin control proposed and;

(f) response proposed to complaints received about any vermin adjacent to the facility.

REASON: To provide for the control of nuisances.

CONDITION 8 MONITORING

8.1 The licensee shall carry out such monitoring and at such locations and frequencies as set out in *Schedule D: Monitoring*, of this licence and as specified in this licence. Unless otherwise specified by this licence, all environmental monitoring shall commence no later than two months after the date of grant of this licence.

8.2 The licensee shall amend the frequency, locations, methods and scope of monitoring as required by this licence only upon the written instruction of the Agency and shall provide such information concerning such amendments as may be requested in writing by the Agency. Such alterations shall be carried out within any timescale nominated by the Agency.

8.3 Monitoring and analysis equipment shall be operated and maintained in accordance with the manufacturers' instructions (if any) so that all monitoring results accurately reflect any emission, discharge or environmental parameter.

8.4 The licensee shall provide safe and permanent access to all on-site sampling and monitoring points and to off-site points as required by the Agency.

8.5 All persons conducting the sampling, monitoring and interpretation as required by this licence shall be suitably competent.

8.6 Landfill Gas

8.6.1 All landfill gas monitoring equipment, other than permanent monitoring systems within buildings, shall be certified as being intrinsically safe.

8.6.2 Landfill gas monitoring shall commence three months from date of placement of waste at the facility.

8.7 Noise Monitoring

8.7.1 Noise monitoring shall commence one month prior to the commencement of construction at the facility.

8.8 Groundwater Monitoring

8.8.1 Subject to the agreement of the well owners, all private wells within 1km of the landfill footprint shall be included in the monitoring programme set out in *Schedule D: Monitoring*, of this licence.

8.9 Surface Water Monitoring

8.9.1 The licensee shall implement a continuous monitoring programme for the water in the surface water pond. This programme shall include the criteria/trigger levels, which will determine which the automated penstock in the outlet from the surface water pond shall be closed. Such continuous monitoring shall, as a minimum, include conductivity, pH and TOC and shall be carried out on the inlet to the surface water pond at a monitoring location to be agreed by the Agency.

8.10 Topographical Survey

8.10.1 A topographical survey shall be carried out within eighteen months of the date of depositon of waste at the facility. The survey shall include a measurement of the remaining available void space. It shall be repeated annually thereafter. The survey shall be in accordance with any written instructions issued by the Agency.

8.11 Biological Assessment

8.11.1 An annual biological assessment of the Kentstown Stream and Nanny River shall be undertaken. This assessment shall use appropriate biological methods such as the EPA Q-rating system for the assessment of rivers and streams. The report shall include a map showing the location of monitoring points, each identified by a unique number and a twelve point grid reference. The scope, content and details of the contractor carrying out the assessment shall be submitted to the Agency for its agreement prior to the assessment.

8.12 Archaeological Assessment

8.12.1 Prior to the development of any undisturbed area, the holy well or farm building, the advice of Duchas the Heritage Service shall be sought. On completion of such development a report of the results of any archaeological monitoring shall be submitted to Duchas and to the Agency.

8.13 Stability Assessment

8.13.1 Within one year of the date of commencement of waste acivities, and annually thereafter, the licensee shall carry out a stability assessment of the side slopes of the facility.

8.14 Nuisance Monitoring

8.14.1 The licensee shall, at a minimum of one week intervals, inspect the facility and its immediate surrounds for nuisances caused by litter, vermin, birds, flies, mud, dust and odours.

8.14.2 The licensee shall within three months of the date of commencement of waste activities submit a programme to the Agency for agreement for the monitoring and assessment of odour emissions arising from the facility.

REASON: To ensure compliance with the conditions of this licence by provision of a satisfactory system of monitoring of emissions.

CONDITION 9 CONTINGENCY ARRANGEMENTS

9.1. In the event of an incident the licensee shall immediately:

a) identify the date, time and place of the incident;

b) carry out an immediate investigation to identify the nature, source and cause of the incident and any emission arising therefrom;

c) isolate the source of any such emission;

d) evaluate the environmental pollution, if any, caused by the incident;

e) identify and execute measures to minimise the emissions/malfunction and the effects thereof;

f) provide a proposal to the Agency for its agreement within one month of the incident occurring to:

i) identify and put in place measures to avoid reoccurrence of the incident; and

ii) identify and put in place any other appropriate remedial action.

9.2. The licensee shall, within six months of the date of grant of this licence, submit a written Emergency Response Procedure (ERP) to the Agency for its agreement. The ERP shall address any emergency situations which may originate on the facility and shall include provision for minimising the effects of any emergency on the environment. This shall include a risk assessment to determine the requirements at the facility for fire fighting and fire water retention facilities. The Fire Authority shall be consulted by the licensee during this assessment.

9.3. The licensee shall have in storage an adequate supply of containment booms and/or suitable absorbent material to contain and absorb any spillage at the facility. Once used the absorbent material shall be disposed of at an appropriate facility.

9.4. Emergencies

9.4.1. All significant spillages occurring at the facility shall be treated as an emergency and immediately cleaned up and dealt with so as to alleviate their effects.

9.4.2. No waste shall be burnt within the boundaries of the facility. A fire at the facility shall be treated as an emergency and immediate action shall be taken to extinguish it and notify the appropriate authorities.

9.4.3. In the event that monitoring of local wells indicates that the facility is having a significant adverse effect on the quantity and/or quality of the water supply this shall be treated as an emergency and the licensee shall provide and fund an alternative supply of water to those affected.

9.4.4. In the event that monitoring of the slide slopes of the facility indicate that there may be a risk of slope failure this will be treated as an emergency.

9.4.5. In the event that monitoring should indicate contamination of the site surface water in the Knockharley stream, the stream shall be diverted to the surface water lagoon.

9.5 After construction of the facility, or part thereof, and prior to the disposal of any waste in the facility or part thereof, and prior to the use of any infrastructure at the facility, an independent third party shall carry out a risk assessment of the facility, or part thereof, as agreed in advance with the Agency. The risk assessment shall pay particular regard to any accidents, emergencies, or other incidents, which might occur at the facility and their effect on the environment, on the neighbours of the facility and on adjoining land-uses. The assessment and recommendations, including a timescale for implementation, shall be submitted to the Agency for agreement. The agreed recommendations shall be implemented within the agreed timescale.

REASON: To ensure compliance with the conditions of this licence by provision of a satisfactory system of monitoring of emissions

CONDITION 10 RECORDS

10.1 The licensee shall keep the following documents at the facility office.

a) the current waste licence relating to the facility;

b) the current EMS for the facility;

c) the previous year's AER for the facility;

d) all written procedures produced by the licensee which relate to the licensed activities.

10.2 The licensee shall maintain a written record for each load of waste arriving at the facility. The licensee shall record the following:

a) the date;

b) the name of the carrier (including if appropriate, the waste carrier registration details);

c) the vehicle registration number;

d) the name of the producer(s)/collector(s) of the waste as appropriate;

e) the name of the waste facility (if appropriate) from which the load originated including the waste licence or waste permit register number;

f) a description of the waste including the associated EWC codes;

g) the quantity of the waste, recorded in tonnes;

h) the name of the person checking the load; and,

i) where loads or wastes are removed or rejected, details of the date of occurrence, the types of waste and the facility to which they were removed.

10.3 Written Records

The following written records shall be maintained by the licensee:

a) the types and quantities of waste recovered and disposed of at the facility each year. These records shall include the relevant EWC Codes;

b) all training undertaken by facility staff;

c) results from all integrity tests of bunds and other structures and any maintenance or remedial work arising from them;

d) details of all nuisance inspections; and

e) the names and qualifications of all persons who carry out all sampling and monitoring as required by this licence and who carry out the interpretation of the results of such sampling and monitoring.

10.4 The licensee shall maintain a written record of all complaints relating to the operation of the activity. Each such record shall give details of the following:

a) date and time of the complaint;

b) the name of the complainant;

c) details of the nature of the complaint;

d) actions taken on foot of the complaint and the results of such actions; and,

e) the response made to each complainant.

10.5 A written record shall be kept of each consignment of leachate removed from the facility. The record shall include the following:

a) the name of the carrier;

b) the date and time of removal of leachate from the facility;

c) the volume of leachate, in cubic metres, removed from the facility on each occasion;

d) the name and address of the Waste Water Treatment Plant to which the leachate was transported;

e) any incidents or spillages of leachate during its removal or transportation.

10.6 A written record shall be kept at the facility of the programme for the control and eradication of vermin and fly infestations at the facility. These records shall include as a minimum the following:

a) the date and time during which spraying of insecticide is carried out;

b) contractor details;

c) contractor logs and site inspection reports;

d) details of the rodenticide(s) and insecticide(s) used;

e) operator training details;

f) details of any infestations;

g) mode, frequency, location and quantity of application; and,

h) measures to contain sprays within the facility boundary.

REASON: To provide for the keeping of proper records of the operation of the facility.

CONDITION 11 REPORTS AND NOTIFICATIONS

11.1 Unless otherwise agreed by the Agency, all reports and notifications submitted to the Agency shall:

a) be sent to the Agency's Headquarters;

b) comprise one original and three copies unless additional copies are required;

c) be formatted in accordance with any written instruction or guidance issued by the Agency;

d) include whatever information as is specified in writing by the Agency;

e) be identified by a unique code, indicate any modification or amendment, and be correctly dated to reflect any such modification or amendment;

f) be submitted in accordance to the relevant reporting frequencies specified by this licence, such as in *Schedule E: Recording and Reporting to the Agency*, of this licence;

g) be accompanied by a written interpretation setting out their significance in the case of all monitoring data; and

h) be transferred electronically to the Agency's computer system if required by the Agency.

11.2 In the event of an incident occurring on the facility, the licensee shall:

a) notify the Agency as soon as practicable and in any case not later than 10.00 am the following working day after the occurrence of any incident;

b) submit a written record of the incident, including all aspects described in Condition 9.1(a-e), to the Agency as soon as practicable and in any case within five working days after the occurrence of any incident;

c) in the event of any incident which relates to discharges to surface water or groundwaters, notify Eastern Regional Fisheries Board as soon as practicable and in any case not later than 10:00am on the following working day after such an incident; and

d) Should any further actions be taken as a result of an incident occurring, the licensee shall forward a written report of those actions to the Agency as soon as practicable and no later than ten days after the initiation of those actions.

11.3 Waste Recovery Reports

11.3.1 Within six months of the commencement of waste activities at the facility, a report examining waste recovery options shall be submitted to the Agency for its agreement. This report shall address methods to contribute to the achievement of the recovery targets stated in national and European Union waste policies and shall include the following:

a) proposals for the contribution of the facility to the achievement of targets for the reduction of biodegradable waste going to landfills as specified in the Landfill Directive;

b) the separation of recyclable materials from the waste;

c) the recovery of Construction and Demolition Waste;

d) the recovery of commercial waste, including cardboard;

e) composting of biodegradable or green waste at the facility having regard to good practice and sustainability; and

f) Report on how the requirements of Condition 1.6 regarding treatment of Waste will be met.

11.4 Reports relating to Facility Operations

11.4.1. Leachate Handling Procedures

11.4.1.1 The licensee shall submit to the Agency for its agreement, prior to the use of the leachate storage lagoons, Handling Procedures for the handling of leachate which include (1) procedures for the handling of leachate during removal from the lagoons and subsequent transport/discharge to a Waste Water Treatment Plant and (2) monitoring infrastructure details and procedures for monitoring the level of leachate in the pump sumps, the cells and the lagoon.

11.4.2. Achievement of Final Profile

11.4.2.1 Within eighteen months of the date of grant of this licence, the licensee shall submit to the Agency for its agreement, proposals for landfilling and restoration to achieve the final profile/height of the facility to the Agency for its agreement.

11.4.3. Operation in Adverse Wind Conditions

11.4.3.1 Within three months of the date of grant of this licence the licensee shall submit to the Agency for its agreement proposals for the operation of the facility in adverse wind conditions.

11.5 Vermin and Flies

11.5.1. Prior to the commencement of waste activities, the licensee shall submit to the Agency for its agreement a proposal for the control and eradication of vermin and fly infestations at the facility. This proposal should include as a minimum, operator

training, details on the rodenticide(s) and insecticide(s) to be used, mode and frequency of application and measures to contain sprays within the facility boundary.

11.6 Monitoring Locations

11.6.1. Within one month prior to the placement of waste at the facility the licensee shall submit to the Agency an appropriately scaled drawing(s) showing all the monitoring locations that are stipulated in this licence. The drawing(s) shall include the reference code of each monitoring point.

11.7 Annual Environmental Report

11.7.1 The licensee shall submit to the Agency for its agreement, within thirteen months from the date of grant of this licence, and within one month of the end of each year thereafter, an Annual Environmental Report (AER).

11.7.2 The AER shall include as a minimum the information specified in *Schedule F: Content of Annual Environmental Report*, of this licence and shall be prepared in accordance with any relevant written guidance issued by the Agency.

REASON: To provide for proper report to and notification of the Agency.

CONDITION 12 CHARGES AND FINANCIAL PROVISIONS

12.1 Agency Charges

12.1.1 The licensee shall pay to the Agency an annual contribution of €29,937.00 or such sum as the Agency from time to time determines, towards the cost of monitoring the activity or otherwise in performing any functions in relation to the activity, as the Agency considers necessary for the performance of its functions under the Waste Management Act, 1996. The licensee shall in 2004 and subsequent years, not later than January 31 of each year, pay to the Agency this amount updated in accordance with changes in the Public Sector Average Earnings Index from the date of the licence to the renewal date. The updated amount shall be notified to the licensee by the Agency. For 2003, the licensee shall pay a pro rata amount from the date of this licence to 31st December. This amount shall be paid to the Agency within one month of the date of grant of this licence.

12.1.2 In the event that the frequency or extent of monitoring or other functions carried out by the Agency needs to be increased the licensee shall contribute such sums as determined by the Agency to defraying its costs.

12.2 Financial Provision for Closure, Restoration and Aftercare

12.2.1 The licensee shall arrange for the completion of a comprehensive and fully costed Environmental Liabilities Risk Assessment for the facility which will address liabilities arising from the carrying on of the activities to which this licence relates. A report on this assessment shall be submitted to the Agency for its agreement within six months of date of grant of this licence.

12.2.2 Within nine months of the date of grant of this licence, the licensee shall make a Proposal for Financial Provision to the Agency for its agreement to cover any liabilities incurred by the licensee in carrying on the activities to which this licence relates and in ceasing to carry on those activities. Such provision shall be maintained by the licensee unless otherwise agreed by the Agency.

12.2.3 The amount of financial provision, held under Condition 12.2.2 shall be reviewed and revised as necessary, but at least annually. Any proposal for such a revision shall be submitted to the Agency for its agreement.

12.2.4 The licensee shall within two weeks of purchase, renewal or revision of the financial provision required under Condition 12.2.2, forward to the Agency written proof of such indemnity.

12.2.5 Unless otherwise agreed any revision to the fund shall be computed using the following formula:

Cost = (ECOST x WPI) + CiCC

Where:

Cost = Revised restoration and aftercare cost

ECOST = Existing restoration and aftercare cost

WPI = Appropriate Wholesale Price Index [Capital Goods, Building & Construction (i.e. Materials & Wages) Index], as published by the Central Statistics Office, for the year since last closure calculation/revision.

CiCC = Change in compliance costs as a result of change in site conditions, changes in law, regulations, regulatory authority charges, or other significant changes.

12.3 The licensee shall ensure the costs in the setting up, operation of, provision of financial security and closure and after care for a period of at least 30 years shall be covered by the price to be charged for the disposal of waste at the facility.

REASON: To provide for adequate financing for monitoring and financial provisions for measures to protect the environment.

SCHEDULE A : Waste Acceptance

A.1 Waste Acceptance

Table A.1 Waste Categories and Quantities

WASTE TYPE	MAXIMUM (TONNES PER ANNUM)
Household	100,000
Commercial	45,000
Industrial	30,000
Sub Total **Waste for Disposal**	**175,000**
Construction & Demolition for recovery at the facility	25,000
TOTAL	**200,000**

SCHEDULE B : Specified Engineering Works

Specified Engineering Works
Development of the facility including preparatory works and lining.
Final capping.
Installation of Landfill Gas Management Infrastructure.
Installation of Leachate Management Infrastructure.
Installation of Groundwater Control Infrastructure.
Installation of Surface Water Management Infrastructure.
Any other works notified in writing by the Agency.

SCHEDULE C : Emission Limits

C.1 Noise Emissions: (Measured at the noise sensitive monitoring points indicated in Table D.1.1 Monitoring Locations).

Day dB(A) L_{Aeq}(30 minutes)	Night dB(A) L_{Aeq}(30 minutes)
55	45

C.2 Landfill Gas Concentration Limits: (Measured in any building on or adjacent to the facility).

Methane	Carbon Dioxide
20 % LEL (1% v/v)	1.5 % v/v

C.3 Dust Deposition Limits: (Measured at monitoring locations at or dust sensitive locations)

Level (mg/m^2 /day)[Note 1]
350

Note 1: 30 day composite sample with the results expressed as mg/m^2 /day.

C.4 Surface Water Discharge Limits: Measured at the discharge point from the surface water pond to the adjacent stream (grid reference to be submitted to the Agency).

Level (Suspended Solids mg/l)
35

C.5 Emission Limits Values for Landfill Gas Plant & Gas Flares

Emission Point reference nos: (to be agreed with the Agency)
Location: Landfill Gas combustion plant and flarestacks
Maximum volume to be emitted: $3000m^3/hr$
Minimum discharge height: 5m

Parameter	Emission Limit Value [Notes 3 &4]
Nitrogen oxides as (NO_2)	500 mg/m^3 (150mg/m^3) [Note 1]
CO	650 mg/m^3 (50mg/m^3) [Note 1]
Particulates	130 mg/m^3
TA Luft Organics Class I [Note 2]	20 mg/m^3 - at mass flows > 0.1 kg/hr (Not applicable) [Note 1]
TA Luft Organics Class II[Note 2]	100 mg/m^3 -at mass flows > 2 kg/hr (Not applicable) [Note 1]
TA Luft Organics Class III [Note 2]	150 mg/m^3 at mass flows > 3kg/hr (Not applicable) [Note 1]
Total Organic Carbon	10mg/m^3
Hydrogen Chloride	50 mg/m^3 - at mass flows > 0.3 kg/h)
Hydrogen Fluoride	5 mg/m^3 -at mass flows > 0.05 kg/h

Note 1: Emission limit values in brackets represent limit values for flare units.
Note 2: In addition to the above individual limits, the sum of the concentrations of Class I, II and III shall not exceed the Class III limits.
Note 3: These emission limit values may be revised with the agreement of the Agency on the basis of the technology employed.
Note 4: Dry gas referenced to 5% oxygen by volume for utilisation plants and 3% oxygen by volume for flares.

SCHEDULE D :Monitoring

Monitoring to be carried out as specified below.

D.1 Monitoring Locations

Monitoring locations shall be those as set out in Table D.1.1.

Table D.1.1 Monitoring Locations

LANDFILL GAS **Note 1 & 2**	DUST **Note 1 &5**	PM_{10} Note 1 &5	NOISE **Note 4 & 5**	SURFACE WATER **Note 5**	GROUND WATER **Note 1,2, 5 & 6.**	LEACHATE **Note 1 &2**	LANDFILL GAS FLARE Note 1
STATIONS	STATIONS	STATION	STATIONS	STATIONS	STATIONS	STATIONS	STATIONS
Perimeter boreholes at 50m intervals.	D1	North of the facility	N1	SW1	MW1d	Each active cell	To be agreed
Site office & other buildings	D2	East of the facility	N2	SW2	MW2d	Each storage lagoon	
Two boreholes per hectare within the waste mass	D3	South-west of the facility	N3	SW3	MW3d		
	D4	P4	N4	SW5	MW5d		
	D5	P5		SW6	MW6d		
	D6	P6		SW7	MW7d		
	D7			SW8	MW16d		
	D8				Private wells within 1km Note 3		
	D9						
	D10						

Note 1: The licensee shall, within one month prior to the placement of waste at the facility, submit to the Agency for agreement an appropriately sized and referenced drawing along with twelve digit national grid references for landfill gas, landfill gas combustion plant, additional surface water, dust, leachate and groundwater monitoring locations.

Note 2: This information shall be updated with the phased development of cells.

Note 3: Subject to the agreement of the owners / occupiers.

Note 4: The licensee shall, within one month of the date of grant of licence, submit to the Agency an appropriately sized and referenced drawing along with twelve digit national grid references for additional noise monitoring locations for agreement with the Agency.

Note 5: As per Figure J.1 Suggested Monitoring Locations submitted as Article 14 Response – April 2001. Additional locations to be agreed with the Agency.

Note 6. All private wells within 1km of the facility as per Condition 8.

Note 7. VOC monitoring location to be agreed with the Agency.

D.2 Landfill Gas

Table D.2.1 Landfill Gas Monitoring Parameters, Frequency and Technique

Parameter	Monitoring Frequency		Analysis Method[Note1]/Technique[Note2]
	Gas Boreholes/ Vents/Wells	Site Office	
Methane (CH_4) % v/v	Monthly	Continuous	Infrared analyser/flame ionisation detector
Carbon dioxide (CO_2)%v/v	Monthly	Continuous	Infrared analyser/ flame ionisation detector
Oxygen(O_2) %v/v	Monthly	Continuous	Electrochemical cell
Atmospheric Pressure	Monthly	-	Standard
Temperature	Monthly	-	Standard

Note1: All monitoring equipment used should be intrinsically safe.
Note 2 : Or other methods agreed in advance with the Agency.

D.3 Dust

Table D.3.1 Dust Monitoring Frequency and Technique

Parameter ($mg/m^2/day$)	Monitoring Frequency [Note 3]	Analysis Method/Technique
Dust	Monthly [Note 2]	Standard Method [Note 1]
PM_{10}	Quarterly	Standard Method [Note 2]

Note 1: Standard method VDI2119 (Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method) German Engineering Institute). A modification (not included in the standard) which 2 methoxy ethanol may be employed to eliminate interference due to algae growth in the gauge.

Note 2: As described in prEN12341 "Air Quality – field test procedure to demonstrate reference equivalence of sampling methods for PM_{10} fraction of particulate matter" or an alternative agreed in writing with the Agency

Note 3: Monitoring shall commence one month prior to the commencement of construction of the facility.

D.4 Noise

Table D.4.1 Noise Monitoring Frequency and Technique

Parameter	Monitoring Frequency	Analysis Method/Technique
$L(A)_{EQ}$ [30 minutes]	**Quarterly**	Standard [Note 1]
$L(A)_{10}$ [30 minutes]	**Quarterly**	Standard [Note 1]
$L(A)_{90}$ [30 minutes]	**Quarterly**	Standard [Note 1]
Frequency Analysis(1/3 Octave band analysis)	**Quarterly**	Standard [Note 1]

Note 1: "International Standards Organisation. ISO 1996. Acoustics - description and Measurement of Environmental noise. Parts 1, 2 and 3."

D.5 Surface Water, Groundwater and Leachate

Table D.5.1 Water and Leachate - Parameters /Frequency

Parameter [Note 1]	SURFACE WATER Monitoring Frequency	GROUNDWATER [Note 9] Monitoring Frequency	LEACHATE Monitoring Frequency
Visual Inspection/Odour [Note 2]	Weekly	Quarterly	Quarterly
Groundwater Level	Not Applicable	Monthly	Not Applicable
Leachate Level	Not Applicable	Not Applicable	Weekly
Ammoniacal Nitrogen	Quarterly [Note 6]	Quarterly	Quarterly
BOD	Quarterly [Note 6]	Not Applicable	Quarterly
COD	Quarterly	Not Applicable	Quarterly
Chloride	Quarterly	Quarterly	Quarterly
Dissolved Oxygen	Quarterly	Quarterly	Not Applicable
Electrical Conductivity	Quarterly [Note 6]	Quarterly	Quarterly
PH	Quarterly [Note 6]	Quarterly	Quarterly
Total Suspended Solids	Quarterly [Note 6]	Not Applicable	Not Applicable
Temperature	Quarterly [Note 6]	Monthly	Quarterly
Boron	Not Applicable	Annually	Annually
Cadmium	Annually	Annually	Annually
Calcium	Annually	Annually	Annually
Chromium (Total)	Annually	Annually	Annually
Copper	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
Iron	Annually	Quarterly	Annually
Lead	Annually	Annually	Annually
List I/II organic substances [Note 3]	Note 8	Annually	Note 8
Magnesium	Annually	Annually	Annually
Manganese	Annually	Annually	Annually
Mercury	Annually	Annually	Annually
Potassium	Annually	Quarterly	Annually
Sulphate	Annually	Annually	Annually
Sodium	Annually	Quarterly	Annually
Total Alkalinity	Annually	Annually	Annually [Note 5]
Total Phosphorus / orthophosphate	Annually [Note 6]	Annually	Annually
Total Oxidised Nitrogen	Annually	Quarterly	Quarterly
Total Organic Carbon	Not Applicable	Quarterly	Not Applicable
Residue on evaporation	Not Applicable	Annually	Not Applicable
Zinc	Annually	Annually	Annually
Phenols	Not Applicable	Quarterly	Not Applicable
Faecal Coliforms [Note 4]	Not Applicable	Quarterly	Annually
Total Coliforms [Note 4]	Not Applicable	Quarterly	Annually
Biological Assessment	Annually [Note7]	Not Applicable	Not Applicable

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures.

Note 2: Where there is evident gross contamination of leachate, additional samples should be analysed.

Note 3: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (US Environmental Protection Agency method 525 or equivalent, and pesticides (US Environmental Protection Agency method 608 or equivalent).

Note 4: In the case where groundwater is extracted for drinking water, if there is evidence of bacterial contamination, the analysis at up gradient and downgradient monitoring points should include enumeration of total bacteria at 22^{o}C and 37^{o}C and faecal streptococci.

Note 5: Only to be analysed in instances of on-site treatment of leachate.

Note 6: Discharge of diverted surface water/groundwater shall be monitored on a monthly basis for these parameters unless flow in that month does not allow such monitoring.

Note 7: Appropriate biological methods (such as EPA Q-Rating System to be used for the assessment of rivers and streams).

Note 8: Once off for List I/II organic substances.

Note 9: All private wells within 1Km of the landfill footprint shall be analysed annually for ammonical N, K, Na, pH, electrical conductivity and TOC. A written report and interpretation shall accompany the analysis results.

D.6 Meteorological Monitoring

Table D.6.1 Meteorological Monitoring:
Data to be obtained from the on-site meteorological station. The location of the on-site meteorological station shall be in accordance with advice from Met Eireann and agreed in advance with the Agency.

Parameter	Monitoring Frequency	Analysis Method/Technique
Precipitation Volume	Daily	Standard
Temperature (min/max.)	Daily	Standard
Wind Force and Direction	Daily	Standard
Evaporation	Daily	Standard
Evapotranspiration	Daily	Standard
Humidity	Daily	Standard
Atmospheric Pressure	Daily	Standard

D.7 Landfill Gas Combustion Plant/Enclosed Flare

Location: Utilisation plant and enclosed flare (exact location of flare to be agreed with the Agency in advance).

Table D.7.1 Landfill Gas Utilisation Plant/Enclosed Flare Parameters and Monitoring Frequency

Parameter	Flare (enclosed)	Utilisation Plant	Analysis Method[Note1]/Technique[Note2]
	Monitoring Frequency	**Monitoring Frequency**	
Inlet			
Methane (CH_4) % v/v	Continuous	Weekly	Infrared analyser/flame ionisation detector/thermal conductivity
Carbon dioxide (CO_2)%v/v	Continuous	Weekly	Infrared analyser/ thermal conductivity
Oxygen (O_2) %v/v	Continuous	Weekly	Electrochemical/thermal conductivity
Total Sulphur	Annually	Annually	Ion chromatography
Total Chlorine	Annually	Annually	Ion chromatography
Total Fluorine	Annually	Annually	Ion Selective Electrode
Process Parameters			
Combustion Temperature	Continuous	Quarterly	Temperature Probe/datalogger
Outlet			
CO	Continuous	Continuous	Flue gas analyser/datalogger
NOx	Annually	Annually	Flue gas analyser
SO_2	Annually	Annually	Flue gas analyser
Particulates	Not applicable	Annually	Isokinetic/Gravimetric
TA Luft Class I, II, III organics	Not applicable	Annually	Adsorption/Desorption /GC/GCMS [Note 3]
TOC	Annually	Not applicable	Flame ionisation
Hydrochloric acid	Annually	Annually	Impinger / Ion Chromatography
Hydrogen fluoride	Annually	Annually	Impinger / Ion Chromatography

Note 1: All monitoring equipment used should be intrinsically safe.
Note 2: Or other methods agreed in advance with the Agency.
Note 3: Test methods should be capable of detecting acetonitrile, dichloromethane, tetrachlorethylene and vinyl chloride as a minimum

D.8 VOC Monitoring

Parameter	Monitoring Frequency	Analysis
VOC	Continuous	To be agreed with the Agency.

SCHEDULE E : Recording and Reporting to the Agency

Report	Reporting Frequency [Note1]	Report Submission Date
Environmental Management System Updates	Annually	One month after the end of the year reported on.
Annual Environment Report (AER)	Annually	Thirteen months from the date of grant of licence and one month after the end of each year thereafter.
Record of incidents	As they occur	Within five days of the incident.
Bund, tank and container integrity assessment	Every three years	Six months from the date of grant of licence and one month after end of the three year period being reported on.
Specified Engineering Works reports	As they arise	Prior to the works commencing.
Monitoring of landfill gas	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Surface Water Quality	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Groundwater Quality	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Leachate	Quarterly	Ten days after end of the quarter being reported on.
Meteorological Monitoring	Annually	One month after end of the year being reported on.
Dust Monitoring	Three times a year	Ten days after the period being reported on
Noise Monitoring	Bi-annually	One month after end of the year being reported on.
Any other monitoring	As they occur	Within ten days of obtaining results.

Note 1: Unless altered at the request of the Agency

SCHEDULE F : Content of the Annual Environmental Report

Annual Environmental Report Content
Reporting Period.
Waste activities carried out at the facility.
Quantity and Composition of waste received, disposed of and recovered during the reporting period and each previous year.
Calculated remaining capacity of the facility and year in which final capacity is expected to be reached.
Methods of deposition of waste.
Summary report on emissions.
Summary of results and interpretation of environmental monitoring.
Resource and energy consumption summary.
Proposed development of the facility and timescale of such development.
Volume of leachate produced and volume of leachate transported / discharged off-site.
Feasibility study on alternatives to treating leachate off-site
Report on development works undertaken during the reporting period, and a timescale for those proposed during the coming year.
Report on restoration of completed cells/ phases.
Site survey showing existing levels of the facility at the end of the reporting period.
Estimated annual and cumulative quantities of landfill gas emitted from the facility.
Annual water balance calculation and interpretation.
Report on the progress towards achievement of the Environmental Objectives and Targets contained in previous year's report.
Schedule of Environmental Objectives and Targets for the forthcoming year.
Full title and a written summary of any procedures developed by the licensee in the year which relates to the facility operation.
Tank, pipeline and bund testing and inspection report.
Reported incidents and Complaints summaries.
Review of Nuisance Controls.
Reports on financial provision made under this licence, management and staffing structure of the facility, and a programme for public information.
Report on training of staff.
Any other items specified by the Agency.
Treatment of waste received.

Sealed by the seal of the Agency on this the 19th day of March, 2003

PRESENT when the seal of the Agency
was affixed hereto:

Padraic Larkin, **Director/Authorised Person**

Archive.

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Headquarters
P.O. Box 3000
Johnstown Castle Estate
County Wexford
Ireland

AMENDMENT A
TO
WASTE LICENCE

Licence Register Number:	146-1
Licensee	Celtic Waste Limited
Location of Facility:	Knockharley Landfill, Knockharley, Navan, County Meath (includes townlands of Tuiterath and Flemingstown).

Reason for the Amendment of Conditions

The Environmental Protection Agency has examined the terms of Waste Licence Reg. No. 146-1 as required by the provisions of Section 76(3)(a) of the Waste Management Acts 1996 to 2003, and determined that the licence can be brought into conformity with the provisions and requirements of Council Directive 96/61/EC by the exercise of the powers conferred by Section 76(4) of the Waste Management Acts 1996 to 2003.

The Environmental Protection Agency is satisfied, on the basis of the information available, that subject to compliance with the conditions of Waste Licence Reg. No. 146-1 granted on the 19/03/2003, as well as any amendments noted herein, any emissions from the activity will comply with and not contravene any of the requirements of Section 40(4) of the Waste Management Acts 1996 to 2003.

Amendment of Conditions

In pursuance of the powers conferred on it by Section 76(4) of the Waste Management Acts 1996 to 2003, the Agency amends Waste Licence Reg. No. 146-1, granted to Celtic Waste Limited, for a facility located at Knockharley, Navan, Co. Meath (includes townlands of Tuiterath and Flemingstown).

This amendment is limited to the following conditions of Waste Licence Reg. No. 146-1.

Amendments

Interpretation

BAT	Best Available Techniques.

To be inserted into the Interpretation of the existing licence.

Resource Use and Energy Efficiency

2.5 Resource Use and Energy Efficiency

2.5.1 The licensee shall carry out an audit of the energy efficiency of the site within one year of the date of grant of this amendment. The audit shall:-

(i) identify all opportunities for energy use reduction and efficiency;

(ii) be carried out in accordance with the guidance published by the Agency - "Guidance Note on Energy Efficiency Auditing"; and

(iii) be repeated at intervals as required by the Agency.

The recommendations of the audit will be incorporated into the Schedule of Environmental Objectives and Targets under Condition 2.3.2.1 above.

2.5.2 The licensee shall identify opportunities for reduction in the quantity of water used on site including recycling and reuse initiatives, wherever possible. Reductions in water usage shall be incorporated into the Schedule of Environmental Objectives and Targets.

2.5.3 The licensee shall undertake an assessment of the efficiency of use of raw materials in all processes, having particular regard to the reduction in waste generated. The assessment should take account of best international practice for this type of activity. Where improvements are identified, these shall be incorporated into the Schedule of Environmental Objectives and Targets.

To be inserted after Condition 2.4 of the existing licence.

Reason: ***To provide for the efficient use of resources and energy in all site operations.***

Accident Prevention and Emergency Response

9.6 The licensee shall, within twelve months of date of this amendment, ensure that a documented Accident Prevention Policy is in place, which will address the hazards on-site, particularly in relation to the prevention of accidents with a possible impact on the environment. This procedure shall be reviewed annually and updated as necessary.

9.7 The Emergency Response Procedure shall be reviewed annually and updated as necessary.

To be inserted after Condition 9.5 of the existing licence.

Reason: ***To provide for the protection of the environment.***

Restoration and Aftercare Plan

4.8 A final validation report to include a certificate of completion for the Restoration and Aftercare Plan, for all or part of the site as necessary, shall be submitted to the Agency within three months of execution of the plan. The licensee shall carry out such tests, investigations or submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment.

To be inserted after Condition 4.7 of the existing licence.

Reason: ***To provide for the restoration of the facility.***

These amendments should be read in conjunction with Waste Licence Reg. No. 146-1, granted on 19/03/2003.

Sealed by the seal of the Agency on this the11th day of October 2005

PRESENT when the seal of the Agency was affixed hereto:

Padraic Larkin, Director/Authorised Person

An Bord Pleanála

LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS, 1963 TO 1999

Meath County

Planning Register Reference Number: 01/5006

APPEAL by Fergal O'Byrne of Painestown, Yellow Furze, Beauparc, County Meath and by Celtic Waste Limited of Burton Court, Burton Hall Road, Sandyford, Dublin and by others against the decision made on the 12th day of July, 2001 by the Council of the County of Meath to grant subject to conditions a permission to the said Celtic Waste Limited for development comprising the development and operation of an engineered landfill (area 25 hectares, height 15 metres) to accept 180,000 tonnes/annum of non-hazardous waste for 14 years and ancillary facilities including leachate lagoon, site drains, surface water pond, gas flare, landscaped screening bunds, new entrance layout, new access road (900 metres long), road widening of National Road (N2), underpass at County Road (CR 384), site roads, modular administration building (160 square metres), maintenance garage (72 square metres), portable sheds (two number each 24 square metres), parking spaces (16 number cars, six number coaches), hardstanding area (625 square metres), bunded diesel tank (6,000 litre), waste quarantine area (120 square metres), waste inspection area (120 square metres), effluent treatment system, weighbridge office (24 square metres), weighbridges (two number), wheelwash, aviary fencing, gates, barriers, perimeter and other landscaping, at a 135.45 hectare site, with access to the N2 at Tuiterath, in the townlands of Knockharley, Flemingstown and Tuiterath, Navan, County Meath, in accordance with plans and particulars lodged with the said Council:

DECISION: Pursuant to the Local Government (Planning and Development) Acts, 1963 to 1999, it is hereby decided, for the reason set out in the First Schedule hereto, to grant permission for the said development in accordance with the said plans and particulars, subject to the conditions specified in the Second Schedule hereto, the reasons for the imposition of the said conditions being as set out in the said Second Schedule and the said permission is hereby granted subject to the said conditions.

FIRST SCHEDULE

Having regard to -

(a) the provisions of Section 54(3) of the Waste Management Act, 1996, which precludes An Bord Pleanála from consideration of matters relating to the risk of environmental pollution from the activities,

(b) the national waste management policy framework and strategy as set out in Government policy statements "Changing Our Ways" and "Delivering Change" published by the Department of the Environment and Local Government in September, 1998 and March, 2002 respectively,

(c) the waste management strategy for the North-East region as set out in the North-East Regional Waste Management Plan, 1999-2004,

(d) the 2001 Meath County Development Plan which has an objective for the provision of a landfill site at Knockharley, and

(e) to the Environmental Impact Statement and additional information submitted in connection with the planning application and the appeal,

it is considered that, subject to compliance with the conditions set out in the Second Schedule, the proposed development would not seriously injure the amenities of property in the vicinity, would be acceptable in terms of traffic safety and convenience and would be in accordance with the proper planning and development of the area.

SECOND SCHEDULE

1. The development shall be carried out in accordance with the plans and particulars lodged with the application as amended by the particulars received by the planning authority on the 17th day of May, 2001, the 1st day of June, 2001 and the 3rd and 9th days of July, 2001, except as may otherwise be required in order to comply with the following conditions.

   Reason: In the interest of clarity.

2. Waste to be accepted for disposal at the residual landfill facility -

   (a) shall be limited to waste arising from the North-East region as defined by the Counties of Meath, Louth, Cavan and Monaghan, and

   (b) shall be restricted to 132,000 tonnes per annum until December 2007, thereafter tonnage for disposal at the landfill facility shall be restricted to a maximum of 88,000 tonnes per annum.

Each consignment of waste arriving for disposal at the landfill facility shall be accompanied by a Certificate which shall identify the weight of each consignment, the name and address of the waste collection contractor disposing of the waste and the composition and nature of the waste for disposal.

On a monthly basis to be agreed with the planning authority, the developer shall submit to the planning authority records of all waste delivered to the site on a daily, weekly and monthly basis.

Reason: To ensure that waste arisings within the North-East region shall be disposed of within that region in accordance with the proximity principle as expressed in the 1997 Waste Management (Planning Regulations) and to ensure that the principles of regional waste management as set out in the 1999-2004 North-East Region Waste Management Plan are adhered to.

3. The proposed landfill footprint indicated on drawing number 2000-144-01-17, submitted to the planning authority on the 11th day of January, 2001, shall be revised to provide for a minimum separation distance of 250 metres between the northern perimeter of the landfill footprint and the existing southernmost boundary of the third party appellant, Mr. Martin Curran's, property to the north. Plans and drawings showing the revised on site location of the landfill shall be submitted to and agreed upon in writing with the planning authority prior to the commencement of development.

Reason: To ensure that the residential amenities associated with the private open space at the rear of the dwelling will not be adversely impacted upon during the construction phase of the proposed development by reason of noise and to ensure that the locational context of the dwelling will not be adversely impacted on by reason of undue proximity of the rear garden to the landfill footprint.

4. Prior to the commencement of development, the developer shall submit to the planning authority for written agreement, plans and drawings providing details of that area within the landfill administration block which it is proposed to provide for use as a public education area as outlined at Section 17 of the Environmental Impact Statement Addendum submitted to the planning authority on the 17th day of May, 2001.

Reason: To clarify the extent of the proposed public area within the administration block.

5. The identification of environmental community projects and works shall be decided upon by a community liaison committee; the composition of the committee shall be based upon equal representation of personnel from the planning authority, the developer, local residents and elected members of Meath County Council; any variation in the composition of the committee shall be subject to the prior agreement of the planning authority.

Reason: To identify appropriate environmental community projects which will mitigate the impact of the landfill facility on the local community in accordance with Government policy as set out in 'Changing Our Ways' published by the Department of the Environment and Local Government in September, 1998.

6. Prior to the commencement of development, the developer shall submit for the written agreement of the planning authority and the National Roads Authority design details for the following -

(a) the landfill access road junction with the National Primary Route, the N2, including drainage and lighting details, and

(b) details of all construction work associated with the proposed underpass of the CR384, including bridge construction works and associated traffic diversion arrangements to facilitate same.

No landfill operations shall take place on site until such time as the proposed access road to the landfill site from the national primary route, the N2, is complete as certified in writing by the planning authority.

Reason: In the interest of vehicular and pedestrian safety.

7. The developer shall -

(a) submit for the written agreement of the planning authority and the National Roads Authority prior to the commencement of development, details of the proposed traffic management plan which shall include, provisions prohibiting landfill associated traffic from travelling along the regional road, the R150, between its junction with the R153 to the west and the N2 to the east, and

(b) submit over the lifetime of the traffic management plan details of any modifications deemed necessary to the plan as a result of any plan review. The review shall be carried out in conjunction with the planning authority and the National Roads Authority at not less than three monthly intervals during the initial construction phase of the landfill development and thereafter at not less than six monthly phases during the remaining life of the landfill.

Reason: In the interest of traffic and pedestrian safety and to protect existing educational and recreational facilities associated with the village.

8. Working hours during the construction phase of the proposed development shall be confined to between 0800 and 2000 hours Monday to Friday inclusive and 0800 and 1300 hours on Saturdays (excluding public holidays and Sundays) during the months of August and September 2002, and May, June, July, August and September 2003 unless otherwise previously agreed in writing with the planning authority. Working hours outside of the above during the construction phase of the proposed development, shall be confined to between 0800 and 1800 hours Monday to Friday inclusive and 0800 and 1300 hours on Saturdays (excluding public holidays and Sundays) unless otherwise previously agreed in writing with the planning authority.

Reason: To protect the residential amenities of the area during the construction phase of the proposed development.

9. During the initial construction phase of the proposed development noise levels at the site when measured at noise sensitive locations in the vicinity shall not exceed 65dB(A) between 0800 and 2000 hours Monday to Friday inclusive and 0800 and 1300 hours on Saturdays, excluding public holidays and Sundays, and 45dB(A) at any other time.

Noise monitoring locations for the purposes of the construction phase of the proposed development shall be agreed upon in writing with the planning authority prior to the commencement of any development on site.

Reason: To protect the amenities of property in the vicinity of the site.

10. Prior to the commencement of development, the developer shall put in place monitoring arrangements for the measurement of noise emissions, dust deposition and suspended solids of surface water run-off associated with the initial construction phase of the development; during the construction phase of the development the developer shall submit to the planning authority, on a frequency to be determined by the planning authority, the results of the monitoring programme. Monitoring locations for the above shall be agreed upon in writing with the planning authority prior to the commencement of development on site.

Dust deposition during the initial construction phase of the proposed development shall not exceed 350mg/m^2/day (DIN standard) when measured at the site boundaries and averaged over 30 days.

Reason: To protect the amenities of the area.

11. Prior to the commencement of development, the developer shall submit to the planning authority for written agreement, details of temporary settlement ponds/silt traps and interceptors to control discharges of site surface water run-off in advance of the construction of the proposed permanent attenuation pond. The concentration of suspended solids in the surface water run-off from the site construction works, for discharge to surface waters shall not exceed 30mg/litre.

Reason: To prevent surface water pollution during the construction phase of the proposed development.

12. Prior to the commencement of development, the developer shall submit to the planning authority for written agreement details of -

(a) the extent, alignment, grading, elevational height and overall configuration of the screening berms proposed along the perimeter of the landfill footprint; the details shall provide for a 400 metre northerly extension of the screening berm proposed at the south-eastern corner of the footprint in order to provide screening of Phases 1, 2 and 3 from the dwellings to the east,

(b) landscaping proposals for the planted woodland belts around the perimeter of the site and for the proposed screening berms shall -

(i) indicate the configuration and depth of the planted perimeter belts,

(ii) provide for a mix of feathered and standard, mainly deciduous fast growing native species of trees of minimum girth 8-10 centimetres, and

(iii) provide for 10 per cent of all planted trees to be fast growing evergreens.

(c) supplementary planting to strengthen hedgerows, and tree belts proposed for retention,

(d) the estimated height of proposed planting at completion of each phase of the landfill,

(e) a proposed planting scheme to a minimum depth of 10 metres along the entire length of both margins of the site access road, and

(f) phased landscape implementation and maintenance programmes for the entire site including replacement of failed planting, the implementation and maintenance programmes shall accord priority to the landscaping treatment proposed around the southern, south-western and south-eastern corners of the landfill footprint and the site access road. The scheme shall provide, in particular, that the slopes of the screening berms be topsoiled, grass-seeded and planted as soon as practicable after their construction and that dust suppression sprays shall be used during periods of dry weather until a stable grass covering has been established.

Where modification to the above proposals at (a) to (f) above are required these shall not be carried out without the prior written consent of the planning authority and or, in default of agreement, shall be determined by An Bord Pleanála.

Reason: To protect the visual and residential amenities of the area.

13. During the construction phase of the proposed development -

(a) bunded storage areas shall be provided for the containment of oil, fuel storage tanks, chemicals and any other materials which pose a risk during the construction phase of the development to waters spilled. The bunded area shall be equivalent to a volume of 110 per cent of the capacity of the largest container stored. Proposed method of drainage of the bunded area shall be to the satisfaction of the planning authority,

(b) a wheel-wash facility shall be provided adjacent to the site exit, the details, including the location of such a facility, being agreed upon in writing prior to the commencement of development with the planning authority, and

(c) arrangements for the collection, storage and disposal of all foul sewage effluent arising from temporary site sanitary facilities shall be submitted to and agreed upon with the planning authority prior to the commencement of development.

Reason: In the interest of public health and the protection of the amenities of the area.

14. The developer shall facilitate the planning authority in the archaeological appraisal of the site and in preserving and recording or otherwise protecting archaeological materials or features which may exist within the site. In this regard, the developer shall -

(a) notify the planning authority in writing at least four weeks prior to the commencement of any site operation (including hydrological and geotechnical investigations) relating to the proposed development, and

(b) employ a suitably-qualified archaeologist prior to the commencement of development. The archaeologist shall assess the site and monitor all site development works.

The assessment shall address the following issues:-

(i) the nature and location of archaeological material on the site, and

(ii) the impact of the proposed development on such archaeological material.

Prior to the commencement of development, a report containing the results of the assessment shall be submitted to the planning authority. Arising from this assessment, the developer shall agree with the planning authority details regarding any further archaeological requirements (including, if necessary, archaeological excavation) prior to commencement of construction works.

In default of agreement on any of these requirements, the matter shall be determined by An Bord Pleanála.

Reason: In order to conserve the archaeological heritage of the site and to secure the preservation of any remains which may exist within the site.

15. During the construction phase of the proposed development a minimum 15 metre wayleave free from development shall be provided adjacent to the gas transmission line and the ESB high tension pylons crossing the site. The developer shall consult with the relevant statutory utility operators in this regard.

Reason: In the interest of public safety and to conform with the requirements of the relevant utility operators.

16. Within two years of the final capping of the last phase of the landfill, the planning authority shall, by way of formal notification, require the developer to implement any final landscaping restoration measures it may require. In the event of failure to comply with that formal notification, the planning authority shall be empowered to apply the funds or part thereof as referred to in condition number 20 to the satisfactory completion of such restoration measures.

Reason: To ensure satisfactory restoration of the site in the interests of amenity.

17. The internal road network accessing and serving the proposed landfill disposal facility, including turning bays, junctions, parking, hardstanding areas, footpaths, kerbs and the construction of the N2/access road entrance shall be carried out in accordance with the detailed requirements of the planning authority for such works.

Reason: In the interest of amenity and public safety.

18. Lighting arrangements for the overall site and access road shall be provided in accordance with a scheme, details of which shall be submitted to the planning authority for agreement prior to the commencement of development.

Reason: In the interest of public safety and to provide a satisfactory standard of development.

19. Prior to commencement of development, the developer shall lodge with the planning authority a cash deposit to secure satisfactory implementation of measures to replace affected water supplies which may result from the construction phase of the proposed development, coupled with an agreement empowering the planning authority to apply such security or part thereof to the provision of such implementation. The amount of the security shall be as agreed between the planning authority and the developer or, in default of agreement, shall be determined by An Bord Pleanála.

Reason: In the interest of public health and to ensure a continuous supply of potable water during the construction phase of the proposed development.

20. Prior to commencement of development the developer shall lodge with the planning authority a cash deposit to secure any final landscaping restoration measures required to be undertaken under the terms of condition number 16, coupled with an agreement empowering the planning authority to apply such security or part thereof to the satisfactory completion and maintenance of any part of the landscape restoration plan. The amount of the security shall be as agreed between the planning authority and the developer or, in default of agreement, shall be determined by An Bord Pleanála.

Reason: To ensure the satisfactory completion of a landscape restoration plan for the site.

21. The developer shall pay a sum of money to the planning authority as a contribution towards the expenditure that is proposed to be incurred by the planning authority in respect of environmental works facilitating the proposed development. The amount of the contribution and the arrangements for payment shall be agreed between the developer and the planning authority or, in default of agreement, shall be determined by An Bord Pleanála.

Payment of this contribution is subject to the provisions of section 26(2)(h) of the Local Government (Planning and Development) Act, 1963 generally, and in particular, the specified period for the purposes of paragraph (h) shall be the period of seven years from the date of this order.

Reason: It is considered reasonable that the developer should contribute towards the expenditure proposed to be incurred by the planning authority in respect of environmental improvement works for the area in which the proposed landfill is situated.

22. The developer shall pay a sum of money to the planning authority as a contribution towards expenditure that was and/or that is proposed to be incurred by the planning authority in respect of road works facilitating the proposed development. The amount of the contribution and the arrangements for payment shall be agreed between the developer and the planning authority or, in default of agreement, shall be determined by An Bord Pleanála.

In the case of expenditure that is proposed to be incurred, the requirement to pay this contribution is subject to the provisions of section 26(2)(h) of the Local Government (Planning and Development) Act, 1963 generally, and in particular, the specified period for the purposes of paragraph (h) shall be the period of seven years from the date of this order.

Reason: It is considered reasonable that the developer should contribute towards the expenditure that was and/or that is proposed to be incurred by the planning authority in respect of works facilitating the proposed development.

23. The developer shall pay a sum of money to the planning authority as a contribution towards the expenditure that is proposed to be incurred by the planning authority in respect of monitoring costs (construction phase only) facilitating the proposed development. The amount of the contribution and the arrangements for payment shall be agreed between the developer and the planning authority or, in default of agreement, shall be determined by An Bord Pleanála.

Payment of this contribution is subject to the provisions of section 26(2)(h) of the Local Government (Planning and Development) Act, 1963 generally, and in particular, the specified period for the purposes of paragraph (h) shall be the period of seven years from the date of this order.

Reason: It is considered reasonable that the developer should contribute towards the expenditure proposed to be incurred by the planning authority in respect of works facilitating the proposed development.

Member of An Bord Pleanála
duly authorised to authenticate
the seal of the Board.

Dated this 26 day of August 2002.

An Bord Pleanála

PLANNING AND DEVELOPMENT ACTS 2000 TO 2006

Meath County

Planning Register Reference Number: NA/60336

An Bord Pleanála Reference Number: PL 17.220331

APPEAL by Greenstar Holdings Limited care of Kiaran O'Malley and Company Limited of Saint Heliers, Saint Heliers Copse, Stillorgan Park, Blackrock, County Dublin against the decision made on the 2nd day of October, 2006 by Meath County Council in relation to an application by the said Greenstar Holdings Limited for permission for (1) extension measuring circa two hectares (height 15 metres) to existing permitted landfill footprint (circa 23 hectares, height 15 metres) to create an overall landfill footprint (circa 25 hectares, height 15 metres) and all ancillary works. The proposed extension comprises 3.4 hectares of earthworks to construct two hectares of EU compliant lined landfill, (2) increase in waste intake volume to 200,000 tonnes per annum (tpa) until the 2,800,000 tonnes potential capacity of the landfill is complete, and (3) removal of the regional restriction on the origin of the waste accepted at the facility by modifying condition number 2(a) of planning register reference number 01/5006 so the facility can accept waste from adjoining waste regions. Site access will continue at the existing permitted access at the N2 National Primary Route and the proposed development will utilise the existing permitted infrastructure and facilities all on a site at Knockharley, Flemingstown and Tuiterath, County Meath in accordance with the plans and particulars lodged with the said Council (which decision was to grant subject to a condition permission for the said removal of the regional restriction on the origin of the waste accepted at the facility by modifying condition number 2(a) of planning register reference number 01/5006 so the facility can accept waste from adjoining waste regions and to refuse permission for the said extension measuring circa two hectares (height 15 metres) to existing permitted landfill footprint (circa 23 hectares, height 15 metres) to create an overall landfill footprint (circa 25 hectares, height 15 metres) and all ancillary works and increase in waste intake volume to 200,000 tonnes per annum (tpa) until the 2,800,000 tonnes potential capacity of the landfill is complete):

DECISION

(1) GRANT permission for the said extension to the existing landfill footprint in accordance with the said plans and particulars based on the reasons and considerations marked (1) under and subject to the conditions marked (1) set out below.

(2) GRANT permission for the said removal of the regional restriction on the origin of the waste accepted at the facility in accordance with the said plans and particulars based on the reasons and considerations marked (2) under and subject to the condition marked (2) set out below.

(3) GRANT permission, notwithstanding the decision set out at (4) below, for the continuation of the approved level of the annual intake volume of 132,000 tonnes until the end of 2010, based on the reasons and considerations marked (3) under and subject to the condition marked (3) set out below.

(4) REFUSE permission for the said increase in the waste intake volume to 200,000 tonnes per annum, based on the reasons and considerations marked (4) under.

REASONS AND CONSIDERATIONS (1)

Having regard to the planning history of the site and the designation of the existing landfill as the long term residual landfill for the North East Region, it is considered that the proposed footprint extension would not be incompatible with its 'residual role' or inconsistent with the core objectives of the Waste Management Plan for the North East Region 2005-2010. It is therefore considered that, subject to compliance with the conditions set out below, the proposed development would be in accordance with the proper planning and sustainable development of the area.

CONDITIONS (1)

1. The proposed development shall be carried out in accordance with the conditions attached to the permission granted under appeal reference number PL 17.125891 on the 26th day of August, 2002, except as amended to conform with the provisions indicated in the plans lodged in connection with this application, with the following conditions and with the other elements of this Order.

   Reason: To ensure consistency with the development as previously permitted.

2. The developer shall facilitate the planning authority in the archaeological appraisal of the site and in preserving and recording or otherwise protecting archaeological materials or features, which may exist within the site. In this regard the developer shall:-

(a) notify the planning authority in writing at least four weeks prior to the commencement of any subsurface works (including hydrological and geotechnical investigations) relating to the proposed development, and

(b) employ a suitably-qualified archaeologist prior to the commencement of development. The archaeologist shall assess the site and monitor all site development works.

The assessment shall address the following issues:-

(i) the nature and location of any archaeological material on the site, and

(ii) the impact of the proposed development on such archaeological material.

Prior to the commencement of development, a report containing the results of the assessment shall be submitted to the planning authority. Arising from this assessment, the developer shall agree with the planning authority details regarding any future archaeological requirements (including, if necessary, archaeological excavation) prior to commencement of construction works.

In default of agreement on any of these requirements, the matter shall be referred to An Bord Pleanala for determination.

Reason: In order to conserve the archaeological potential of the site and to secure the preservation of any remains which may exist within the site

3. The developer shall pay to the planning authority a financial contribution in respect of public infrastructure and facilities benefiting development in the area of the planning authority that is provided or intended to be provided by or on behalf of the authority in accordance with the terms of the Development Contribution Scheme made under section 48 of the Planning and Development Act 2000. The contribution shall be paid prior to the commencement of development or in such phased payments as the planning authority may facilitate and shall be subject to any applicable indexation provisions of the Scheme at the time of payment. Details of the application of the terms of the Scheme shall be agreed between the planning authority and the developer or, in default of such agreement, the matter shall be referred to the Board to determine the proper application of the terms of the Scheme.

Reason: It is a requirement of the Planning and Development Act 2000 that a condition requiring a contribution in accordance with the Development Contribution Scheme made under section 48 of the Act be applied to the permission.

REASONS AND CONSIDERATIONS (2)

Having regard to:-

(a) the national waste management policy framework and strategy as set out in the Government policy statement "Waste Management - Taking Stock and Moving Forward," published by the Department of the Environment, Heritage and Local Government in April 2004,

(b) the Policy Directions issued pursuant to section 60 of the Waste Management Act, 1996 (as amended), and

(c) the Waste Management Plan for the North East Region 2005-2010 which facilitates the inter-regional movement of waste,

it is considered that the regional restriction on the source of waste accepted at the facility imposed by condition number 2(a) of the permission granted by An Bord Pleanála under appeal reference number Pl 17.125891 should be removed and that waste accepted at the facility be subject to the condition set out below.

CONDITION (2)

The waste to be accepted for disposal at this facility shall primarily be waste arising in the North–East Region as defined by the Counties of Meath, Louth, Cavan and Monaghan and shall otherwise be in accordance with the proximity principle.

Each consignment of waste arriving for disposal at the facility shall be accompanied by a certificate which shall identify the weight of each consignment, the name and address of the waste collection contractor disposing of the waste and the composition and nature of the waste for disposal. The developer shall submit to the planning authority on a monthly basis records of all waste delivered to the site on a daily, weekly and monthly basis.

Reason: To ensure compliance with national and regional waste management policy.

REASONS AND CONSIDERATIONS (3)

Having regard to the short term waste management capacity needs of the North-East Region and the Greater Dublin Area, it is considered that, subject to compliance with the condition set out below, a continuation for a temporary period of the approved level of the annual intake volume of waste to be accepted (132,000 tonnes) would not conflict with the policies of the Waste Management Plan for the North-East Region or be otherwise contrary to the proper planning and sustainable development of the area.

CONDITION (3)

Waste to be accepted at the facility shall be restricted to 132,000 tonnes per annum until December, 2010, thereafter tonnage for disposal at the facility shall be restricted to a maximum of 88,000 tonnes per annum.

Reason: To meet short-term waste management capacity needs and to ensure compliance with the principles of waste management as set out in the North-East Region Waste Management Plan.

REASONS AND CONSIDERATIONS (4)

Having regard to the current available annual landfill and overall landfill capacity in the North-East Region and to the requirement of the current Waste Management Plan for the North-East Region to reduce the volumes of waste diverted to landfill, it is considered that the proposal to increase the tonnage per annum intake at the facility would compromise the viability of more sustainable waste infrastructure and would compromise the long-term waste infrastructure requirements of the region and the designation of Knockharley as the long-term residual landfill for the region. The proposed development would, therefore, conflict with the policies of the Waste Management Plan for the North-East Region and would be contrary to the proper planning and sustainable development of the area.

Member of An Bord Pleanála
duly authorised to authenticate
the seal of the Board.

Dated this day of 2007.

Appendix 3 Notices dated May 8th 2008 and dated 10th July 2008 from An Bord Pleanála to Kiaran O'Malley & Co. Ltd under Section 37B(4)(a)

Our Ref: 17.PC0043

An Bord Pleanála

Kiaran O'Malley & Company
St. Heliers
St. Heliers Copse
Stillorgan Park
Blackrock Co. Dublin

8th May 2008

Re: Proposed increased rate of waste acceptance at the permitted residual waste landfill at Knockharley, near Kentstown, Co.Meath

Dear Sir/Madam,

Please be advised that following consultations under section 37B of the Planning and Development Act, 2000 as amended, the Board hereby serves notice under section 37B(4)(a) that it is of the opinion that the proposed development falls within the scope of paragraphs 37A(2) of the Act. Accordingly, the Board has decided that the proposed development would be strategic infrastructure within the meaning of section 37A of the Planning and Development Act, 2000, as amended. Any application for permission for the proposed development must therefore be made directly to An Bord Pleanála under section 37E of the Act.

Furthermore, the Board has also decided that a further meeting should be held to advise on planning application procedures. The Board will revert to you shortly in relation to this matter.

If you have any queries in relation to the matter please contact the undersigned officer of the Board.

Please quote the above-mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

Yours faithfully,

Nichola Meehan
Executive Officer

Kiaran O'Malley & Co. Ltd.
Rec'd By: Hand / Courier / Post
- 9 MAY 2008

Circulate	KOM	JOM	ROM
Job Name			

64 Sráid Maoilbhríde,
Baile Átha Cliath 1.

Tel: (01) 858 8100
LoCall: 1890 275 175
Fax: (01) 872 2684
Web.http//www.pleanala.ie
email:bord@pleanala.ie

64 Marlborough Street,
Dublin 1.

Our Ref: 17.PC0043

An Bord Pleanála

Kiaran O'Malley & Company
St. Heliers
St. Heliers Copse
Stillorgan Park
Blackrock Co. Dublin

10th July 2008

Re: Proposed increased rate of waste acceptance at the permitted residual waste landfill at Knockharley, near Kentstown, Co.Meath

Dear Sir/Madam,

Please be advised that following consultations under section 37B of the Planning and Development Act, 2000 as amended, the Board hereby serves notice under section 37B(4)(a) that it is of the opinion that the proposed development falls within the scope of paragraphs 37A(2) of the Act. Accordingly, the Board has decided that the proposed development would be strategic infrastructure within the meaning of section 37A of the Planning and Development Act, 2000, as amended. Any application for permission for the proposed development must therefore be made directly to An Bord Pleanála under section 37E of the Act.

Please also be informed that the Board considers that the pre-application consultation process in respect of this proposed development is now closed.

In accordance with section 146(5) of the Planning and Development Act, 2000 as amended, the Board will make available for inspection and purchase at its offices the documents relating to the decision within 3 working days following its decision. This information is normally made available on the list of decided cases on the website on the Wednesday following the week in which the decision is made.

If you have any queries in relation to the matter please contact the undersigned officer of the Board.

Please quote the above-mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

Yours faithfully,

Nichola Meehan
Executive Officer

64 Sráid Maoilbhride,
Baile Átha Cliath 1.

Tel: (01) 858 8100
LoCall: 1890 275 175
Fax: (01) 872 2684
Web:http//www.pleanala.ie
email:bord@pleanala.ie

64 Marlborough Street,
Dublin 1.

Appendix 4 Leachate Monitoring Results & Predictive Model Output

Table 1: 2006 Leachate Monitoring Results

SAMPLE IDENTITY		LE1	LE2	LE3	LE4	LE5	LE6	LES
Quarter 1 2006								
pH	pH Units	7.42	7.1	6.91	7	-	-	7.14
Conductivity (at 25 deg. C)	mS/cm	4.191	5.385	4.326	5.675	-	-	2.927
Ammoniacal Nitrogen as N	mg/l	85.6	138.9	73.9	138.9	-	-	42.6
Temperature	mg/l					-	-	
Chloride	mg/l	433	640	356	657	-	-	281
COD Unfiltered	mg/l	897	979	885	784	-	-	344
BOD Unfiltered	mg/l	55	88	54	59	-	-	1634
Total Oxidised Nitrogen as N	mg/l	<0.3	<0.3	<0.3	<0.3	-	-	<0.3
Quarter 2 2006								
pH	pH units	-	-	-	-	-	-	7.45
Conductivity	mS/cm	-	-	-	-	-	-	2.441
Ammoniacal Nitrogen	mg/l	-	-	-	-	-	-	55.7
Chloride	mg/l	-	-	-	-	-	-	285
Total Oxidised Nitrogen	mg/l	-	-	-	-	-	-	<0.3
BOD	mg/l	-	-	-	-	-	-	751
COD	mg/l	-	-	-	-	-	-	312
Quarter 3 2006								
pH	pH Units	7.09	7.43	7.3	7.37	-	-	7.33
Conductivity (at 25 deg. C)	mS/cm	6	7	9	11	-	-	2.25
Ammoniacal Nitrogen as N	mg/l	205.7	279.6	461.8	408.7	-	-	37.1
Temperature	mg/l					-	-	
Chloride	mg/l	789	825	1152	1853	-	-	212
COD Unfiltered	mg/l	673	530	915	693	-	-	137
BOD Unfiltered	mg/l	388	82	239	139	-	-	NDP
Total Oxidised Nitrogen as N	mg/l	<0.3	1.8	<0.3	<0.3	-	-	<0.3
Quarter 4 2006								
pH	pH units	7.15	7.17	7.21	7.34	7.35	7.14	7.71
Conductivity	mS/cm	4.275	7.5	3.852	7.5	1.302	1.145	1.648
Ammoniacal Nitrogen	mg/l	148.3	293	151.3	308.3	41	34.2	32.3
Chloride	mg/l	552	1046	477	1033	115	112	149
Total Oxidised Nitrogen	mg/l	0.4	<0.3	<0.3	<0.3	0.7	0.3	<0.3
BOD	mg/l	66	138	56	120	11	13	23
COD	mg/l	290	598	249	600	66	35	<0.3

Table 2: 2007 Leachate Monitoring Results

SAMPLE IDENTITY		LE1	LE2	LE3	LE4	LE5	LE6	LES
Quarter 1 2007								
pH	pH Units	7.21	6.93	7.66	7.12	No Sample	6.85	7.29
Conductivity (at 25 deg. C)	mS/cm	7.00	8.00	11.00	10.00		9.00	6.00
Ammoniacal Nitrogen as N	mg/l	305.9	303.0	479.7	528.9		326.8	204.5
Temperature	mg/l	8.3	8.5	8.3	8.1		7.6	10.4
Chloride	mg/l	933	894	1155	1076		993	774
COD Unfiltered	mg/l	554	4065	1340	2704		3996	NDP
BOD Unfiltered	mg/l	37	2049	279	1402		2169	2173
Total Oxidised Nitrogen as N	mg/l	<0.3	<0.3	<0.3	<0.3		<0.3	<0.3
Total Suspended Solids	mg/l	58	172	58	144		188	62
ortho-Phosphate as PO4	mg/l	0.03	<0.03	3.13	<0.03		<0.03	1.37
Quarter 2 2007								
pH	pH units	7.35	7.43	7.63	7.36	6.59	7.34	7.35
Conductivity	mS/cm	10.000	8.000	13.000	9.5000	14.000	15.000	6.000
Ammoniacal Nitrogen	mg/l	597.8	410.9	863.3	556.2	557.2	862.2	197.3
Chloride	mg/l	1218	1010	1576	1122	1660	2200	763
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BOD	mg/l	37	37	304	135	383	3175	3385
COD	mg/l	1039	467	1408	1044	587	2296	10709
Quarter 3 2007								
pH	pH Units	7.18	7.47	7.16	7.48	No Sample	7.31	7.43
Conductivity (at 25 deg. C)	mS/cm	12.25	11.65	12.30	16.65		9.45	6.45
Ammoniacal Nitrogen as N	mg/l	708.1	874.1	739.5	868.2		489.2	298.7
Temperature	mg/l							
Chloride	mg/l	1686	325	2672	299		1381	1371
COD Unfiltered	mg/l	5045	1498	5143	2043		1184	545
BOD Unfiltered	mg/l	3614	373	1928	746		431	124
Total Oxidised Nitrogen as N	mg/l	<0.3	<0.3	<0.3	<0.3		<0.3	<0.3
ortho-Phosphate as PO4	mg/l	1.31	2.42	1.42	2.25		0.38	0.37
Quarter 4 2007								
pH	pH units	7.27	7.36	7.39	7.3	7.34	7.34	7.48
Conductivity	mS/cm	13.00	12.50	13.00	12.00	13.00	10.00	8.00
Ammoniacal Nitrogen	mg/l	833.0	772.7	801.9	770.3	805.9	645.1	353.2
Chloride	mg/l	1555	1596	1602	1529	1582	1434	899
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BOD	mg/l	Not analysed						94
COD	mg/l	6305	4628	5965	4911	6309	1102	899

Table 3: 2008 Leachate Monitoring Results

SAMPLE IDENTITY		LE1	LE2	LE3	LE4	LE5	LE6	LE7	LE8	LES
Quarter 1 2008										
pH	pH Units	7.33	7.45	7.38	7.41	7.49	7.37			7.66
Conductivity (at 25 deg. C)	mS/cm	10.5	11.0	11.0	11.0	8.0	11.0			9.0
Ammoniacal Nitrogen as N	mg/l	607.0	606.7	646.2	583.9	342.1	474.5			512.5
Chloride	mg/l	1272	1222	1281	1369	1173	1455			1171
COD Unfiltered	mg/l	4065	4140	4020	4174	854	4212			773
BOD Unfiltered	mg/l	2020	2029	1990	2050	224	2104			123
Quarter 2 2008										
pH	pH units	7.9	7.6	7.7	7.8	7.6	7.6		7.6	8.0
Conductivity	mS/cm	12.5	10.5	11.8	12.2	7.38	10.5		10.6	7.57
Ammoniacal Nitrogen	mg/l	994	769	871	1030	431	769		798	456
Chloride	mg/l	1660	1550	1590	1720	1010	1550		1520	1110
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	<0.3
BOD	mg/l	127	129	152	147	167	129		120	97
COD	mg/l	1740	1370	1660	2430	860	1370		1390	780
Quarter 3 2008										
pH	pH Units	7.4	7.6	7.6	7.8	7.4	7.4	7.1	7..5	8.0
Conductivity (at 25 deg. C)	mS/cm	10.4	10.3	10.7	10.7	8.7	9.73	7.88	10.1	7.85
Ammoniacal Nitrogen as N	mg/l	765	759	810	799	618	718	525	747	476
Temperature	mg/l	1150	1210	1160	1260	813	1150	714	1180	986
Chloride	mg/l	*	*	*	*	*	*	*	*	<0.3
COD Unfiltered	mg/l	305	160	288	151	1220	201	**	149	60
BOD Unfiltered	mg/l	1760	1620	1840	155	2430	266	321	158	87

*not possible to analyse for TON due to interference from the sample matrix
**no BOD results due to under dilution of the sample in the laboratory

Knockharley Residual Landfill

Appendix 4 Leachate Prediction-400,000 tpa

Year		Active Cell No.	Active Area (m2)	Waste Input (t)	Active Infiltration (m^3)	Intermediate Restoration Cell No.	Intermediate Restored Area (m^2)	Intermediate Infiltration (m^3)	Final Restoration Cell No.	Restored Area (m^2)	Restored Infiltration (m^3)	Liquid Waste (m^3)	Total Leachate (m^3)	Cummulative Leachate (m^3)	Absorptive Capacity (m^3)	Cummulative Absorptive Capacity (m^3)	Cummulative Leachate Generation (m^3)	Annual Leachate Generation (m^3)
2005	1	1,2	17,814	132,000	8,016	n/a	0	0	n/a	0	0	0	8,016	8,016	9,240	9,240	-1,224	-1,224
2006	2	1,2,3,4	35,628	132,000	16,033	n/a	0	0	n/a	0	0	0	16,033	24,049	9,240	18,480	5,569	6,793
2007	3	5,6,7,8	35,628	132,000	16,033	1 to 4	35,628	9,620	n/a	0	0	0	25,652	49,701	9,240	27,720	21,981	16,412
2008	4	5,6,7,8,9,10	53,442	132,000	24,049	1 to 4	35,628	9,620	n/a	0	0	0	33,668	83,370	9,240	36,960	46,410	24,428
2009	5	9,10,11,12,27,28	53,442	280,000	24,049	5,6,7,8	35,628	9,620	1 to 4	35,628	1,204	0	34,873	118,242	19,600	56,560	61,682	15,273
2010	6	11,12,13,14,26,27	53,442	400,000	24,049	9,10,28	26,721	7,215	1 to 8	71,256	2,408	0	33,672	151,914	28,000	84,560	67,354	5,672
2011	7	13,14,15,16,24,25,26	62,349	400,000	28,057	11,12,27,28	35,628	9,620	1 to 10	89,070	3,011	0	40,687	192,601	28,000	112,560	80,041	12,687
2012	8	14,15,16,17,24,25,26	62,349	400,000	28,057	13	8,907	2,405	1 to 12, 27 to 28	124,698	4,215	0	34,677	227,278	28,000	140,560	86,718	6,677
2013	9	16,17,19,23,24,25	53,442	400,000	24,049	13,14,15,26	35,628	9,620	1 to 12, 27 to 28	124,698	4,215	0	37,883	265,161	28,000	168,560	96,601	9,883
2014	10	16,17,19,21,22,23	53,442	400,000	24,049	24,25,26	26,721	7,215	1 to 15, 27 to 28	151,419	5,118	0	36,382	301,543	28,000	196,560	104,983	8,382
2015	11	17,19,21,22,23	44,535	400,000	20,041	16	8,907	2,405	1 to 15, 24 to 28	178,140	6,021	0	28,467	330,010	28,000	224,560	105,450	467
2016	12	17,18,19,20,21	44,535	400,000	20,041	16,22,23	26,721	3,607	1 to 15, 24 to 28	178,140	6,021	0	29,669	359,679	28,000	252,560	107,119	1,669
2017	13	18,20	17,814	200,000	8,016	17,19,21	26,721	3,607	1 to 16, 22 to 28	204,861	6,924	0	18,548	378,227	14,000	266,560	111,667	4,548
2018	14	n/a	0	0	0	17,18,19,20,21	44,535	6,012	1 to 16, 22 to 28	204,861	6,924	0	12,937	391,163	0	266,560	124,603	12,937
2019	15	n/a	0	0	0	0	0	0	1 to 28	249,396	8,430	0	8,430	399,593	0	266,560	133,033	8,430

Cell area (m^2)	8,907	Estimated maximum waste input (t/year)	400,000
Total rainfall (m/year)	0.835	Liquid waste input (t/year)	0
Effective Rainfall post vegetation (m/year)	0.338	Final Infiltration	0.10 10% of Effective Rainfall per annum
Density of *in-situ* waste (t/m^3)	0.800	Intermediate Infiltration	0.60 60% of Effective Rainfall per annum
Absorptive capacity (m^3/t)	0.070	Calculations are based on a 11 year landfill operation.	
Effective Rainfall before vegetation assumed to be (m)	0.450	Average cell capacity	107,143

[1] Area for Intermediate Restored Area includes cells 19 to 22 and the infiltration has been calculated using the appropriate periods
[2] Area for Restored Area includes cells 1 to 18 and the infiltration has been calculated using the appropriate periods

Appendix 5 Gas Monitoring Results & Predictive Model Output

Table 1: Summary of Methane Results from Landfill Gas Monitoring 2006 to Quarter 1 2007

Row ID	Gas tag	Sample Date	LG01	LG02	LG03	LG04	LG05	LG06	LG07	LG08	LG09	LG10	LG11	LG12	LG13	LG14	LG15	LG16	LG17	LG18	LG19	Trigger value
1	Methane	January 5, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
6	Methane	February 2, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
11	Methane	March 2, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
16	Methane	May 18, 2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
21	Methane	June 26, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
26	Methane	July 19, 2006	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
31	Methane	August 24, 2006	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
36	Methane	September 20, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
41	Methane	October 23, 2006	0.0	0.2	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
46	Methane	November 23, 2006	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	1.0
51	Methane	December 18, 2006	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	1.0
56	Methane	January 31, 2007	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
61	Methane	March 1, 2007	0.0	0.1	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0

Table 2: Summary of Carbon Dioxide Results from Landfill Gas Monitoring 2006 to Quarter 1 2007

Row ID	Gas tag	Sample Date	LG01	LG02	LG03	LG04	LG05	LG06	LG07	LG08	LG09	LG10	LG11	LG12	LG13	LG14	LG15	LG16	LG17	LG18	LG19	Trigger value
2	Carbon Dioxide	January 5, 2006	0.4	0.7	3.1	0.0	0.5	0.1	0.5	0.2	0.4	0.0	0.8	0.3	0.0	0.7	1.3	0.5	1.4	0.8	0.0	1.5
7	Carbon Dioxide	February 2, 2006	0.0	0.7	3.0	0.3	1.1	0.4	1.5	0.6	0.4	2.2	1.5	0.5	0.0	0.4	1.2	1.5	1.2	1.3	0.0	1.5
12	Carbon Dioxide	March 2, 2006	0.2	1.1	2.1	0.3	1.3	0.3	0.4	0.1	0.2	0.0	0.6	0.4	0.0	1.0	1.3	1.3	1.3	1.2	0.0	1.5
17	Carbon Dioxide	May 18, 2006	0.1	0.9	2.6	0.0	0.5	0.0	1.0	0.0	0.0	0.5	0.4	0.2	0.0	0.1	0.2	0.0	0.1	0.2	0.1	1.5
22	Carbon Dioxide	June 26, 2006	0.0	0.7	1.2	0.1	0.3	0.0	0.8	0.0	0.0	0.2	0.1	0.3	0.1	0.0	0.0	0.1	0.2	0.1	0.3	1.5
27	Carbon Dioxide	July 19, 2006	0.2	0.7		0.2	0.8	0.0	0.7	1.3	0.0	0.1	0.0	0.7	0.1	2.0	1.6	0.5	0.1	0.0	0.2	1.5
32	Carbon Dioxide	August 24, 2006	0.2	0.7		0.2	0.8	0.0	0.7	1.3	0.0	0.1	0.0	0.7	0.1	2.0	1.6	0.5	0.1	0.0	0.2	1.5
37	Carbon Dioxide	September 20, 2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
42	Carbon Dioxide	October 23, 2006	1.3	2.0	5.2	1.5	0.5	0.0	4.0	0.4	0.2	0.4	0.1	0.1	0.0	2.5	0.7	0.0	0.8	0.0	0.0	1.5
47	Carbon Dioxide	November 23, 2006	0.1	0.4	2.1	0.0	0.6	0.2	1.0	0.7	0.2	0.6	0.0	0.0	0.0		0.7	0.0	0.9	0.1	0.0	1.5
52	Carbon Dioxide	December 18, 2006	0.0	0.3	0.8	0.5	0.5	0.2	0.8	0.6	0.1	0.4	0.1	0.2	0.1		0.3	0.1	1.0	0.1	0.0	1.5
57	Carbon Dioxide	January 31, 2007	0.0	0.1	1.4	1.2	0.3	0.1	0.3	0.1	0.0	0.1	0.0	0.0	0.0	1.4	0.6	0.0	0.2	0.0	0.0	1.5
62	Carbon Dioxide	March 1, 2007	0.1	0.1	0.8	0.3	1.0	0.0	0.8	0.0	0.0	0.4	0.1	0.1	0.0	1.7	0.5	0.0	1.0	0.1	0.0	1.5

Table 3: Landfill Gas Monitoring Quarter 2 2007

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 26/04/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Dry, Warm	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	20.8	1006	
LG-02	Borehole	0.0	0.0	20.6	1006	
LG-03	Borehole	0.0	0.0	20.5	1006	
LG-04	Borehole	0.0	3.7	5.6	1006	
LG-05	Borehole	0.0	0.1	19.6	1006	
LG-06	Borehole	0.0	0.0	20.3	1006	
LG-07	Borehole	0.0	0.4	19.8	1006	
LG-08	Borehole	0.0	0.0	20.3	1006	
LG-09	Borehole	0.0	0.0	20.3	1006	
LG-10	Borehole	0.0	0.5	19.7	1006	
LG-11	Borehole	0.0	0.0	20.3	1006	
LG-12	Borehole	0.0	0.0	19.8	1006	
LG-13	Borehole	0.0	0.0	20.3	1006	
LG-14	Borehole	0.0	0.4	17.1	1006	
LG-15	Borehole	0.0	0.0	20.0	1006	
LG-16	Borehole	0.0	0.0	20.3	1006	
LG-17	Borehole	0.0	0.0	20.3	1006	
LG-18	Borehole	0.0	0.0	20.3	1006	
LG-19	Borehole	0.0	0.0	20.3	1006	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 23/05/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Dry, Warm	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	19.5	1014	
LG-02	Borehole	0.0	0.0	20.7	1014	
LG-03	Borehole	0.0	0.0	20.5	1014	
LG-04	Borehole	0.0	3.0	12.5	1014	
LG-05	Borehole	0.0	0.0	20.5	1014	
LG-06	Borehole	0.0	0.0	20.5	1014	
LG-07	Borehole	0.0	0.0	20.4	1014	
LG-08	Borehole	0.0	0.0	20.4	1014	
LG-09	Borehole	0.0	0.0	20.5	1014	
LG-10	Borehole	0.0	0.1	19.5	1014	
LG-11	Borehole	0.0	0.0	20.4	1014	
LG-12	Borehole	0.0	0.2	19.0	1014	
LG-13	Borehole	0.0	0.0	20.4	1014	
LG-14	Borehole	0.0	0.0	20.5	1014	
LG-15	Borehole	0.0	0.1	20.1	1014	
LG-16	Borehole	0.0	0.0	20.3	1014	
LG-17	Borehole	0.0	0.0	19.5	1014	
LG-18	Borehole	0.0	0.0	20.4	1014	
LG-19	Borehole	0.0	0.0	20.3	1014	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 20/06/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**:	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.0	999	
LG-02	Borehole	0.0	2.7	9.2	999	
LG-03	Borehole	2.9	3.1	0.0	999	
LG-04	Borehole	0.0	0.2	19.8	999	
LG-05	Borehole	0.0	0.3	20.0	999	
LG-06	Borehole	0.0	0.0	20.7	999	
LG-07	Borehole	0.0	1.9	19.1	999	
LG-08	Borehole	0.0	0.0	20.7	999	
LG-09	Borehole	0.0	0.0	20.7	999	
LG-10	Borehole	0.0	0.0	20.4	999	
LG-11	Borehole	0.0	0.0	20.4	999	
LG-12	Borehole	0.0	0.0	20.3	999	
LG-13	Borehole	0.0	0.0	20.6	999	
LG-14	Borehole	0.0	0.0	20.0	999	
LG-15	Borehole	0.0	0.1	20.0	999	
LG-16	Borehole	0.0	0.0	20.4	999	
LG-17	Borehole	0.0	0.0	20.8	999	
LG-18	Borehole	0.0	0.0	20.7	999	
LG-19	Borehole	0.0	0.0	20.7	999	

Table 4: Landfill Gas Monitoring Quarter 3 2007

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 18/072007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, Raining	

Results						
Sample Station Number	**Borehole/ spike/other**	**CH_4 (% v/v)**	**CO_2 (% v/v)**	**O_2 (% v/v)**	**Barometric Pressure (mb)**	**Comment**
LG-01	Borehole	0.0	0.0	21.0	1008	
LG-02	Borehole	0.0	0.0	21.0	1008	
LG-03	Borehole	15.0	2.9	0.6	1008	
LG-04	Borehole	0.0	1.5	18.9	1008	
LG-05	Borehole	0.0	0.0	20.0	1008	
LG-06	Borehole	0.0	0.0	20.4	1008	
LG-07	Borehole	0.0	0.0	20.6	1008	
LG-08	Borehole	0.0	0.0	20.1	1008	
LG-09	Borehole	0.0	0.0	20.4	1008	
LG-10	Borehole	0.0	0.0	20.4	1008	
LG-11	Borehole	0.0	0.0	20.4	1008	
LG-12	Borehole	0.0	0.2	20.5	1008	
LG-13	Borehole	0.0	0.0	20.4	1008	
LG-14	Borehole	0.0	0.0	20.5	1008	
LG-15	Borehole	0.0	0.0	20.4	1008	
LG-16	Borehole	0.0	0.2	20.0	1008	
LG-17	Borehole	0.0	0.0	20.4	1008	
LG-18	Borehole	0.0	0.0	20.6	1008	
LG-19	Borehole	0.0	0.0	20.5	1008	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 15/08/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.0	1012	
LG-02	Borehole	0.0	0.0	21.0	1012	
LG-03	Borehole	31.5	5.1	.04	1012	
LG-04	Borehole	0.1	2.0	15.6	1012	
LG-05	Borehole	0.0	0.4	20.3	1012	
LG-06	Borehole	0.0	0.0	20.8	1012	
LG-07	Borehole	0.0	0.9	19.8	1012	
LG-08	Borehole	0.0	0.0	20.7	1012	
LG-09	Borehole	0.0	0.0	20.7	1012	
LG-10	Borehole	0.0	0.2	20.4	1012	
LG-11	Borehole	0.0	0.0	20.6	1012	
LG-12	Borehole	0.0	0.0	20.6	1012	
LG-13	Borehole	0.0	0.0	20.7	1012	
LG-14	Borehole	0.0	0.4	19.5	1012	
LG-15	Borehole	0.0	0.7	19.2	1012	
LG-16	Borehole	0.0	0.0	20.5	1012	
LG-17	Borehole	0.0	0.1	20.3	1012	
LG-18	Borehole	0.0	0.0	20.5	1012	
LG-19	Borehole	0.0	0.2	19.8	1012	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 14/09/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: warm, dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.7	19.4	1012	
LG-02	Borehole	0.0	0.2	18.3	1012	
LG-03	Borehole	16.1	3.1	0.8	1012	
LG-04	Borehole	0.0	3.5	15.8	1012	
LG-05	Borehole	0.0	1.3	19.3	1012	
LG-06	Borehole	0.0	0.0	21.0	1012	
LG-07	Borehole	0.0	0.9	19.4	1012	
LG-08	Borehole	0.0	0.0	20.6	1012	
LG-09	Borehole	0.0	0.0	20.7	1012	
LG-10	Borehole	0.0	0.0	20.5	1012	
LG-11	Borehole	0.0	0.0	20.6	1012	
LG-12	Borehole	0.0	0.0	20.4	1012	
LG-13	Borehole	0.0	0.0	20.6	1012	
LG-14	Borehole	0.0	0.7	17.9	1012	
LG-15	Borehole	0.0	0.5	19.9	1012	
LG-16	Borehole	0.0	0.0	20.4	1012	
LG-17	Borehole	0.0	0.7	19.7	1012	
LG-18	Borehole	0.0	0.0	20.7	1012	
LG-19	Borehole	0.0	0.0	20.6	1012	

Table 5: Landfill Gas Monitoring Quarter 4 2007

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 12/10/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, Dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.1	1012	
LG-02	Borehole	0.0	0.4	19.8	1012	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	1.8	19.4	1012	
LG-06	Borehole	0.0	0.0	20.7	1012	
LG-07	Borehole	0.0	3.8	14.8	1012	
LG-08	Borehole	0.0	0.0	20.8	1012	
LG-09	Borehole	0.0	0.0	21.0	1012	
LG-10	Borehole	0.0	0.7	20.3	1012	
LG-11	Borehole	0.0	0.0	20.8	1012	
LG-12	Borehole	0.0	0.0	20.5	1012	
LG-13	Borehole	0.0	0.0	20.6	1012	
LG-14	Borehole	0.0	0.6	18.9	1012	
LG-15	Borehole	0.0	0.4	20.0	1012	
LG-16	Borehole	0.0	0.0	20.4	1012	
LG-17	Borehole	0.0	0.7	19.5	1012	
LG-18	Borehole	0.0	0.0	20.6	1012	
LG-19	Borehole	0.0	0.0	20.7	1012	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 09/11/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.1	1010	
LG-02	Borehole	0.0	0.0	21.3		
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	2.3	16.5	1010	
LG-06	Borehole	0.0	0.0	21.5	1010	
LG-07	Borehole	0.0	4.6	6.6	1010	
LG-08	Borehole	0.0	0.0	21.3	1010	
LG-09	Borehole	0.0	0.0	21.2	1010	
LG-10	Borehole	0.0	3.7	18.1	1010	
LG-11	Borehole	0.0	0.0	21.3	1010	
LG-12	Borehole	0.0	0.2	18.9	1010	
LG-13	Borehole	0.0	0.0	21.0	1010	
LG-14	Borehole	0.0	0.8	19.0	1010	
LG-15	Borehole	0.0	0.4	20.6	1010	
LG-16	Borehole	0.0	0.0	21.3	1010	
LG-17	Borehole	0.0	1.1	18.9	1010	
LG-18	Borehole	0.0	0.0	21.0	1010	
LG-19	Borehole	0.0	0.0	21.3	1010	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 07/12/2007	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Cold, Raining	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.1	1006	
LG-02	Borehole	0.0	0.1	20.3	1006	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.6	19.7	1006	
LG-06	Borehole	0.0	0.0	21.5	1006	
LG-07	Borehole	0.0	0.9	16.6	1006	
LG-08	Borehole	0.0	0.0	21.0	1006	
LG-09	Borehole	0.0	0.0	21.1	1006	
LG-10	Borehole	0.0	1.1	18.1	1006	
LG-11	Borehole	0.0	0.0	21.3	1006	
LG-12	Borehole	0.0	0.2	19.9	1006	
LG-13	Borehole	0.0	0.0	21.1	1006	
LG-14	Borehole	0.0	0.8	19.0	1006	
LG-15	Borehole	0.0	0.4	20.6	1006	
LG-16	Borehole	0.0	0.0	21.3	1006	
LG-17	Borehole	0.0	0.5	18.9	1006	
LG-18	Borehole	0.0	0.0	21.0	1006	
LG-19	Borehole	0.0	0.0	21.3	1006	

Table 6: Landfill Gas Monitoring Quarter 1 2008

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		Site Address: Knockharley, Co. Meath	
Operator: GREENSTAR		National Grid Reference: E2977 N2675	
Site Status: Operational		Date: 09/01/2008	
Instrument used: Gas Data LMSx	Normal Analytical Range: 0 – 100%		
Monitoring Personnel: OCM		Weather: Warm, Dry	

Results						
Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.0	1006	
LG-02	Borehole	0.0	0.0	20.7	1006	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.6	19.8	1006	
LG-06	Borehole	0.0	0.0	20.8	1006	
LG-07	Borehole	0.0	0.4	18.7	1006	
LG-08	Borehole	0.0	0.0	20.7	1006	
LG-09	Borehole	0.0	0.0	20.7	1006	
LG-10	Borehole	0.0	0.1	20.3	1006	
LG-11	Borehole	0.0	0.0	20.7	1006	
LG-12	Borehole	0.0	0.0	20.7	1006	
LG-13	Borehole	0.0	0.0	20.7	1006	
LG-14	Borehole	0.0	1.0	16.4	1006	
LG-15	Borehole	0.0	0.0	20.7	1006	
LG-16	Borehole	0.0	0.0	20.8	1006	
LG-17	Borehole	0.0	1.1	13.7	1006	
LG-18	Borehole	0.0	0.0	20.7	1006	
LG-19	Borehole	0.0	0.0	20.7	1006	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 06/02/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range:** 0 – 100%		
Monitoring Personnel: OCM		**Weather:** Warm, dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.1	21.4	1006	
LG-02	Borehole	0.0	0.0	21.6	1006	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.4	20.8	1006	
LG-06	Borehole	0.0	0.0	21.2	1006	
LG-07	Borehole	0.0	1.9	18.4	1006	
LG-08	Borehole	0.0	0.0	21.3	1006	
LG-09	Borehole	0.0	0.0	21.2	1006	
LG-10	Borehole	0.0	1.7	19.5	1006	
LG-11	Borehole	0.0	0.0	21.5	1006	
LG-12	Borehole	0.0	0.0	21.2	1006	
LG-13	Borehole	0.0	0.0	21.3	1006	
LG-14	Borehole	0.0	1.1	15.4	1006	
LG-15	Borehole	0.0	0.0	21.0	1006	
LG-16	Borehole	0.0	0.0	21.3	1006	
LG-17	Borehole	0.0	1.3	12.5	1006	
LG-18	Borehole	0.0	0.0	21.0	1006	
LG-19	Borehole	0.0	0.0	21.1	1006	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 06/03/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Cold, Raining	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.2	0.3	20.9	1028	
LG-02	Borehole	0.2	1.0	18.6	1027	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.9	20.4	1027	
LG-06	Borehole	0.0	0.1	20.7	1027	
LG-07	Borehole	0.0	1.8	19.8	1026	
LG-08	Borehole	0.0	0.3	20.6	1026	
LG-09	Borehole	0.0	0.1	20.6	1026	
LG-10	Borehole	0.0	1.9	19.9	1026	
LG-11	Borehole	0.0	0.1	20.6	1025	
LG-12	Borehole	0.0	0.1	20.6	1025	
LG-13	Borehole	0.0	0.1	20.6	1025	
LG-14	Borehole	0.0	1.0	17.9	1024	
LG-15	Borehole	0.0	0.3	20.4	1024	
LG-16	Borehole	0.0	0.1	20.5	1024	
LG-17	Borehole	0.0	1.6	14.2	1023	
LG-18	Borehole	0.0	0.1	20.5	1023	
LG-19	Borehole	0.0	0.1	20.5	1023	

Table 7: Landfill Gas Monitoring Quarter 2 2008

LANDFILL GAS MONITORING FORM	**Baseline**		**Ambient**
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 03/04/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, Dry	

Results

Sample Station Number	**Borehole/ spike/other**	**CH_4 (% v/v)**	**CO_2 (% v/v)**	**O_2 (% v/v)**	**Barometric Pressure (mb)**	**Comment**
LG-01	Borehole	0.0	0.0	18.4	1028	
LG-02	Borehole	0.0	0.0	18.4	1028	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.2	18.2	1028	
LG-06	Borehole	0.0	0.0	18.4	1028	
LG-07	Borehole	0.0	0.2	18.2	1027	
LG-08	Borehole	0.0	0.0	18.5	1027	
LG-09	Borehole	0.0	0.0	18.4	1027	
LG-10	Borehole	0.0	0.2	18.2	1027	
LG-11	Borehole	0.0	0.0	18.4	1027	
LG-12	Borehole	0.0	0.0	18.4	1026	
LG-13	Borehole	0.0	0.0	18.4	1026	
LG-14	Borehole	0.0	0.2	18.2	1026	
LG-15	Borehole	0.0	0.0	18.3	1026	
LG-16	Borehole	0.0	0.1	18.3	1026	
LG-17	Borehole	0.0	0.2	17.8	1026	
LG-18	Borehole	0.0	0.2	18.1	1026	
LG-19	Borehole	0.0	0.0	18.3	1026	

LANDFILL GAS MONITORING FORM	**Baseline**		**Ambient**
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 08/05/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	20.4	1003	
LG-02	Borehole	0.0	0.2	19.5	1003	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.1	0.1	19.6	1003	
LG-06	Borehole	0.0	0.0	20.5	1003	
LG-07	Borehole	0.0	0.0	20.1	1003	
LG-08	Borehole	0.0	0.0	20.3	1003	
LG-09	Borehole	0.0	0.0	20.3	1003	
LG-10	Borehole	0.0	0.0	20.3	1003	
LG-11	Borehole	0.0	0.0	20.3	1003	
LG-12	Borehole	0.0	0.0	20.3	1003	
LG-13	Borehole	0.0	0.0	20.3	1003	
LG-14	Borehole	0.0	0.0	20.3	1003	
LG-15	Borehole	0.0	0.0	19.7	1003	
LG-16	Borehole	0.0	0.0	20.3	1003	
LG-17	Borehole	0.0	0.0	19.4	1003	
LG-18	Borehole	0.0	0.0	20.3	1003	
LG-19	Borehole	0.0	0.0	20.3	1003	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 06/06/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm. Dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	20.3	1019	
LG-02	Borehole	0.0	0.0	19.6	1019	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.1	0.0	20.3	1019	
LG-06	Borehole	0.0	0.0	20.3	1019	
LG-07	Borehole	0.0	0.5	19.7	1019	
LG-08	Borehole	0.0	0.0	20.3	1019	
LG-09	Borehole	0.0	0.0	20.4	1019	
LG-10	Borehole	0.0	0.0	20.4	1019	
LG-11	Borehole	0.0	0.0	20.4	1019	
LG-12	Borehole	0.0	0.0	20.4	1019	
LG-13	Borehole	0.0	0.0	20.4	1019	
LG-14	Borehole	0.0	0.0	20.2	1019	
LG-15	Borehole	0.0	0.0	20.0	1019	
LG-16	Borehole	0.0	0.0	20.3	1019	
LG-17	Borehole	0.0	0.4	19.5	1019	
LG-18	Borehole	0.0	0.0	20.3	1019	
LG-19	Borehole	0.0	0.0	20.3	1019	

Table 8 Landfill Gas monitoring Quarter 3 2008

LANDFILL GAS MONITORING FORM	**Baseline**		**Ambient**
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 08/08/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, dry	

Results

Sample Station Number	**Borehole/ spike/other**	**CH_4 (% v/v)**	**CO_2 (% v/v)**	**O_2 (% v/v)**	**Barometric Pressure (mb)**	**Comment**
LG-01	Borehole	0.0	0.0	21.0	1011	
LG-02	Borehole	0.0	0.1	20.9	1011	
LG-03	Borehole	-	-	-	-	Removed in Sept 2007
LG-04	Borehole	-	-	-	-	Removed in Sept 2007
LG-05	Borehole	0.0	0.3	20.9	1011	
LG-06	Borehole	0.0	0.0	21.1	1010	
LG-07	Borehole	0.0	4.6	15.9	1010	
LG-08	Borehole	0.0	0.0	21.0	1010	
LG-09	Borehole	0.0	0.0	21.0	1010	
LG-10	Borehole	0.0	0.2	20.9	1010	
LG-11	Borehole	0.0	0.0	21.0	1010	
LG-12	Borehole	0.0	0.0	20.8	1010	
LG-13	Borehole	0.0	0.0	21.0	1010	
LG-14	Borehole	0.0	0.3	20.8	1010	
LG-15	Borehole	0.0	0.8	19.8	1010	
LG-16	Borehole	0.0	0.0	20.8	1010	
LG-17	Borehole	0.0	0.9	19.8	1010	
LG-18	Borehole	0.0	0.0	20.8	1010	
LG-19	Borehole	0.0	0.0	21.0	1010	

LANDFILL GAS MONITORING FORM	Baseline		Ambient
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 05/09/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Mild, Wet	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	0.0	21.0	990	
LG-02	Borehole	0.0	0.5	20.9	990	
LG-03	Borehole	0.0	0.5	20.0	990	
LG-04	Borehole	0.0	0.6	20.1	990	
LG-05	Borehole	0.0	0.5	20.9	990	
LG-06	Borehole	0.0	0.0	21.0	990	
LG-07	Borehole	0.0	0.3	20.0	990	
LG-08	Borehole	0.0	0.0	21.0	990	
LG-09	Borehole	0.0	0.0	21.0	990	
LG-10	Borehole	0.0	0.3	20.3	990	
LG-11	Borehole	0.0	0.0	21.0	990	
LG-12	Borehole	0.0	0.0	20.8	990	
LG-13	Borehole	0.0	0.0	21.0	990	
LG-14	Borehole	0.0	0.3	20.8	990	
LG-15	Borehole	0.0	0.8	19.8	990	
LG-16	Borehole	0.0	0.0	20.8	990	
LG-17	Borehole	0.0	0.5	20.1	990	
LG-18	Borehole	0.0	0.0	20.8	990	
LG-19	Borehole	0.0	0.0	21.0	990	
LG-20	Borehole	0.0	0.8	18.5	990	

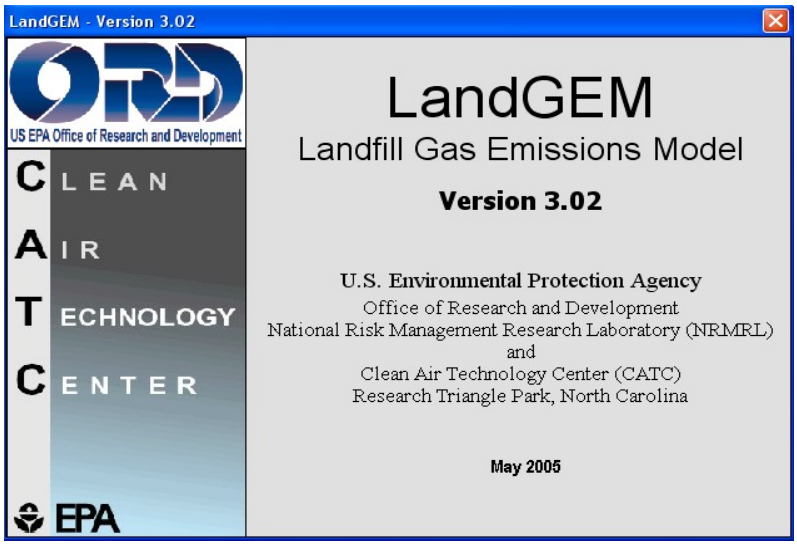
LG-21	Borehole	0.0	0.5	19.8	990	
LG-22	Borehole	0.0	0.9	18.8	990	
LG-23	Borehole	0.0	0.6	19.0	990	
LG-24	Borehole	0.0	0.3	20.1	990	
LG-25	Borehole	0.0	0.2	20.1	990	
LG-50	Borehole	0.0	2.1	17.1	990	
LG-51	Borehole	0.0	3.5	17.0	990	
LG-52	Borehole	0.0	3.3	17.3	990	
LG-53	Borehole	0.0	3.0	17.5	990	
LG-54	Borehole	0.0	3.9	17.0	990	

LANDFILL GAS MONITORING FORM	**Baseline**		**Ambient**
Site Name: Greenstar Ltd. – Knockharley Facility		**Site Address**: Knockharley, Co. Meath	
Operator: GREENSTAR		**National Grid Reference**: E2977 N2675	
Site Status: Operational		**Date**: 24/09/2008	
Instrument used: Gas Data LMSx	**Normal Analytical Range**: 0 – 100%		
Monitoring Personnel: OCM		**Weather**: Warm, Dry	

Results

Sample Station Number	Borehole/ spike/other	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Barometric Pressure (mb)	Comment
LG-01	Borehole	0.0	2.4	19.0	1025	
LG-02	Borehole	0.0	4.2	9.5	1025	
LG-03	Borehole	0.0	0.4	20.5	1025	
LG-04	Borehole	0.0	5.1	14.5	1025	
LG-05	Borehole	0.0	0.6	20.2	1025	
LG-06	Borehole	0.0	0.0	20.7	1025	
LG-07	Borehole	0.0	1.9	19.4	1025	
LG-08	Borehole	0.0	0.3	20.7	1025	
LG-09	Borehole	0.0	0.5	20.4	1025	
LG-10	Borehole	0.0	0.0	20.1	1025	
LG-11	Borehole	0.0	0.0	20.8	1025	
LG-12	Borehole	0.0	0.0	20.0	1025	
LG-13	Borehole	0.0	0.2	20.1	1025	
LG-14	Borehole	0.0	0.6	19.5	1025	
LG-15	Borehole	0.0	0.5	19.5	1025	
LG-16	Borehole	0.0	1.0	19.0	1025	
LG-17	Borehole	0.0	0.1	20.1	1025	
LG-18	Borehole	0.0	0.0	20.0	1025	
LG-19	Borehole	0.0	0.1	20.1	1025	
LG-20	Borehole	0.0	0.0	20.0	1025	

LG-21	Borehole	0.0	0.1	20.1	1025	
LG-22	Borehole	0.0	0.3	20.5	1025	
LG-23	Borehole	0.0	1.2	18.6	1025	
LG-24	Borehole	0.0	0.7	20.2	1025	
LG-25	Borehole	0.0	1.2	16.0	1025	
LG-50	Borehole	0.0	2.7	12.2	1025	
LG-51	Borehole	0.0	4.7	14.6	1025	
LG-52	Borehole	0.0	3.6	15.8	1025	
LG-53	Borehole	0.0	4.6	10.1	1025	
LG-54	Borehole	0.0	4.0	14.0	1025	



Summary Report

Landfill Name or Identifier: Knockharley Landfill (Job No. CE07-172-02)

Date: 05 November 2008

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the i^{th} year (Mg)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2005**	
Landfill Closure Year (with 80-year limit)	**2017**	
Actual Closure Year (without limit)	***2017***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity	**3,800,000**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.050**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**4,000**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1: **Total landfill gas**
Gas / Pollutant #2: **Methane**
Gas / Pollutant #3:
Gas / Pollutant #4:

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2005	132,000	145,200	0	0
2006	132,000	145,200	132,000	145,200
2007	132,000	145,200	264,000	290,400
2008	132,000	145,200	396,000	435,600
2009	280,000	308,000	528,000	580,800
2010	250,000	275,000	808,000	888,800
2011	250,000	275,000	1,058,000	1,163,800
2012	250,000	275,000	1,308,000	1,438,800
2013	250,000	275,000	1,558,000	1,713,800
2014	250,000	275,000	1,808,000	1,988,800
2015	250,000	275,000	2,058,000	2,263,800
2016	250,000	275,000	2,308,000	2,538,800
2017	125,000	137,500	2,558,000	2,813,800
2018	0	0	2,683,000	2,951,300
2019	0	0	2,683,000	2,951,300
2020	0	0	2,683,000	2,951,300
2021	0	0	2,683,000	2,951,300
2022	0	0	2,683,000	2,951,300
2023	0	0	2,683,000	2,951,300
2024	0	0	2,683,000	2,951,300
2025	0	0	2,683,000	2,951,300
2026	0	0	2,683,000	2,951,300
2027	0	0	2,683,000	2,951,300
2028	0	0	2,683,000	2,951,300
2029	0	0	2,683,000	2,951,300
2030	0	0	2,683,000	2,951,300
2031	0	0	2,683,000	2,951,300
2032	0	0	2,683,000	2,951,300
2033	0	0	2,683,000	2,951,300
2034	0	0	2,683,000	2,951,300
2035	0	0	2,683,000	2,951,300
2036	0	0	2,683,000	2,951,300
2037	0	0	2,683,000	2,951,300
2038	0	0	2,683,000	2,951,300
2039	0	0	2,683,000	2,951,300
2040	0	0	2,683,000	2,951,300
2041	0	0	2,683,000	2,951,300
2042	0	0	2,683,000	2,951,300
2043	0	0	2,683,000	2,951,300
2044	0	0	2,683,000	2,951,300

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2045	0	0	2,683,000	2,951,300
2046	0	0	2,683,000	2,951,300
2047	0	0	2,683,000	2,951,300
2048	0	0	2,683,000	2,951,300
2049	0	0	2,683,000	2,951,300
2050	0	0	2,683,000	2,951,300
2051	0	0	2,683,000	2,951,300
2052	0	0	2,683,000	2,951,300
2053	0	0	2,683,000	2,951,300
2054	0	0	2,683,000	2,951,300
2055	0	0	2,683,000	2,951,300
2056	0	0	2,683,000	2,951,300
2057	0	0	2,683,000	2,951,300
2058	0	0	2,683,000	2,951,300
2059	0	0	2,683,000	2,951,300
2060	0	0	2,683,000	2,951,300
2061	0	0	2,683,000	2,951,300
2062	0	0	2,683,000	2,951,300
2063	0	0	2,683,000	2,951,300
2064	0	0	2,683,000	2,951,300
2065	0	0	2,683,000	2,951,300
2066	0	0	2,683,000	2,951,300
2067	0	0	2,683,000	2,951,300
2068	0	0	2,683,000	2,951,300
2069	0	0	2,683,000	2,951,300
2070	0	0	2,683,000	2,951,300
2071	0	0	2,683,000	2,951,300
2072	0	0	2,683,000	2,951,300
2073	0	0	2,683,000	2,951,300
2074	0	0	2,683,000	2,951,300
2075	0	0	2,683,000	2,951,300
2076	0	0	2,683,000	2,951,300
2077	0	0	2,683,000	2,951,300
2078	0	0	2,683,000	2,951,300
2079	0	0	2,683,000	2,951,300
2080	0	0	2,683,000	2,951,300
2081	0	0	2,683,000	2,951,300
2082	0	0	2,683,000	2,951,300
2083	0	0	2,683,000	2,951,300
2084	0	0	2,683,000	2,951,300

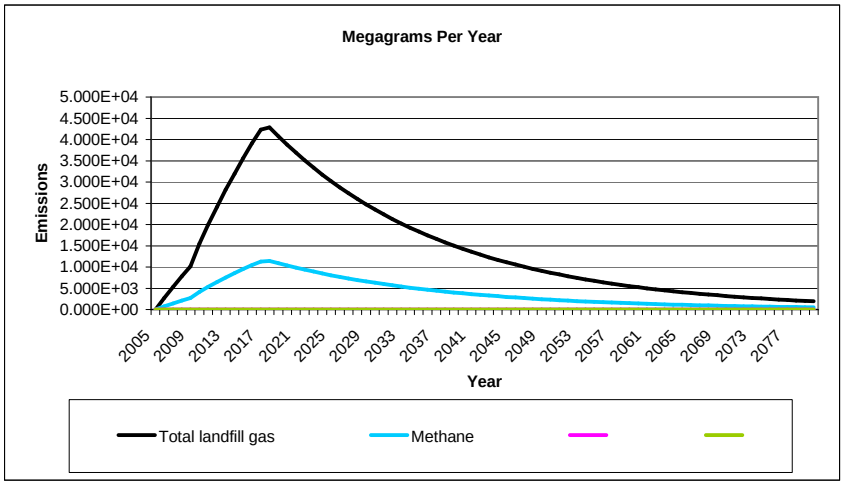
Pollutant Parameters

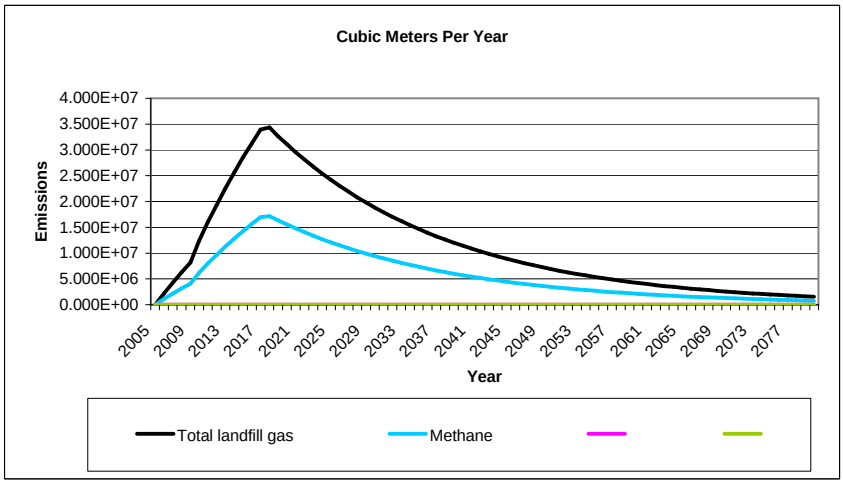
		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

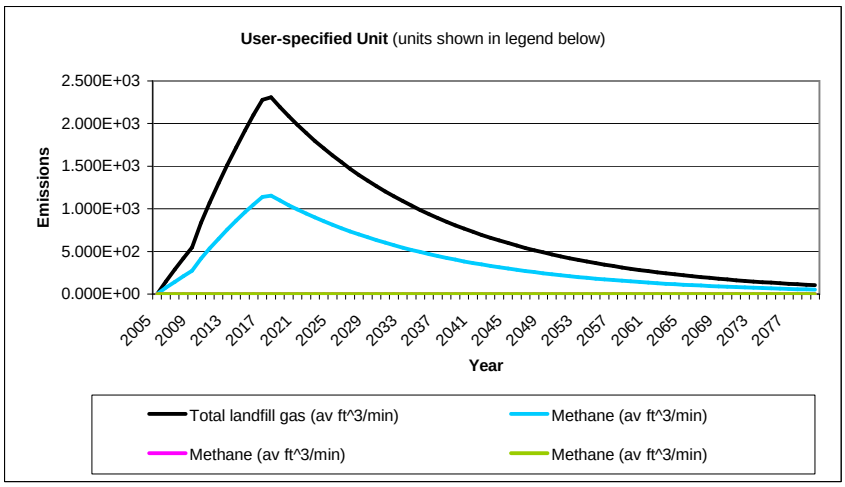
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		***User-specified Pollutant Parameters:***	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
5.000E+04
4.500E+04
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061 2065 2069 2073 2077
Year
Total landfill gas
Methane


Cubic Meters Per Year
Emissions
4.000E+07
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061 2065 2069 2073 2077
Year
Total landfill gas
Methane


User-specified Unit (units shown in legend below)
Emissions
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061 2065 2069 2073 2077
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Methane (av ft^3/min)
Methane (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2005	0	0	0	0	0	0
2006	2.740E+03	2.194E+06	1.474E+02	7.320E+02	1.097E+06	7.372E+01
2007	5.347E+03	4.282E+06	2.877E+02	1.428E+03	2.141E+06	1.438E+02
2008	7.826E+03	6.267E+06	4.211E+02	2.091E+03	3.134E+06	2.105E+02
2009	1.019E+04	8.156E+06	5.480E+02	2.721E+03	4.078E+06	2.740E+02
2010	1.550E+04	1.241E+07	8.340E+02	4.141E+03	6.206E+06	4.170E+02
2011	1.994E+04	1.596E+07	1.073E+03	5.325E+03	7.982E+06	5.363E+02
2012	2.415E+04	1.934E+07	1.299E+03	6.451E+03	9.670E+06	6.497E+02
2013	2.816E+04	2.255E+07	1.515E+03	7.523E+03	1.128E+07	7.577E+02
2014	3.198E+04	2.561E+07	1.721E+03	8.542E+03	1.280E+07	8.603E+02
2015	3.561E+04	2.852E+07	1.916E+03	9.512E+03	1.426E+07	9.580E+02
2016	3.906E+04	3.128E+07	2.102E+03	1.043E+04	1.564E+07	1.051E+03
2017	4.235E+04	3.391E+07	2.278E+03	1.131E+04	1.696E+07	1.139E+03
2018	4.288E+04	3.434E+07	2.307E+03	1.145E+04	1.717E+07	1.153E+03
2019	4.079E+04	3.266E+07	2.194E+03	1.089E+04	1.633E+07	1.097E+03
2020	3.880E+04	3.107E+07	2.087E+03	1.036E+04	1.553E+07	1.044E+03
2021	3.691E+04	2.955E+07	1.986E+03	9.858E+03	1.478E+07	9.928E+02
2022	3.511E+04	2.811E+07	1.889E+03	9.377E+03	1.406E+07	9.444E+02
2023	3.339E+04	2.674E+07	1.797E+03	8.920E+03	1.337E+07	8.983E+02
2024	3.177E+04	2.544E+07	1.709E+03	8.485E+03	1.272E+07	8.545E+02
2025	3.022E+04	2.420E+07	1.626E+03	8.071E+03	1.210E+07	8.129E+02
2026	2.874E+04	2.302E+07	1.546E+03	7.677E+03	1.151E+07	7.732E+02
2027	2.734E+04	2.189E+07	1.471E+03	7.303E+03	1.095E+07	7.355E+02
2028	2.601E+04	2.083E+07	1.399E+03	6.947E+03	1.041E+07	6.996E+02
2029	2.474E+04	1.981E+07	1.331E+03	6.608E+03	9.905E+06	6.655E+02
2030	2.353E+04	1.884E+07	1.266E+03	6.286E+03	9.422E+06	6.331E+02
2031	2.238E+04	1.792E+07	1.204E+03	5.979E+03	8.962E+06	6.022E+02
2032	2.129E+04	1.705E+07	1.146E+03	5.688E+03	8.525E+06	5.728E+02
2033	2.025E+04	1.622E+07	1.090E+03	5.410E+03	8.109E+06	5.449E+02
2034	1.927E+04	1.543E+07	1.037E+03	5.146E+03	7.714E+06	5.183E+02
2035	1.833E+04	1.468E+07	9.860E+02	4.895E+03	7.338E+06	4.930E+02
2036	1.743E+04	1.396E+07	9.380E+02	4.657E+03	6.980E+06	4.690E+02
2037	1.658E+04	1.328E+07	8.922E+02	4.429E+03	6.639E+06	4.461E+02
2038	1.577E+04	1.263E+07	8.487E+02	4.213E+03	6.316E+06	4.243E+02
2039	1.500E+04	1.202E+07	8.073E+02	4.008E+03	6.008E+06	4.037E+02
2040	1.427E+04	1.143E+07	7.679E+02	3.813E+03	5.715E+06	3.840E+02
2041	1.358E+04	1.087E+07	7.305E+02	3.627E+03	5.436E+06	3.652E+02
2042	1.291E+04	1.034E+07	6.949E+02	3.450E+03	5.171E+06	3.474E+02
2043	1.228E+04	9.837E+06	6.610E+02	3.281E+03	4.919E+06	3.305E+02
2044	1.169E+04	9.357E+06	6.287E+02	3.121E+03	4.679E+06	3.144E+02
2045	1.112E+04	8.901E+06	5.981E+02	2.969E+03	4.451E+06	2.990E+02
2046	1.057E+04	8.467E+06	5.689E+02	2.824E+03	4.233E+06	2.844E+02
2047	1.006E+04	8.054E+06	5.412E+02	2.687E+03	4.027E+06	2.706E+02
2048	9.568E+03	7.661E+06	5.148E+02	2.556E+03	3.831E+06	2.574E+02
2049	9.101E+03	7.288E+06	4.897E+02	2.431E+03	3.644E+06	2.448E+02
2050	8.657E+03	6.932E+06	4.658E+02	2.312E+03	3.466E+06	2.329E+02
2051	8.235E+03	6.594E+06	4.431E+02	2.200E+03	3.297E+06	2.215E+02
2052	7.833E+03	6.273E+06	4.214E+02	2.092E+03	3.136E+06	2.107E+02
2053	7.451E+03	5.967E+06	4.009E+02	1.990E+03	2.983E+06	2.004E+02
2054	7.088E+03	5.676E+06	3.813E+02	1.893E+03	2.838E+06	1.907E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2055	6.742E+03	5.399E+06	3.627E+02	1.801E+03	2.699E+06	1.814E+02
2056	6.413E+03	5.135E+06	3.451E+02	1.713E+03	2.568E+06	1.725E+02
2057	6.101E+03	4.885E+06	3.282E+02	1.630E+03	2.443E+06	1.641E+02
2058	5.803E+03	4.647E+06	3.122E+02	1.550E+03	2.323E+06	1.561E+02
2059	5.520E+03	4.420E+06	2.970E+02	1.474E+03	2.210E+06	1.485E+02
2060	5.251E+03	4.205E+06	2.825E+02	1.403E+03	2.102E+06	1.413E+02
2061	4.995E+03	4.000E+06	2.687E+02	1.334E+03	2.000E+06	1.344E+02
2062	4.751E+03	3.804E+06	2.556E+02	1.269E+03	1.902E+06	1.278E+02
2063	4.519E+03	3.619E+06	2.432E+02	1.207E+03	1.809E+06	1.216E+02
2064	4.299E+03	3.442E+06	2.313E+02	1.148E+03	1.721E+06	1.156E+02
2065	4.089E+03	3.275E+06	2.200E+02	1.092E+03	1.637E+06	1.100E+02
2066	3.890E+03	3.115E+06	2.093E+02	1.039E+03	1.557E+06	1.046E+02
2067	3.700E+03	2.963E+06	1.991E+02	9.884E+02	1.481E+06	9.954E+01
2068	3.520E+03	2.818E+06	1.894E+02	9.402E+02	1.409E+06	9.468E+01
2069	3.348E+03	2.681E+06	1.801E+02	8.943E+02	1.340E+06	9.007E+01
2070	3.185E+03	2.550E+06	1.713E+02	8.507E+02	1.275E+06	8.567E+01
2071	3.029E+03	2.426E+06	1.630E+02	8.092E+02	1.213E+06	8.150E+01
2072	2.882E+03	2.308E+06	1.550E+02	7.697E+02	1.154E+06	7.752E+01
2073	2.741E+03	2.195E+06	1.475E+02	7.322E+02	1.097E+06	7.374E+01
2074	2.607E+03	2.088E+06	1.403E+02	6.965E+02	1.044E+06	7.014E+01
2075	2.480E+03	1.986E+06	1.334E+02	6.625E+02	9.931E+05	6.672E+01
2076	2.359E+03	1.889E+06	1.269E+02	6.302E+02	9.446E+05	6.347E+01
2077	2.244E+03	1.797E+06	1.207E+02	5.995E+02	8.986E+05	6.037E+01
2078	2.135E+03	1.709E+06	1.149E+02	5.702E+02	8.547E+05	5.743E+01
2079	2.031E+03	1.626E+06	1.093E+02	5.424E+02	8.130E+05	5.463E+01
2080	1.932E+03	1.547E+06	1.039E+02	5.160E+02	7.734E+05	5.196E+01
2081	1.837E+03	1.471E+06	9.886E+01	4.908E+02	7.357E+05	4.943E+01
2082	1.748E+03	1.400E+06	9.404E+01	4.669E+02	6.998E+05	4.702E+01
2083	1.663E+03	1.331E+06	8.945E+01	4.441E+02	6.657E+05	4.473E+01
2084	1.582E+03	1.266E+06	8.509E+01	4.224E+02	6.332E+05	4.254E+01
2085	1.504E+03	1.205E+06	8.094E+01	4.018E+02	6.023E+05	4.047E+01
2086	1.431E+03	1.146E+06	7.699E+01	3.822E+02	5.729E+05	3.850E+01
2087	1.361E+03	1.090E+06	7.324E+01	3.636E+02	5.450E+05	3.662E+01
2088	1.295E+03	1.037E+06	6.966E+01	3.459E+02	5.184E+05	3.483E+01
2089	1.232E+03	9.863E+05	6.627E+01	3.290E+02	4.931E+05	3.313E+01
2090	1.172E+03	9.382E+05	6.304E+01	3.129E+02	4.691E+05	3.152E+01
2091	1.114E+03	8.924E+05	5.996E+01	2.977E+02	4.462E+05	2.998E+01
2092	1.060E+03	8.489E+05	5.704E+01	2.832E+02	4.244E+05	2.852E+01
2093	1.008E+03	8.075E+05	5.426E+01	2.694E+02	4.037E+05	2.713E+01
2094	9.592E+02	7.681E+05	5.161E+01	2.562E+02	3.841E+05	2.580E+01
2095	9.124E+02	7.306E+05	4.909E+01	2.437E+02	3.653E+05	2.455E+01
2096	8.679E+02	6.950E+05	4.670E+01	2.318E+02	3.475E+05	2.335E+01
2097	8.256E+02	6.611E+05	4.442E+01	2.205E+02	3.306E+05	2.221E+01
2098	7.854E+02	6.289E+05	4.225E+01	2.098E+02	3.144E+05	2.113E+01
2099	7.471E+02	5.982E+05	4.019E+01	1.995E+02	2.991E+05	2.010E+01
2100	7.106E+02	5.690E+05	3.823E+01	1.898E+02	2.845E+05	1.912E+01
2101	6.760E+02	5.413E+05	3.637E+01	1.806E+02	2.706E+05	1.818E+01
2102	6.430E+02	5.149E+05	3.459E+01	1.718E+02	2.574E+05	1.730E+01
2103	6.116E+02	4.898E+05	3.291E+01	1.634E+02	2.449E+05	1.645E+01
2104	5.818E+02	4.659E+05	3.130E+01	1.554E+02	2.329E+05	1.565E+01
2105	5.534E+02	4.432E+05	2.978E+01	1.478E+02	2.216E+05	1.489E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2106	5.264E+02	4.215E+05	2.832E+01	1.406E+02	2.108E+05	1.416E+01
2107	5.008E+02	4.010E+05	2.694E+01	1.338E+02	2.005E+05	1.347E+01
2108	4.763E+02	3.814E+05	2.563E+01	1.272E+02	1.907E+05	1.281E+01
2109	4.531E+02	3.628E+05	2.438E+01	1.210E+02	1.814E+05	1.219E+01
2110	4.310E+02	3.451E+05	2.319E+01	1.151E+02	1.726E+05	1.159E+01
2111	4.100E+02	3.283E+05	2.206E+01	1.095E+02	1.642E+05	1.103E+01
2112	3.900E+02	3.123E+05	2.098E+01	1.042E+02	1.561E+05	1.049E+01
2113	3.710E+02	2.971E+05	1.996E+01	9.909E+01	1.485E+05	9.980E+00
2114	3.529E+02	2.826E+05	1.899E+01	9.426E+01	1.413E+05	9.493E+00
2115	3.357E+02	2.688E+05	1.806E+01	8.966E+01	1.344E+05	9.030E+00
2116	3.193E+02	2.557E+05	1.718E+01	8.529E+01	1.278E+05	8.590E+00
2117	3.037E+02	2.432E+05	1.634E+01	8.113E+01	1.216E+05	8.171E+00
2118	2.889E+02	2.313E+05	1.554E+01	7.717E+01	1.157E+05	7.772E+00
2119	2.748E+02	2.201E+05	1.479E+01	7.341E+01	1.100E+05	7.393E+00
2120	2.614E+02	2.093E+05	1.407E+01	6.983E+01	1.047E+05	7.033E+00
2121	2.487E+02	1.991E+05	1.338E+01	6.642E+01	9.956E+04	6.690E+00
2122	2.365E+02	1.894E+05	1.273E+01	6.318E+01	9.471E+04	6.363E+00
2123	2.250E+02	1.802E+05	1.211E+01	6.010E+01	9.009E+04	6.053E+00
2124	2.140E+02	1.714E+05	1.152E+01	5.717E+01	8.569E+04	5.758E+00
2125	2.036E+02	1.630E+05	1.095E+01	5.438E+01	8.151E+04	5.477E+00
2126	1.937E+02	1.551E+05	1.042E+01	5.173E+01	7.754E+04	5.210E+00
2127	1.842E+02	1.475E+05	9.912E+00	4.921E+01	7.376E+04	4.956E+00
2128	1.752E+02	1.403E+05	9.428E+00	4.681E+01	7.016E+04	4.714E+00
2129	1.667E+02	1.335E+05	8.968E+00	4.452E+01	6.674E+04	4.484E+00
2130	1.586E+02	1.270E+05	8.531E+00	4.235E+01	6.348E+04	4.265E+00
2131	1.508E+02	1.208E+05	8.115E+00	4.029E+01	6.039E+04	4.057E+00
2132	1.435E+02	1.149E+05	7.719E+00	3.832E+01	5.744E+04	3.860E+00
2133	1.365E+02	1.093E+05	7.343E+00	3.645E+01	5.464E+04	3.671E+00
2134	1.298E+02	1.040E+05	6.985E+00	3.468E+01	5.198E+04	3.492E+00
2135	1.235E+02	9.888E+04	6.644E+00	3.298E+01	4.944E+04	3.322E+00
2136	1.175E+02	9.406E+04	6.320E+00	3.138E+01	4.703E+04	3.160E+00
2137	1.117E+02	8.947E+04	6.012E+00	2.985E+01	4.474E+04	3.006E+00
2138	1.063E+02	8.511E+04	5.718E+00	2.839E+01	4.255E+04	2.859E+00
2139	1.011E+02	8.096E+04	5.440E+00	2.701E+01	4.048E+04	2.720E+00
2140	9.617E+01	7.701E+04	5.174E+00	2.569E+01	3.850E+04	2.587E+00
2141	9.148E+01	7.325E+04	4.922E+00	2.444E+01	3.663E+04	2.461E+00
2142	8.702E+01	6.968E+04	4.682E+00	2.324E+01	3.484E+04	2.341E+00
2143	8.278E+01	6.628E+04	4.454E+00	2.211E+01	3.314E+04	2.227E+00
2144	7.874E+01	6.305E+04	4.236E+00	2.103E+01	3.153E+04	2.118E+00
2145	7.490E+01	5.998E+04	4.030E+00	2.001E+01	2.999E+04	2.015E+00

Results (Continued)

Year						
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2005	0	0	0	0	0	0
2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2026	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2027	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2028	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2029	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2030	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2031	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2032	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2033	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2034	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2035	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2036	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2037	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2038	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2039	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2040	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2041	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2042	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2043	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2044	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2045	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2046	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2047	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2048	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2049	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2050	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2051	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2052	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2053	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2054	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Results (Continued)

Year						
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2055	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2056	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2057	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2058	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2059	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2060	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2061	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2062	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2063	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2064	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2065	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2066	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2067	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2068	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2069	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2070	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2071	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2072	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2073	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2074	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2075	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2076	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2077	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2078	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2079	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2080	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2081	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2082	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2083	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2084	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2085	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2086	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2087	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2088	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2089	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2090	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2091	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2092	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2093	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2094	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2095	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2096	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2097	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2098	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2099	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2100	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2101	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2102	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2103	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2104	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2105	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Results (Continued)

Year						
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2106	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2107	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2108	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2109	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2110	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2111	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2112	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2113	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2114	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2115	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2116	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2117	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2118	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2119	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2120	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2121	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2122	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2123	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2124	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2125	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2126	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2127	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2128	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2129	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2130	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2131	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2132	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2133	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2134	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2135	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2136	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2138	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2139	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2140	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2141	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2142	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2143	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2145	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Appendix 6 Surface Water Monitoring Results

Table 1: 2006 Surface Water Quarterly Monitoring Results

SW1	Baseline	Q1	Q2	Q3	Q4	MAC
pH (pH units)	7.94-8.20	8.35	8.03	Dry	8.11	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.613-0.730	0.709	0.478	Dry	0.598	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.6	<0.2	<0.2	Dry	<0.2	0.23
Temperature (°C)		1.9	10.8	Dry	10.8	NC
Dissolved Oxygen (mg/l)	5.3-9.4	7.3	3.3	Dry	5.1	No abnormal change
COD (mg/l)	<15-41	<15	49	Dry	<15	40
BOD (mg/l)	<2-2	<2	6	Dry	<2	5
Chloride (mg/l)	21-31	29	17	Dry	21	250
Total Suspended Solids (mg/l)	<10-48	<10	<10	Dry	<10	50
SW2	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.70-8.44	7.94	7.87	7.73	8.09	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.653-0.682	0.65	0.464	1.386	0.579	1
Ammoniacal Nitrogen (mg/l as N)	<0.2	<0.2	<0.2	0.4	<0.2	0.23
Temperature (°C)		1.3	11.4	15	11.4	NC
Dissolved Oxygen (mg/l)	4.7-8.9	6.8	3.5	4.2	4.9	No abnormal change
COD (mg/l)	<15-25	<15	44	34	16	40
BOD (mg/l)	<2-12	<2	5	3	<2	5
Chloride (mg/l)	23-56	22	15	54	19	250
Total Suspended Solids (mg/l)	<10-46	<10	<10	<10	<10	50
SW3	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.54-7.98	8.06	7.88	7.6	7.79	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.593-0.688	0.664	0.517	0.879	0.565	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.1	<0.2	<0.2	<0.2	<0.2	0.23
Temperature (°C)		3.3	11.7	15.6	11.7	NC
Dissolved Oxygen (mg/l)	5.1-8.6	6.9	3.7	4.3	4.3	No abnormal change
COD (mg/l)	<15-46	<15	36	31	18	40
BOD (mg/l)	<2-5	<2	3	4	<2	5
Chloride (mg/l)	29-36	26	18	35	18	250
Total Suspended Solids (mg/l)	<10-34	<10	<10	<10	<10	50

SW5	Baseline	Q1	Q2	Q3	Q4	MAC
pH (pH units)	7.61-8.07	8	8.07	7.71	7.99	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.549-0.726	0.686	0.510	0.652	0.567	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	1.5	0.7	2.4	<0.2	0.23
Temperature (^{o}C)		2	11.3	14.6	11.3	NC
Dissolved Oxygen (mg/l)	4.4-8.4	6.3	3.8	4.1	4.1	No abnormal change
COD (mg/l)	<15-43	18	38	30	19	40
BOD (mg/l)	<2-4	3	6	4	<2	5
Chloride (mg/l)	29-35	29	19	29	20	250
Total Suspended Solids (mg/l)	<10	11	<10	<10	<10	50
SW6	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.60-8.06	8.11	8.07	Dry	7.89	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.625-0.698	0.714	0.449	Dry	0.631	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	1.3	<0.2	Dry	<0.2	0.23
Temperature (^{o}C)		1.8	15.2	Dry	15.2	NC
Dissolved Oxygen (mg/l)	5.0-8.9	6.5	3.8	Dry	4.8	No abnormal change
COD (mg/l)	<15-41	<15	25	Dry	15	40
BOD (mg/l)	<2-3	3	5	Dry	3	5
Chloride (mg/l)	28-33	28	10	Dry	12	250
Total Suspended Solids (mg/l)	<10-11	<10	<10	Dry	<10	50
SW7	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.42-8.37	8.7	7.92	7.91	8.1	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.590-0.694	0.675	0.53	0.724	0.692	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.7	<0.2	0.5	<0.2	<0.2	0.23
Temperature (^{o}C)		1.6	12.2	14.7	12.2	NC
Dissolved Oxygen (mg/l)	5.0-8.7	6.8	2.9	4.2	4.7	No abnormal change
COD (mg/l)	<15-29	<15	34	21	<15	40
BOD (mg/l)	<2-3	<2	6	<2	3	5
Chloride (mg/l)	24-36	26	17	26	26	250
Total Suspended Solids (mg/l)	<10-10	<10	17	<10	<10	50

SW8	Baseline	Q1	Q2	Q3	Q4	MAC
pH (pH units)	7.63-8.02	8.1	7.84	7.61	8.11	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.662-0.720	0.645	0.443	0.952	0.657	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.4	0.6	0.2	0.4	<0.2	0.23
Temperature (^{o}C)		5.2	13.8	14.8	13.8	NC
Dissolved Oxygen (mg/l)	4.6-8.5	6.9	3.6	4.2	5.2	No abnormal change
COD (mg/l)	<15-31	<15	34	<15	15	40
BOD (mg/l)	<2-3	2	6	<2	2	5
Chloride (mg/l)	30-54	30	16	28	43	250
Total Suspended Solids (mg/l)	<10-15	<10	11	<10	<10	50

MAC = S.I. No. 294/1989:European Communitites (Quality of surface water intended for the abstraction of drinking water) regulations 1989. Standards for A1 waters.

Table 2: Annual 2006 Surface Water Monitoring Results

	Results (mg/l unless otherwise stated)						
Sample ID	**SW1**	**SW2**	**SW3**	**SW5**	**SW6**	**SW7**	**SW8**
Conductivity (at 25 deg. C) (mS/cm)	Dry	1.386	0.879	0.652	Dry	0.724	0.952
Total Alkalinity as CaCO3	Dry	280	160	350	Dry	310	240
Total Oxidised Nitrogen as N	Dry	0.4	<0.3	2.8	Dry	<0.3	0.8
Potassium	Dry	20	15	19	Dry	7.8	5.9
Sodium	Dry	27.5	24.5	21	Dry	12.5	18.5
Sulphate	Dry	467	639	181	Dry	45	75
Total Chromium	Dry	<0.05	<0.05	<0.05	Dry	<0.05	<0.05
Total Phosphorous	Dry	0.09	<0.05	0.35	Dry	0.09	0.14
ortho Phosphate as PO4	Dry	0.37	0.69	1.81	Dry	0.55	1.05
Dissolved Cadmium Low Level (µg/l)	Dry	<1	<1	<1	Dry	<1	<1
Dissolved Calcium Low Level	Dry	279.4	297.7	192.2	Dry	125.5	107.8
Dissolved Copper Low Level (µg/l)	Dry	<1	<1	<1	Dry	<1	<1
Dissolved Iron Low Level (µg/l)	Dry	29	30	59	Dry	40	24
Dissolved Lead Low Level (µg/l)	Dry	<1	1	<1	Dry	<1	<1
Dissolved Magnesium Low Level	Dry	16.64	19.54	15.77	Dry	11.39	9.33
Dissolved Manganese Low Level (µg/l)	Dry	12	18	13	Dry	11	3
Dissolved Mercury Low Level (µg/l)	Dry	<0.05	<0.05	<0.05	Dry	<0.05	<0.05
Dissolved Zinc Low Level (µg/l)	Dry	17	21	17	Dry	17	17

Table 3: 2007 Surface Water Quarterly Monitoring Results

SW1	Baseline	Q1	Q2	Q3	Q4	MAC
pH (pH units)	7.94-8.20	8.23	8.14	8.07	8.04	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.613-0.730	0.544	0.723	0.606	0.820	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.6	<0.2	<0.2	<0.2	<0.2	0.23
Temperature (°C)		9.6	13.5	13.3	6.8	NC
Dissolved Oxygen (mg/l)	5.3-9.4	5.1	5.8	4.5	4.5	No abnormal change
COD (mg/l)	<15-41	21	17	19	36	40
BOD (mg/l)	<2-2	<2	<2	*	5	5
Chloride (mg/l)	21-31	18	36	14	44	250
Total Suspended Solids (mg/l)	<10-48	<10	<10	<10	<10	50
SW2	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.70-8.44	7.97	8.07	7.99	7.88	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.653-0.682	0.514	0.725	0.610	0.815	1
Ammoniacal Nitrogen (mg/l as N)	<0.2	<0.2	1.3	<0.2	<0.2	0.23
Temperature (°C)		9.0	14.4	14.3	7.5	NC
Dissolved Oxygen (mg/l)	4.7-8.9	4.4	6.0	3.9	4.1	No abnormal change
COD (mg/l)	<15-25	21	37	19	29	40
BOD (mg/l)	<2-12	<2	<2	*	7	5
Chloride (mg/l)	23-56	18	40	13	47	250
Total Suspended Solids (mg/l)	<10-46	<10	13	12	<10	50
SW3	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.54-7.98	7.97	7.66	7.72	7.82	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.593-0.688	0.420	0.718	0.612	0.798	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.1	<0.2	<0.2	<0.2	0.9	0.23
Temperature (°C)		9.1	13.9	14.2	7.4	NC
Dissolved Oxygen (mg/l)	5.1-8.6	7.9	7.2	4.7	4.4	No abnormal change
COD (mg/l)	<15-46	NDP	28	19	30	40
BOD (mg/l)	<2-5	3	<2	*	5	5
Chloride (mg/l)	29-36	17	38	13	41	250
Total Suspended Solids (mg/l)	<10-34	32	<10	<10	<10	50
SW5	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.61-8.07	7.70	7.82	7.78	7.02	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.549-0.726	0.431	0.756	0.626	0.916	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	0.2	0.9	<0.2	2.1	0.23
Temperature (°C)		10.3	13.5	14.5	7.3	NC

Dissolved Oxygen (mg/l)	4.4-8.4	4.7	6.5	4.6	4.0	No abnormal change
COD (mg/l)	<15-43	NDP	30	22	41	40
BOD (mg/l)	<2-4	12	3	*	11	5
Chloride (mg/l)	29-35	17	32	14	37	250
Total Suspended Solids (mg/l)	<10	22	<10	16	<10	50
SW6	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.60-8.06	7.90	7.58	7.70	7.72	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.625-0.698	0.447	0.666	0.636	0.770	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	<0.2	<0.2	<0.2	<0.2	0.23
Temperature (^{o}C)		9.4	16.1	13.8	6.2	NC
Dissolved Oxygen (mg/l)	5.0-8.9	5.2	6.6	4.2	4.2	No abnormal change
COD (mg/l)	<15-41	NDP	23	23	22	40
BOD (mg/l)	<2-3	4	3	*	2	5
Chloride (mg/l)	28-33	16	23	13	25	250
Total Suspended Solids (mg/l)	<10-11	34	47	<10	<10	50
SW7	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.42-8.37	8.02	7.99	7.93	7.66	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.590-0.694	0.572	0.669	0.691	0.642	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.7	0.5	0.3	0.7	<0.2	0.23
Temperature (^{o}C)		10.7	14.5	13.8	6.5	NC
Dissolved Oxygen (mg/l)	5.0-8.7	4.6	5.6	4.0	4.8	No abnormal change
COD (mg/l)	<15-29	NDP	24	18	<15	40
BOD (mg/l)	<2-3	3	3	*	2	5
Chloride (mg/l)	24-36	19	21	19	26	250
Total Suspended Solids (mg/l)	<10-10	25	<10	11	<10	50
SW8	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)	7.63-8.02	8.13	8.05	7.98	7.88	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.662-0.720	0.616	0.722	0.671	0.760	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.4	<0.2	0.5	<0.2	0.2	0.23
Temperature (^{o}C)		7.9	13.6	14.4	7.4	NC
Dissolved Oxygen (mg/l)	4.6-8.5	4.8	5.8	4.5	4.6	No abnormal change
COD (mg/l)	<15-31	17	22	19	21	40
BOD (mg/l)	<2-3	3	<2	*	3	5
Chloride (mg/l)	30-54	24	34	17	32	250
Total Suspended Solids (mg/l)	<10-15	60	<10	<10	<10	50
SW9	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**MAC**
pH (pH units)				7.47	7.55	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)				0.673	0.673	1
Ammoniacal Nitrogen (mg/l as N)				<0.2	<0.2	0.23
Temperature (^{o}C)				16.6	6.7	NC

Dissolved Oxygen (mg/l)				5.5	6.3	No abnormal change
COD (mg/l)				18	<15	40
BOD (mg/l)				*	4	5
Chloride (mg/l)				9	15	250
Total Suspended Solids (mg/l)				<10	15	50

MAC = S.I. No. 294/1989:European Communitites (Quality of surface water intended for the abstraction of drinking water) regulations 1989. Standards for A1 waters.

Table 4: Annual 2007 Surface Water Monitoring Results

	Results (mg/l unless otherwise stated)							
Sample ID	**SW1**	**SW2**	**SW3**	**SW5**	**SW6**	**SW7**	**SW8**	**SW9**
Conductivity (at 25 deg. C) (mS/cm)	0.606	0.610	0.612	0.626	0.636	0.691	0.671	0.673
Total Alkalinity as CaCO3	350	390	390	390	360	390	389	180
Potassium	4.7	4.1	4.3	4.9	4.7	5.4	4.8	4.1
Sodium	10.0	10.0	11.5	11.0	11.0	9.5	10.5	9.5
Sulphate	15	15	13	13	50	22	29	222
Total Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Phosphorous	0.11	0.06	<0.05	<0.05	0.06	0.18	<0.05	0.16
Dissolved Cadmium Low Level (µg/l)	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Dissolved Calcium Low Level	115.6	117.9	115.2	117.8	119.6	130.4	127.2	116.9
Dissolved Copper Low Level (µg/l)	2	2	2	2	2	3	3	<1
Dissolved Iron Low Level (µg/l)	20	14	26	<2	9	24	57	<2
Dissolved Lead Low Level (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Magnesium Low Level	7.52	7.57	8.02	7.90	8.95	10.7	10.02	15.61
Dissolved Manganese Low Level (µg/l)	<1	<1	<1	<1	<1	<1	3	<1
Dissolved Mercury Low Level (µg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Zinc Low Level (µg/l)	10	14	92	12	10	10	12	14

Table 5:2008 Surface Water Quarterly Monitoring Results

SW1	Baseline	Q1	Q2	Q3	MAC
pH (pH units)	7.94-8.20	8.10	8.0	8.13	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.613-0.730	0.470	0.578	0.626	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.6	1.8	<0.3	LE	0.23
Temperature (°C)		5.0	15.1	13.7	NC
Dissolved Oxygen (mg/l)	5.3-9.4	26	3.8	10.2	No abnormal change
COD (mg/l)	<15-41	<1	20	27	40
BOD (mg/l)	<2-2	3.3	<1	<2	5
Chloride (mg/l)	21-31	17	24	22	250
Total Suspended Solids (mg/l)	<10-48	10	14	<10	50
SW2	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)	7.70-8.44	7.70	7.8	7.64	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.653-0.682	0.435	0.571	0.591	1
Ammoniacal Nitrogen (mg/l as N)	<0.2	1.3	<0.3	LE	0.23
Temperature (°C)		4.7	14.7	14.1	NC
Dissolved Oxygen (mg/l)	4.7-8.9	20	5.6	10.0	No abnormal change
COD (mg/l)	<15-25	<1	<20	<15	40
BOD (mg/l)	<2-12	2.1	3	<2	5
Chloride (mg/l)	23-56	13	25	14	250
Total Suspended Solids (mg/l)	<10-46	11	18	<10	50
SW3	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)	7.54-7.98	7.80	7.7	7.75	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.593-0.688	0.436	0.582	0.584	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.1	1.1	<0.3	LE	0.23
Temperature (°C)		4.7	15.1	14.5	NC
Dissolved Oxygen (mg/l)	5.1-8.6	39	3.5	9.8	No abnormal change
COD (mg/l)	<15-46	3	<20	38	40
BOD (mg/l)	<2-5	2.9	3	<2	5
Chloride (mg/l)	29-36	17	27	19	250
Total Suspended Solids (mg/l)	<10-34	17	12	11	50
SW5	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)	7.61-8.07	7.90	7.9	7.81	5.5 - 8.5
Conductivity (at 25°C) (mS/cm)	0.549-0.726	0.430	0.587	0.599	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	1.3	<0.3	LE	0.23
Temperature (°C)		5.0	15.0	14.6	NC
Dissolved Oxygen (mg/l)	4.4-8.4	29	3.3	9.6	No abnormal change
COD (mg/l)	<15-43	<1	21	33	40
BOD (mg/l)	<2-4	2.9	1	<2	5
Chloride (mg/l)	29-35	17	25	19	250
Total Suspended Solids (mg/l)	<10	15	2	10	50

SW6	Baseline	Q1	Q2	Q3	MAC
pH (pH units)	7.60-8.06	8.10	7.9	7.75	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.625-0.698	0.553	0.577	0.702	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	0.9	<0.3	LE	0.23
Temperature (^{o}C)		4.5	13.9	15.8	NC
Dissolved Oxygen (mg/l)	5.0-8.9	37	4.9	9.7	No abnormal change
COD (mg/l)	<15-41	1	<20	<15	40
BOD (mg/l)	<2-3	2.8	<1	2	5
Chloride (mg/l)	28-33	14	23	14	250
Total Suspended Solids (mg/l)	<10-11	25	11	<10	50
SW7	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)	7.42-8.37	8.00	8.2	8.04	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.590-0.694	0.538	0.565	0.696	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-1.7	0.8	<0.3	LE	0.23
Temperature (^{o}C)		4.6	14	14.6	NC
Dissolved Oxygen (mg/l)	5.0-8.7	26	3.4	9.7	No abnormal change
COD (mg/l)	<15-29	<1	<20	21	40
BOD (mg/l)	<2-3	2.6	<1	<2	5
Chloride (mg/l)	24-36	21	23	25	250
Total Suspended Solids (mg/l)	<10-10	15	2	10	50
SW8	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)	7.63-8.02	7.90	7.9	7.94	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)	0.662-0.720	0.480	0.587	0.633	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.4	0.6	<0.3	LE	0.23
Temperature (^{o}C)		4.5	15.2	14.6	NC
Dissolved Oxygen (mg/l)	4.6-8.5	30	2.2	9.7	No abnormal change
COD (mg/l)	<15-31	1	25	29	40
BOD (mg/l)	<2-3	2.7	<1	<2	5
Chloride (mg/l)	30-54	17	25	20	250
Total Suspended Solids (mg/l)	<10-15	19	8	22	50
SW9	**Baseline**	**Q1**	**Q2**	**Q3**	**MAC**
pH (pH units)		8.20	7.5	7.68	5.5 - 8.5
Conductivity (at 25^{o}C) (mS/cm)		0.609	0.589	0.708	1
Ammoniacal Nitrogen (mg/l as N)		0.6	<0.3	LE	0.23
Temperature (^{o}C)		4.8	20.0	17.5	NC
Dissolved Oxygen (mg/l)		<20	4.3	9.7	No abnormal change
COD (mg/l)		<1	<20	<15	40
BOD (mg/l)		3.3	2	4	5
Chloride (mg/l)		12	10	14	250
Total Suspended Solids (mg/l)		15	35	<10	50

MAC = S.I. No. 294/1989:European Communitites (Quality of surface water intended for the abstraction of drinking water) regulations 1989. Standards for A1 waters.
LE=ammoniacal nitrogen not analysed due to laboratory error

Appendix 7 Groundwater Monitoring Results

Table 1: Summary of 2006 Quarterly Groundwater Results

MW1d	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.39-7.60	7.95	Dry	7.75	7.75	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.629	Dry	0.652	0.652	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.2	Dry	<0.2	<0.2	0.15
Temperature (^{o}C)		9.2	Dry			
Dissolved Oxygen (mg/l)	4.9-8.5	5.6	Dry	4	4	No abnormal change
Chloride (mg/l)	22-27	23	Dry	23	23	30
Total Organic Carbon (mg/l)	<0.2	3	Dry	4	4	No abnormal change
Dissolved Iron Low Level (µg/l)			Dry	<2	<2	0.2
Potassium (mg/l)	1.8-7.2	3.8	Dry	3.7	3.7	5
Sodium (mg/l)	16-62	44	Dry	42.5	42.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	Dry	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	Dry	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	Dry	6	6	0
Total Coliforms (no./100ml)	2-140	10	Dry	144	144	0
MW2d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.24-7.96	7.86	7.61	7.96	7.96	>=6.5 & <=9.5
Conductivity (mS/cm)	0.685-0.705	0.693	0.578	0.689	0.689	1
Ammoniacal Nitrogen (mg/l as N)	<0.2	<0.2	<0.2	<0.2	<0.2	0.15
Temperature (^{o}C)		10	8			
Dissolved Oxygen (mg/l)	4.5-8.3	6.4	4.3	4.5	4.5	No abnormal change
Chloride (mg/l)	18-19	16	18	18	18	30
Total Organic Carbon (mg/l)	<0.2	4	5	6	6	No abnormal change
Dissolved Iron Low Level (µg/l)		38	<2	<2	0.2	
Potassium (mg/l)	2.0-3.0	2.6	2.6	2.5	2.5	5
Sodium (mg/l)	29-62	41	39	46.5	46.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-0.4	<0.3	<0.3	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-3	<1	<1	<1	<1	0
Total Coliforms (no./100ml)	0-24	96	<1	250000	250000	0

MW3d	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.20-8.00	8.08	7.67	7.63	7.63	>=6.5 & <=9.5
Conductivity (mS/cm)	0.796-0.858	0.709	0.059	0.803	0.803	1
Ammoniacal Nitrogen (mg/l as N)	0.4-1.4	0.4	0.4	<0.2	<0.2	0.15
Temperature (^{o}C)		9.8	11			
Dissolved Oxygen (mg/l)	4.7-8.1	4.9	3.9	3.6	3.6	No abnormal change
Chloride (mg/l)	24-26	24	24	25	25	30
Total Organic Carbon (mg/l)	<0.2	3	<2	<2	<2	No abnormal change
Dissolved Iron Low Level (µg/l)		12	<2	<2	0.2	
Potassium (mg/l)	3.0-4.2	3.4	3.5	3.3	3.3	5
Sodium (mg/l)	39-142.5	52	48.5	35	35	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-0.5	<0.3	0.5	0.5	0.5	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-37	<1	<1	<1	<1	0
Total Coliforms (no./100ml)	0-56	<1	3	56	56	0
MW5d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.27-8.32	7.22	7.76	7.81	7.81	>=6.5 & <=9.5
Conductivity (mS/cm)	0.626-0.861	0.582	0.622	0.631	0.631	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.5	0.4	0.4	<0.2	<0.2	0.15
Temperature (^{o}C)		9.7	8.1			
Dissolved Oxygen (mg/l)	4.7-8.1	3.8	5.7	4.1	4.1	No abnormal change
Chloride (mg/l)	13-26	17	17	19	19	30
Total Organic Carbon (mg/l)	<0.2	3	2	<2	<2	No abnormal change
Dissolved Iron Low Level (µg/l)		77	<2	<2	0.2	
Potassium (mg/l)	2.0-5.0	2.6	2.6	2.3	2.3	5
Sodium (mg/l)	25-84.5	28.5	25	31.5	31.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-5.0	<0.3	<0.3	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-9	<1	<1	<1	<1	0
Total Coliforms (no./100ml)	0-780	<1	<1	6	6	0
MW6d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.47-7.87	7.53	7.78	7.9	7.9	>=6.5 & <=9.5
Conductivity (mS/cm)	0.604-0.660	0.561	0.6	0.718	0.718	1

Ammoniacal Nitrogen (mg/l as N)	<0.2-0.6	0.4	0.6	0.4	0.4	0.15
Temperature (^{o}C)		9.2	11.5			
Dissolved Oxygen (mg/l)	3.7-8.2	3.2	3.9	4.4	4.4	No abnormal change
Chloride (mg/l)	15-17	16	17	14	14	30
Total Organic Carbon (mg/l)	<0.2	3	2	5	5	No abnormal change
Dissolved Iron Low Level (µg/l)		40	<2	<2	0.2	
Potassium (mg/l)	2.0-3.6	2.8	5	3.1	3.1	5
Sodium (mg/l)	21-55	24	27	-	-	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-0.8	0.4	<0.3	1	1	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-17	<1	<1	46	46	0
Total Coliforms (no./100ml)	0-18	10	8	110	110	0
MW7d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.38-7.88	8.25	7.8	7.64	7.64	>=6.5 & <=9.5
Conductivity (mS/cm)	0.621-0.685	0.55	0.621	0.645	0.645	1
Ammoniacal Nitrogen (mg/l as N)	0.3-1.3	<0.2	0.2	0.3	0.3	0.15
Temperature (^{o}C)		9.9	9.2			
Dissolved Oxygen (mg/l)	3.8-8.1	5.1	4.7	4.6	4.6	No abnormal change
Chloride (mg/l)	16-18	16	17	18	18	30
Total Organic Carbon (mg/l)	<0.2	3	2	5	5	No abnormal change
Dissolved Iron Low Level (µg/l)		23	<2	<2	0.2	
Potassium (mg/l)	2.4-4.2	3.6	3.6	3.3	3.3	5
Sodium (mg/l)	31.5-79	65	70	-	-	150
Total Oxidised Nitrogen (mg/l as N)	0.4-0.9	0.5	<0.3	0.4	0.4	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	2	-	-	0
Total Coliforms (no./100ml)	0-28	3	265	-	-	0
MW16d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.28-7.61	7.28	7.56	8.04	8.04	>=6.5 & <=9.5
Conductivity (mS/cm)	0.627-0.689	0.584	0.412	0.636	0.636	1
Ammoniacal Nitrogen (mg/l as N)	0.4-0.7	0.6	0.5	<0.2	<0.2	0.15
Temperature (^{o}C)		10.1	10.9			
Dissolved Oxygen	4.4-7.8	3.3	3.5	4.3	4.3	No abnormal

(mg/l)						change
Chloride (mg/l)	17-18	17	18	18	18	30
Total Organic Carbon (mg/l)	<0.2	3	2	2	2	No abnormal change
Dissolved Iron Low Level (µg/l)		8	<2	<2	0.2	
Potassium (mg/l)	2.2-3.6	2.9	3	2.7	2.7	5
Sodium (mg/l)	25.5-41.5	28.5	26	28.5	28.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3	<0.3	0.4	0.5	0.5	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	<1	<1	<1	0
Total Coliforms (no./100ml)	0-4	<1	<1	32	32	0

IGV= towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report, EPA 2003

Table 2: Summary of 2007 Quarterly Groundwater Results

MW1d	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.39-7.60	8.09	7.79	7.71	7.58	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.657	0.634	0.641	0.628	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.6	1.9	0.2	0.2	0.15
Temperature (^{o}C)		9.3	13.0	12.9	9.5	
Dissolved Oxygen (mg/l)	4.9-8.5	4.3	6.2	4.0	6.7	No abnormal change
Chloride (mg/l)	22-27	23	24	21	24	30
Total Organic Carbon (mg/l)	<0.2	<2	<2	<2	3	No abnormal change
Dissolved Iron Low Level (µg/l)		18	<2	13	83	0.2
Potassium (mg/l)	1.8-7.2	3.9	4.0	4.6	3.9	5
Sodium (mg/l)	16-62	38.5	46.5	41.0	39.0	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	<0.3	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	108	5600	14000	0
Total Coliforms (no./100ml)	2-140	1	<1	<1	11	0
MW2d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.84	7.69	7.65	7.51	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.722	0.684	0.702	0.665	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.2	0.2	<0.2	<0.2	0.15
Temperature (^{o}C)		10.1	13.5	12.2	9.4	
Dissolved Oxygen (mg/l)	4.9-8.5	3.7	6.3	6.0	6.6	No abnormal change
Chloride (mg/l)	22-27	18	18	16	19	30
Total Organic Carbon (mg/l)	<0.2	2	<2	<2	3	No abnormal change
Dissolved Iron Low Level (µg/l)		6	<2	<2	92	0.2
Potassium (mg/l)	1.8-7.2	2.8	3.0	3.2	2.2	5
Sodium (mg/l)	16-62	35.0	45.5	40.5	31.0	150

Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	0.3	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	-	86000	1700	0
Total Coliforms (no./100ml)	2-140	12	-	<1	3	0
MW3d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.84	7.56	7.38	7.32	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.852	0.786	0.791	0.777	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.3	1.6	0.4	0.4	0.15
Temperature (^{o}C)		9.7	13.2	11.3	10.1	
Dissolved Oxygen (mg/l)	4.9-8.5	3.2	5.9	4.0	5.6	No abnormal change
Chloride (mg/l)	22-27	25	25	22	25	30
Total Organic Carbon (mg/l)	<0.2	<2	<2	<2	2	No abnormal change
Dissolved Iron Low Level (µg/l)		13	<2	4	79	0.2
Potassium (mg/l)	1.8-7.2	3.7	3.6	3.8	3.5	5
Sodium (mg/l)	16-62	40.0	51.5	51.5	46.0	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	<0.3	<0.3	0.5	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	17	1	900	13	0
Total Coliforms (no./100ml)	2-140	29	<1	<1	<1	0
MW5	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.26	7.79	7.33	7.37	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.636	0.527	0.626	0.711	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.5	1.0	0.4	0.5	0.15
Temperature (^{o}C)		10.1	13.5	12.0	8.0	
Dissolved Oxygen (mg/l)	4.9-8.5	4.1	5.4	3.9	6.1	No abnormal change

Chloride (mg/l)	22-27	19	18	16	9	30
Total Organic Carbon (mg/l)	<0.2	<2	<2	<2	3	No abnormal change
Dissolved Iron Low Level (µg/l)		61	<2	<2	72	0.2
Potassium (mg/l)	1.8-7.2	2.8	2.3	2.8	2.9	5
Sodium (mg/l)	16-62	25.0	21.0	29.0	15.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	<0.3	<0.3	0.4	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	2	18	14000	0
Total Coliforms (no./100ml)	2-140	9	<1	<1	18	0
MW6	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.56	8.07	7.21	7.63	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.628	0.598	0.765	0.610	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.2	1.0	0.4	0.4	0.15
Temperature (^{o}C)		10.1	12.4	12.0	8.8	
Dissolved Oxygen (mg/l)	4.9-8.5	4.2	6.0	4.3	6.2	No abnormal change
Chloride (mg/l)	22-27	17	20	4	19	30
Total Organic Carbon (mg/l)	<0.2	<2	<2	4	2	No abnormal change
Dissolved Iron Low Level (µg/l)		71	<2	<2	82	0.2
Potassium (mg/l)	1.8-7.2	3.1	3.0	3.0	2.7	5
Sodium (mg/l)	16-62	24.5	28.0	12.0	24.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	0.5	<0.3	<0.3	0.4	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	<1	5800	1900	0
Total Coliforms (no./100ml)	2-140	268	<1	2	15	0

MW7d	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.39-7.60	8.12	7.95	7.53	7.40	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.669	0.469	0.662	0.638	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.2	0.7	0.9	0.3	0.15
Temperature (^{o}C)		9.8	13.0	10.6	9.4	
Dissolved Oxygen (mg/l)	4.9-8.5	3.3	6.1	4.1	5.9	No abnormal change
Chloride (mg/l)	22-27	16	19	11	14	30
Total Organic Carbon (mg/l)	<0.2	2	<2	3	3	No abnormal change
Dissolved Iron Low Level (µg/l)		14	85	2	86	0.2
Potassium (mg/l)	1.8-7.2	3.5	2.0	3.2	2.7	5
Sodium (mg/l)	16-62	55.0	18.5	50.0	44.5	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	<0.3	<0.3	<0.3	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	<1	7400	10000	0
Total Coliforms (no./100ml)	2-140	39	<1	<1	<1	0
MW16	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.52	7.76	7.35	7.26	>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.640	0.526	0.636	0.626	1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.6	0.6	0.5	0.5	0.15
Temperature (^{o}C)		10.5	13.0	12.2	8.9	
Dissolved Oxygen (mg/l)	4.9-8.5	4.5	5.9	4.0	5.9	No abnormal change
Chloride (mg/l)	22-27	18	21	15	19	30
Total Organic Carbon (mg/l)	<0.2	<2	<2	2	3	No abnormal change
Dissolved Iron Low Level (µg/l)		68	<2	5	87	0.2
Potassium (mg/l)	1.8-7.2	3.1	2.5	3.2	3.0	5

Sodium (mg/l)	16-62	25.0	21.0	29.0	25.0	150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<0.3	0.8	<0.3	0.7	No abnormal change
Phenols (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	0.5ug/l
Faecal Coliforms (no./100ml)	0-2	<1	<1	52	3	0
Total Coliforms (no./100ml)	2-140	36	<1	<1	<1	0

IGV= towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report, EPA 2003

Table 3: Summary of 2008 Quarterly Groundwater Results

MW1d	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.39-7.60	7.90	7.8	7.81		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.556	0.573	0.637		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	0.4	<0.3	0.5		0.15
Temperature (^{o}C)		10.6	11.7	11.6		
Dissolved Oxygen (mg/l)	4.9-8.5	7.9	2.2	10.8		No abnormal change
Chloride (mg/l)	22-27	22	21	30		30
Total Organic Carbon (mg/l)	<0.2	1.7	0.7	<2		No abnormal change
Dissolved Iron Low Level (µg/l)		3.2	<0.05	2267		200
Potassium (mg/l)	1.8-7.2	38	4.6	3.2		5
Sodium (mg/l)	16-62	<50	49	45.9		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	0.3	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	>100	3	7		0
Total Coliforms (no./100ml)	2-140	>100	1	1200		0
MW2d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.90	7.6	7.51		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.592	0.613	0.684		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.4		0.15
Temperature (^{o}C)		10.9	11.8	11.0		
Dissolved Oxygen (mg/l)	4.9-8.5	1.0	2.1	9.7		No abnormal change
Chloride (mg/l)	22-27	16	16	23		30
Total Organic Carbon (mg/l)	<0.2	1.5	1.0	2		No abnormal change
Dissolved Iron Low Level (µg/l)		2.1	<0.05	346		200
Potassium (mg/l)	1.8-7.2	38	2.9	2.3		5

Sodium (mg/l)	16-62	<0.3	43	41.4		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	3	0	5		0
Total Coliforms (no./100ml)	2-140	1	0	400		0
MW3d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.80	7.5	7.47		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.688	0.696	0.785		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.6		0.15
Temperature (^{o}C)		10.2	11.5	10.9		
Dissolved Oxygen (mg/l)	4.9-8.5	2.3	1.0	10.7		No abnormal change
Chloride (mg/l)	22-27	21	22	35		30
Total Organic Carbon (mg/l)	<0.2	1.2	0.8	<2		No abnormal change
Dissolved Iron Low Level (µg/l)		2.8	<0.05	1185		200
Potassium (mg/l)	1.8-7.2	45	3.9	3.1		5
Sodium (mg/l)	16-62	<0.3	55	53.1		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	0	0	<1		0
Total Coliforms (no./100ml)	2-140	0	0	400		0

MW5	Baseline	Q1	Q2	Q3	Q4	IGV Values
pH (pH units)	7.39-7.60	7.60	7.6	7.53		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.547	0.554	0.619		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.6		0.15
Temperature (^{o}C)		9.8	11.7	11.0		
Dissolved Oxygen (mg/l)	4.9-8.5	1.8	1.6	9.6		No abnormal change
Chloride (mg/l)	22-27	15	16	24		30
Total Organic Carbon (mg/l)	<0.2	1.4	2.5	<2		No abnormal change
Dissolved Iron Low Level (µg/l)		2.2	<0.05	21		200
Potassium (mg/l)	1.8-7.2	25	2.8	2.2		5
Sodium (mg/l)	16-62	<0.3	29	27.7		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	0	0	13		0
Total Coliforms (no./100ml)	2-140	0	0	130		0
MW6	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.60	7.6	7.32		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.569	0.558	0.723		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.9		0.15
Temperature (^{o}C)		10.9	13.1	11.2		
Dissolved Oxygen (mg/l)	4.9-8.5	1.8	<0.5	9.9		No abnormal change
Chloride (mg/l)	22-27	12	15	14		30
Total Organic Carbon (mg/l)	<0.2	0.7	3.4	3		No abnormal change
Dissolved Iron Low Level (µg/l)		3.5	0.15	866		200

Potassium (mg/l)	1.8-7.2	27	6.3	2.9		5
Sodium (mg/l)	16-62	0.4	36	19.0		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	0	390	5		0
Total Coliforms (no./100ml)	2-140	0	>100	1300		0
MW7d	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.60	7.6	7.64		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.544	0.558	0.623		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.5		0.15
Temperature (^{o}C)		10.8	13.3	10.9		
Dissolved Oxygen (mg/l)	4.9-8.5	2.3	2.0	10.7		No abnormal change
Chloride (mg/l)	22-27	13	14	20		30
Total Organic Carbon (mg/l)	<0.2	0.7	2.4	<2		No abnormal change
Dissolved Iron Low Level (µg/l)		2.4	<0.05	156		200
Potassium (mg/l)	1.8-7.2	52	3.2	2.9		5
Sodium (mg/l)	16-62	0.3	67	59.5		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.05	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	4	4	60		0
Total Coliforms (no./100ml)	2-140	1	32	4400		0
MW16	**Baseline**	**Q1**	**Q2**	**Q3**	**Q4**	**IGV Values**
pH (pH units)	7.39-7.60	7.80	7.5	7.51		>=6.5 & <=9.5
Conductivity (mS/cm)	0.586-0.654	0.551	0.564	0.629		1
Ammoniacal Nitrogen (mg/l as N)	<0.2-0.3	<0.3	<0.3	0.7		0.15

Temperature (^{o}C)		10.9	12.0	11.2		
Dissolved Oxygen (mg/l)	4.9-8.5	2.0	2.0	9.9		No abnormal change
Chloride (mg/l)	22-27	15	15	22		30
Total Organic Carbon (mg/l)	<0.2	1.3	1.5	<2		No abnormal change
Dissolved Iron Low Level (µg/l)		2.3	<0.05	<2		200
Potassium (mg/l)	1.8-7.2	25	3.1	2.6		5
Sodium (mg/l)	16-62	<0.3	30	28.2		150
Total Oxidised Nitrogen (mg/l as N)	<0.3-3.4	<50	<0.3	<0.3		No abnormal change
Phenols (mg/l)	<0.01	<0.005	<0.005	<0.01		0.5ug/l
Faecal Coliforms (no./100ml)	0-2	0	0	1		0
Total Coliforms (no./100ml)	2-140	0	1	100		0

IGV= towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report, EPA 2003

Appendix 8 Dust Deposition Monitoring Results

Table 1: Summary of 2006 Dust Deposition Results

	Jan-06			Feb-06			Mar-06		
	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust
D1			90			145			nd
D2			34			33			90
D3			105			73			58
D4			34			*			124
D5			66			110			nd
D6			*			101			nd
D7			19			81			115
D8			*			121			234
D9			96			139			174
D10			23			18			58
	April-06			**May-06**			**June-06**		
D1			96			50			6
D2			7			8			685
D3			10			7			21
D4			14			nd			41
D5			186			12			19
D6			nd			96			290
D7			<5			nd			9
D8			14			<5			43
D9			31			8			14
D10			9			<5			7
	July-06			**Aug-06**			**Sep-06**		
D1			50			1497			54
D2			45			181			*
D3			11			286			192
D4			88			381			75
D5			7			435			344
D6			81			110			207
D7			17			233			***
D8			191			272			*
D9			98			62			107
D10			54			377			56
	Oct-06			**Nov-06**					
D1			**20**			**			
D2			105			**			
D3			106			*			
D4			38			**			
D5			43			**			
D6			***			**			
D7			***			*			
D8			55			148			

nd no data; dust pots were knocked over or disturbed during the sampling period

* = Sample contaminated with foreign material

** = No accurate determination was possible due to interference caused by an anti-algal growth additive resulting in unrepresentative results in samples D1 to D6. D8 had no additive added as a control point.

*** = Results for these monitoring locations are presented below in a separate table below.

Non-representative Monthly Dust Deposition Results (mg/m2/day)

	Sept 06			Oct 06			Nov 06		
D1			*			*			*
D2			*			*			*
D3			*			*			*
D4			*			*			*
D5			*			*			*
D6			2575			373			*
D7			*			506			*
D8			*			*			*

* = See table above for other results

Table 2: Dust Deposition Results 2007

	Jan-07			Feb-07			Mar-07		
	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust
D1	38	123	161	13	13	26	<10	<10	<10
D2	37	87	124	57	76	133	<10	<10	<10
D3	46	87	133	33	14	47	<30	<10	39
D4	132	101	233	21	27	48	22	40	62
D5	57	111	168	10	36	46	76	24	100
D6	89	16	105	28	37	65	35	37	72
D7	Bird litter contamination			Bird litter contamination					
D8	88	42	130	54	152	206	27	69	96
	April-07			**May-07**			**June-07**		
D1			95			*			222
D2			72			145			195
D3			33			143			185
D4			112			163			305
D5			151			*			184
D6			94			*			172
D7			*			*			*
D8			181			202			238
	July-07			**Aug-07**			**Sep-07**		
D1			319			72			37
D2			90			148			24
D3			85			96			42
D4			96			99			43
D5			315			*			75
D6			114			234			65
D7			*			*			100
D8			147			212			51
	Oct-07			**Nov-07**			**Dec-07**		
D1	57	<10	67	<10	<10	<10	54	17	71
D2	<10	<10	<10	<10	<10	<10	35	29	64
D3	<10	<10	<10	31	<10	41	<10	<10	<10
D4	15	<10	25	<10	<10	<10	79	14	93
D5	*	*	*	*	*	*	46	14	60
D6	*	*	*	<10	<10	<10	*	*	*
D7	*	*	*	*	*	*	23	15	38
D8	52	<10	62	<10	<10	14	39	41	80

* - Dust gauges contaminated with bird excrement.

Table 3: Dust Deposition Results 2008

	Jan-08			Feb-08			Mar-08		
	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust	Organic Dust	Inorganic Dust	Total Dust
D1			<10	74	85	159	*	*	*
D2			<10	55	98	153	34	12	46
D3			<10	60	70	130	26	11	37
D4			<10	56	67	122	<10	<10	17
D5			17	135	194	329	*	*	*
D6			60	*	*	*	*	*	*
D7			<10	37	82	119	43	81	124
D8			<10	**	**	**	<10	<10	<10
	April-08			**May-08**			**June-08**		
D1			38			125			169
D2			*			*			20
D3			*			119			23
D4			28			*			<10
D5			*			*			*
D6			*			*			*
D7			12			106			56
D8			31			126			40
	July-08			**Aug-08**			**Sep-08**		
D1			*			49			
D2			221			61			
D3			71			26			
D4			<10			79			
D5			*			*			
D6			*			*			
D7			85			23			
D8			131			264			

* - Dust gauges contaminated with bird excrement.

** - Sample container broken in transit to lab

Appendix 9 PM_{10} Monitoring Results

Table 1: PM_{10} Results 2006

Average PM_{10} Concentration Value ($\mu g/m^3$)				
Location	Monitoring Period			
	Q1	Q2	Q3	Q4
PM1	7	43.1	18.1	8.3
PM2	<7	25	15.3	12.5
PM3	17	9.7	11.1	12.5
PM4	<7	26.4	13.9	11.1
PM5	11	13.9	13.9	2.8
PM6	<6	20.8	3.5	16.7

Table 2: PM_{10} Results 2007

Average PM_{10} Concentration Value ($\mu g/m^3$)				
Location	Monitoring Period			
	Q1	Q2	Q3	Q4
PM1	62.5	25.0	18	19
PM2	6.9	23.6	12.5	28
PM3	NDP	26.4	19.4	26
PM4	11.1	19.4	22.2	31
PM5	18.1	26.4	11.1	24
PM6	48.6	16.7	15.9	17

Table 3: PM_{10} Results 2008

Average PM_{10} Concentration Value ($\mu g/m^3$)				
Location	Monitoring Period			
	Q1	Q2	Q3	Q4
PM1	22	12	14	
PM2	20	10	18	
PM3	24	12	15	
PM4	28	9	16	
PM5	19	7	10	
PM6	24	7	13	

Appendix 10 Noise Monitoring Results

Table 1: Summary of Noise Monitoring Results, 2006

Location	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}
N1	53	54	48	55	57	51	52	55	44	50	52	42
N2	55	55	49	42	42	36	47	47	40	50	52	42
N3	55	53	46	44	47	40	46	47	40	46	47	42
N4	47	48	43	42	44	35	48	47	38	52	51	44

Table 2: Summary of Noise Monitoring Results, 2007

Location	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}
N1	55.0	52.6	42.2	48	51	38	44	47	36	46	45	39
N2	50.4	52.8	44.4	51	54	39	56	47	36	60	57	43
N3	50.5	48.8	41.2	45	48	38	54	53	40	50	53	46
N4	52.8	50.6	41.8	46	48	39	45	45	36	52	47	38

Table 3: Summary of Noise Monitoring Results, 2008

Location	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}	L_{Aeq}	L_{AF10}	L_{AF90}
N1	46	45	35	47	47	41	48	47	33			
N2	60	53	39	58	55	43	52	50	36			
N3	50	49	40	49	47	41	44	46	37			
N4	44	44	33	44	45	38	47	43	32			

Appendix 11 Archaeological Monitoring Results & Reports

Margaret Gowan & Company Archaeological Reports

2.11 CULTURAL HERITAGE

2.11.1 Baseline Survey

The Record of Historic Sites and Monuments for Co. Meath was consulted for the relevant parts of Co. Meath Ordnance Survey 6" Sheets 26 and 32. All sites within a radius of *c.* 3 km of the proposed development were identified (Figure 2.11.1 & Appendix 2.11.1). The relevant files for these sites, which contain details from aerial photographs, early maps, OS memoirs, OPW Archaeological Survey notes and other relevant publications, were then studied in the Sites and Monuments Records Office. These monuments are listed in Appendix 2.11.1.

The topographical files in the National Museum of Ireland were consulted to determine if any archaeological artefacts had been recorded from the area. Other published catalogues of prehistoric material were also studied: Raftery (1983 - Iron Age antiquities), Eogan (1965; 1983; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers) and the Irish Stone Axe Project Database (Archaeology Dept., U.C.D.). The finds from the area are listed in Appendix 2.11.2.

Aerial photographs of the area of the proposed development were examined in the Geological Survey of Ireland (G.S.I. N275). There were no aerial photographs relevant to the site in the National Museum (Cambridge-St. Joseph Collection). A commissioned aerial photograph of the site was later made available by K.T. Cullen. Several earthworks were visible (see section 2.11.4).

Primary historical sources consulted included the Civil Survey for Co. Meath (1654-6), the Census of Ireland (*c.* 1659), Bishop Dopping's Visitation book (*c.* 1682-5), the Census of Ireland (1851), and Griffith's General Valuation of Rateable Property in Ireland (1854).

Primary cartographic sources consulted consisted of the Ordnance Survey 6" maps, sheets 26 & 32, 1836 and 1909 editions (T.C.D. Map Library).

2.11.2 Previous Research

Previous archaeological research was Carried out by Margaret Gowen and Co. This consisted of a preliminary site selection study and of archaeological test trenching in 1997. This was followed by a geophysical survey in 1998. Further test trenching was then carried out, to clarify the results of the geophysical survey. The overall results were published in a previous report (see Gowen 1999). The results are summarised below.

Trench 1 (Fields 24/25)
A modern field drain and field boundary were uncovered.

Trench 2 (Field 18)
A 4m wide ditch was exposed after testing an area where geophysical prospection had revealed a circular area of anomalous responses. This was interpreted as quarrying but this is not conclusive.

Trench 3 (Farmyard in centre of site)
A trench was excavated adjacent to the holy well. The farmyard consisted of a 1.3m deep layer of compacted brown clay and stone hardcore. No occupation related to the well was revealed but the well itself was not conclusively examined as it was then flooded

Trenches 4 & 5 (Field 5)
These trenches were excavated through a mound within the 'moat field'. They revealed that it was a natural hillock which had been lightly quarried in modern times.

Trenches 6 & 7 (Field 4)
Anomalous zones highlighted by geophysical prospection were confirmed to be of natural origin.

2.11.3 Archaeological and Historical Background

The archaeological and historical background of the site is presented in Appendix 2.11.3 and is summarised below.

2.11.3.1 Prehistoric Period

Evidence for the earliest known settlement in the vicinity of the site is for the Neolithic period, in the form of a henge monument (Me 32:11) located in Balrath townland to the south east of the site. This is complemented by Neolithic polished stone axe-heads - one from Painestown townland (NMI 1978:139), immediately north of the site and one discovered in the ditch of a ringfort (Me 26:11) in Realtoge townland, immediately to the north of the site. A circular cropmark enclosure (Me 32:18) nearby , which is 80m in diameter could also be of prehistoric provenance.

A bronze vessel (NMI 1944:871) found during peat cutting in Thomastown, Duleek parish, due east of the site could be evidence for Bronze Age activity in the vicinity of the site. However, in the absence of greater details it is uncertain whether this bowl is of Bronze Age or of later provenance.

There is no recorded evidence for Iron Age activity in the immediate vicinity of the site, but this is by no means an indicator of absence. For example, Tara, the legendary royal site, located about 8km to the south west, was the focus of very significant activity in the region at this time.

2.11.3.2 Early Medieval Period

There is more evidence for early medieval settlement in the vicinity of the site. Perhaps the earliest indicator of a presence during this period is in the form of an Ogham stone (NMI 1970:6) found in Painestown townland, immediately north of the site. It consisted of a stone pillar with the following inscription in ogham script; *'Maqi Caratini Avi Ineqaglas'*.

There is ample evidence for settlement sites of the period. There are three ringforts within a 3km radius of the proposed development. Danestown (Me 32:7), Realtoge (Me 26:11) and Brownstown

(Me 26:13). The cropmark of a circular enclosure in Monktown (Me 32:16), measuring 45m in diameter, could mark the site of another destroyed ringfort. It is also situated near a later parish church. A second circular cropmark enclosure nearby (Me 32:18), which is 80m in diameter could date to this period, although it could very well be of prehistoric provenance.

There are also two souterrains immediately beyond the 3km radius, at Mullaghfin (Me 26:16) to the west and at Monktown (Me 32:246), to the south. Another possible souterrain, observed as a shallow linear depression, has been noted within the ringfort at Realtoge (Me 26:11). Such underground passages were normally associated with domestic settlements and functioned both as cool cellars for the storing and protection of dairy produce and also as places of temporary refuge during times of small-scale raiding (Lucas 1973, 165-91). They highlight the possibility of other low visibility settlement sites in the area.

2.11.3.3 Later Medieval Period (1169-1600AD)

Knockharley, Tuiterath and Flemingstown townlands, in the Parish of Kentstown, lay on the border of the lordships of Duleek and Skreen (see Appendix 2.11.4). Hugh de Lacey was granted the Lordship of Meath, which he subinfeuded among his chief retainers. Hugh granted one Adam de Feypo the lordship of Skreen in 1175 (Hickey 1994, 41), while he directly retained the lordship of Duleek. Kentstown parish, which was in the lordship of Duleek was granted to Stephen de Kent (*ibid.*, 123).

The centre of Kentstown parish is marked by the site of the parish church (Me26:6). A thirteenth century font from the church site at Timoole was later moved here (Moore, 1987). The residence of Stephen de Kent, who was lord of the manor, was presumably in the vicinity of the church. The Civil Survey (1654-6) (Simmington 1940) (see Appendix 2.11.5) recorded a castle and a church at Kentstown, which by then belonged to Lord Dunsany. This castle was most likely a tower house, of fifteenth to early seventeenth century date, perhaps sited on the earlier de Kent residence.

There are no other recorded monuments which provide evidence for medieval secular settlement, but a residence of some substance is alluded to in the form of a mid-fourteenth century tomb effigy preserved at the site of the medieval parish church (Figure 2.11.2). It records the death of Thomas de Tuite in 1363. His status is made clear through the commissioning of the fine carved slab and through his depiction as a knight with gloves, spurs, sword and fine cloak (Hunt, 1974, 206). He was 'of Kentstown', but this could mean either the townland or, more generally, the parish. The townland of Tuiterath, within the parish, seems a likely site of such a residence.

Later investment in public religious devotion is evidenced by the fine wayside cross erected in Balrath townland (Fig.2.11.3), which comprises the adjacent parish of the same name. Such crosses served as a prudent investment for the wealthy with an eye on the afterlife. It is inscribed with an appeal for a prayer for Johanis Broin and is probably of sixteenth century date. A further inscription dated to 1727 was commissioned by Sir Andrew Aylmer and his wife Catherine, which provides testament to its continued significance as a local monument of devotion (King 1984, 105).

Bishop Dopping's visitation book of 1682-5 (see Appendix 2.11.6) (Ellison 1971) records that the church had been in disrepair since 1641 and lacked a roof, glass and furnishings. There was a Catholic priest called Nugent, but no Popish school. No details are given of how or where the Catholics worshiped. The possible holy well in Knockharley townland could have served as a continued source of local prayer.

2.11.3.4 Possible Holy Well

This well was recorded by the Folklore Commission in 1930. It is uncertain as to how far back this tradition of a holy well may be traced, but many such wells reveal strong traditions of pre-Christian ritual (Logan 1980, 11). Knockharley exhibits many of the attributes which have been observed at holy wells. It is dedicated to a saint, in this case St. Patrick, and is reputed to have healing or protective powers (see Logan 1980, 12). It is also associated with a stone. Such stones are often bullaun stones, which can be used for curing or cursing, or Saint's 'chairs' or 'beds' (Logan 1980, 17). In this case a stone above the well is reputed to bear the mark of Saint Patrick's fingers, from the time he drank at this spot. Further associations, such as a holy tree with rags and votive offerings (Logan 1980, 114) cannot be vouched for, though they would leave little trace.

The possible holy well site was investigated by test trenching, but the evidence with regard to the dating and the function of the site was inconclusive, as flooding prevented thorough examination. A suggestion that a feature indicated on the third edition of the O.S. 6" map was a structure, which therefore casts doubt on the holy well tradition is not convincing. The 'structure' indicated actually appears to be the holy well itself. This is supported by the drafting of the cattle pond immediately to the north west as a similar, though larger, irregular line-drawn shape (Figure. 2.11.5).

2.11.3.5 Placename Evidence

The townland names of Kentstown parish reflect the subdivision of the manor among several of de Kent's retainers (Appendix 2.11.4). The use of pre-existing Irish townland units in land grants was universal (MacErlean 1983, 332). Kentstown townland itself must have remained in the hands of de Kent. Veldonstown and Flemingstown townlands probably record the names of the farms of two of de Kent's followers. Tuiterath is a composite name. It was held by the de Tuite family. The 'rath' element in the name may refer to a pre-existing ringfort, or else it is a rather poetic and anachronistic name for their residence. Curraghtown and Knockharley are the only other townlands in the parish to retain an Irish element in their name. Significantly, neither name records a Norman family name, which suggests they remained peripheral to Norman settlement within the parish. This possibility is strengthened as Curraghtown means the town of the bog or moor. Knockharley might be translated as Hurley's hill. This is name of relatively recent provenance. It was known as Knockerc in the Civil Survey of the seventeenth century. Erc was a native saint, which could account for the retention of the native placename until the seventeenth century.

2.11.3.6 17th Century Landownership

A brief picture of seventeenth century Kentstown is provided in the Civil Survey (1654-6), which was commissioned to ascertain land ownership, as a prelude to the Cromwellian land settlements (Simmington 1940) (Appendix 2.11.5). The parish core consisted of the church and a castle held by Lord Dunsany. He held most of the parish including Knockharley and Tuiterath. Flemingstown was held by Thomas White who resided there, while Daltonstown was held by Thomas Cusadee of Staffordshire. No details of subtenants or their residences are given.

2.11.3.7 Population-17th -19th Centuries

Unfortunately information on Irish population is scant before the seventeenth century. The census of 1659 (Pender 1939) (Appendix 2.11.7) records 141 adults in Kentstown parish. They were divided into 41 English and 100 Irish, which no doubt reflected the recent influx of Cromwellian settlers. Knockharley (recorded as Knockerc) had a population of 22, consisting of 10 English and 12 Irish, and Tuiterath had a population of 6, consisting of 2 English and 4 Irish. Flemingstown (880 acres), with a population of 42 and Kentstown (459 acres) with a population of 28 were the most populous townlands of the parish, but when adjusted for size they shared a similar density to Knockharley (291 acres). Tuiterath (202 acres) appears relatively underpopulated for its size and indeed had the lowest population in the parish.

In 1837, Lewis (1837) (Appendix 2.11.8) noted that Kentstown had a population of 500. By 1841 (Appendix 2.11.9) this had risen slightly to 514. It had dropped to 382 by 1851, reflecting a 26% collapse, due to famine and attendant disease and emigration during the 1840's. The population of Tuiterath townland was reduced by a devastating 76%, while Knockharley lost 34% of its residents. Kentstown townland fared best, suffering a 15% reduction. This devastation was also reflected in the landscape. The number of houses in Tuiterath fell from five to three, one of which was uninhabited. Knockharley had seven houses, which showed a reduction of two from the 1841 figure.

2.11.3.8 19th Century Landholding

Griffiths Primary Valuation of 1854 (Griffith 1854) provides a clear picture of Kentstown before the Land Acts had finally removed the landlord class (Appendix 2.11.10). It suggests prosperity and modest recovery for those who had weathered the famine. Tuiterath then contained five houses, all inhabited, while Knockharley, with seven houses, showed no change. The valuation provides greater information about the structure of landownership in the parish.

Knockharley was almost entirely owned by one William A. Shaw. A large farm with house, offices and land comprising 263 acres was leased to Laurence Kinshella, who in turn leased a house each to George McLoughlin and Francis Phew, who perhaps worked on the farm. One Mary Levinge leased a house with offices and 12 acres of land from Shaw. She in turn leased a house to Alice Philips. Shaw also leased a house with 8 acres of land to Margaret O'Brien. The remaining 7 acres within the townland was held by Thomas Carpenter who leased it from Arthur Murray. Carpenter leased a house on the premises to Charles Martin.

Tuiterath reflected a similar structure. Michael Campbell leased a house with offices and 179 acres of land from M.G. Everatt. Campbell leased a house to Charles Smith, while another house lay vacant. A smaller portion of the townland was held in fee by Sir William Somerville Bart., whose main estate consisted of Flemingstown townland, where he resided in Somerville demesne. He held 11 acres of Tuiterath as a plantation and leased 6 acres of land to Richard McGrane and a house and 4 acres to Thomas Carter. Carter leased a house to one John Manning. Edward Hogan and Thomas Flood were listed as Trustees of the Navan-Ashbourne Turnpike road which ran through the townland.

2.11.3.9 Townland Boundaries and Field boundaries

The proposed development affects four separate townlands (Figures. 2.11.4 & 2.11.5). The proposed development will bring about a complete transformation of Knockharley townland and has the potential to impinge on the townland boundaries of Curraghtown, Flemingstown and Tuiterath. The Irish townland has long served as the basic unit of land division and as a definer of local identity. Many are of considerable antiquity and can be traced back to at least the twelfth century AD (MacErlean 1983, 315-39). The unique nature of these specific townlands is further emphasised by significant variations in the patterns of land enclosure in each townland. These variations could be due to variations in land occupancy such as evidenced in Griffith's Valuation.

The townland boundaries within the development are of varied form and are not immediately discernible from the surrounding boundaries. However, closer examination often highlights subtle differences. Townland boundaries often utilise natural topography or major man-made features. Hence, the north of Knockharley is defined by a road, while the other three sides are marked by field boundaries set on slight breaks of slope. The eastern townland boundary, dividing Knockharley and Flemingstown is a 2.5m wide ditch, which is 1.6m deep. The land is slightly higher in Flemingstown to the east, where there is a slight bank at the edge of the ditch. Both sides of the ditch are planted with trees, which are 4-5m high. The importance of the boundary is further accentuated by the traces of a drystone wall revetment on the eastern edge of the ditch. This is the only boundary in the proposed development to have this feature. The western boundary between Knockharley and Curraghtown is a 2m wide and 0.5m deep ditch, with a 4-5m tall hedgerow of trees on its western side. The land west in Curraghtown is slightly higher.

The third edition Ordnance Survey 6" maps (1909) provide a general overview. Knockharley townland is characterised by large regular, rectangular fields. The portion of Flemingstown enclosed within the development is noticeably different to both Knockharley, Tuiterath and the reset of Flemingstown. The fields are small and rectangular in shape and of varying size. Tuiterath townland is characterised by relatively large and irregularly shaped fields forming a pattern which is clearly overlaid by the N2 roadway. The few fields of Curraghtown which are to be incorporated within the development are indistinguishable in shape and size from neighbouring Knockharley. However, they are indicated on the O.S. 6" map as partly marsh, perhaps the last vestiges of the 'curragh', or marsh, recorded in the townland name.

The field system in Knockharley townland appears to have been laid out in several blocks. The laneway which leads to the old farm in the centre of the townland effectively bisects it. Field boundaries run at right angles to either side of the laneway, creating what could be considered two separate units. The northern edge of the townland might be considered a third unit as it is separated by a deeply cut channel containing a stream which runs parallel to the roadway and is further divided by the farm laneway.

Analysis of the history of the field boundaries over the last 150 years indicates a continuing process of insertion and removal of field boundaries, leaving the overall pattern much the same. Several field boundaries were removed between 1836 and 1909 in order to create larger fields, while several other fields were subdivided and one (field 3) was significantly improved through the insertion of a grid of deep field drains (Figure 2.11.6). Further changes have been made since 1909 (Figure 2.11.7). Field inspection revealed that fields 12-14 have been amalgamated into one, for the purposes of tillage. All but one of the field drains in field 3 have been backfilled, while the majority of small fields in Flemingstown have been replaced by a network of fields bounded by electric fences.

Modern settlement patterns also vary from townland to townland (Figure 2.11.8). In each case settlement is dispersed and predominantly roadside based, although often with a central farm. Knockharley consists of a farmyard and the site of a farmhouse, which is located in the centre of the townland, accessed by a laneway, in addition to several houses along the road, which serves as the northern townland boundary. This pattern appears to reflect the landholding pattern as depicted in Griffith's Valuation, of a single large farm with small holdings and cottages located by the roadside, well away from the farmhouse. Housing within the relevant portion of Flemingstown straddles a road, which bisects that part of the townland, while settlement in Tuiterath straddles the N2. The general pattern of settlement has not changed much between 1836 and 1909 (O.S. 6" sheets), however there has been a fair degree of discontinuity of site. Six house sites appear to have continued in use, while five house sites, all in Flemingstown, have been abandoned. One new house site was established, in Knockharley townland.

2.11.4 Aerial Photographs

An examination of vertical aerial photographs (G.S.I. N275) of the area of the proposed development revealed no features of potential archaeological interest within the area to be developed.

An aerial survey was carried out by BKS Surveys Ltd as part of this EIS. An examination of the resulting high resolution vertical photographs revealed some features of potential archaeological interest within the area to be developed. They were confined to field 10 at the south of the site (see fig. 2.11.6). They consisted of what appears to be the remains of a bi–vallate circular enclosure, which could be of prehistoric or early medieval provenance and a sequence of ploughed out field boundaries or field drains (see section 2.11.5.1; field 10). Some appear to relate to a more extensive field system, partly recorded on the 1st edition ordnance survey 6" map (1830's), while

others are likely to be field drains associated with the modern field system (1900's), with which they are oriented.

2.11.5 Field Survey

The bulk of the fieldwork was carried out on the 12th and 13th September 2000, in warm and dry conditions. This consisted of fieldwalking of the entire townland of Knockharley and portions of Curraghtown and Flemingstown townlands (fields 1-47). Each field was walked and several features were recorded; namely land use, field boundaries and possible archaeological monuments. The portions of Flemingstown and Tuiterath townlands, which lie east of the county road were not walked at this time, as the exact location of the access route had yet to be finalised. They were walked on the 25th September 2000 in fine, sunny conditions. Fields 8,9 & 10 were walked on 29th November 2000

No monuments of archaeological significance were found in either survey. However several townland boundaries were encountered in addition to the remains of the farmyard complex at the centre of the townland. Please refer to Fig. 2.11.4. for the location of fields and features described in the text.

2.11.5.1 Field Descriptions

Field 1. Level field in stubble/ recently harvested crop. The northern boundary consists of a 2m wide flat-bottomed ditch which was 1.4m deep. A 2m tall hedge is sited on the western side of the flat-bottomed ditch abutting the road. The eastern boundary is 2m wide and 1.6m deep, with 6m tall trees growing from the base of the western edge of the ditch. The southern boundary consists of a 2m wide flat bottomed ditch, 0.4m in depth, with a 6-8m tall hedge of trees set on a 0.3m high bank located on the southern side of the bank. The western boundary consists of a 1.4m deep and a 1.4m wide flat bottomed ditch, with a 6m high hedge of bushes, which are sited on a 0.4m high bank which is located on the western edge of the ditch.

Field 2. Level field in stubble/ recently harvested crop. The northern boundary is 2.5-3m wide and 2m deep flat-bottomed ditch, with mixed rough bushes on the northern side. The eastern boundary serves as a townland boundary, between Knockharley and Flemingstown. It is a ditch 2m wide and 0.5m deep. There is a 0.3m high bank and a 6m high hedgerow of trees on the western edge. The ground level on the eastern side of the boundary is 1.3m higher than on the western side and it has a low bank, which supports a 5m high hedgerow of trees. There are fragmentary remains of a drystone wall revetment on the eastern face of the ditch. The southern boundary consists of a bank and ditch. The ground level on the south side of the ditch is 1.2m lower than that in field 2 and there is a 4m high hedgerow of trees.

Field 3. Damp field in rough pasture. It is cut by a drainage channel, which runs through the centre of the eastern half of the field, in an east west direction. It measures 4m wide and is 1.8m deep and contains some water. Other drainage channels indicated on the O.S. 6" 3rd ed. maps are no longer extant. The northern boundary of the field consists of a ditch, which is 2-3m wide and

1.8m deep and is wet in places. There is a 4m high hedge on the northern edge of the ditch. The eastern boundary is a ditch, 4m wide and 1.8m deep. The southern boundary is a 2.5-3m wide and 2m deep ditch, with mixed rough bushes on the northern side. The western boundary consists of a ditch measuring 2m wide and 0.5m deep, with a hedgerow of trees 5-6m tall on its western edge, abutting the laneway.

Field 4. Field in stubble/ recently harvested crop. The land rises in the centre. The northern boundary consists of a ditch, the base of which rises 2m to the summit of a 0.3m high bank located in field 2, which is at a higher level. The low bank is surmounted by a 6m tall hedge of trees. The eastern boundary is a townland boundary, dividing Knockharley and Flemingstown. It is a 2.5m wide ditch, which is 1.6m deep. The land is slightly higher in fields 32 and 34 to the east, where there is a slight bank at the edge of the ditch. Both sides of the ditch are planted with trees, which are 4-5m high. There are traces of a drystone wall revetment on the eastern edge of the ditch. The southern boundary is a 2m wide ditch, which is 0.6m deep and has a 4-9m high hedge of trees and bushes on its southern side. The western boundary is a 3m wide and 1.4m deep ditch, with 6m high hedgerows of trees on both sides.

Field 5. Field in pasture. There is a mound and adjacent hollow in the centre of the field. (archaeologically tested, but revealing nothing of archaeological interest (see Gowen, 2000)). The northern boundary consists of 6-8m tall trees on a 0.3m high bank, followed by a 2m wide flat bottomed ditch, 0.4m in depth. The eastern boundary is an 8-9m tall hedgerow of trees set on a 0.3m high bank, beyond which, is a 3m wide and 0.4m deep ditch. The southern boundary consists of a 2m wide and 0.6m deep ditch, with a 5-8m high hedge of trees on the southern side. The western boundary consists of the back of farm buildings to the south and is marked elsewhere by a hedgerow of 6-8m high trees, beyond which is a ditch which accentuates a natural drop in slope.

Field 6. Undulating ground in pasture. The northern boundary is a 2m wide ditch, which is 0.6m deep and has a 4-9m high hedgerow of trees and bushes on its southern side. The eastern boundary is a townland boundary between Knockharley and Flemingstown. It is a 2.5m wide ditch, which is 1.6m deep. The land is slightly higher to the east in fields 32 and 34, where there is a slight 0.3m high bank at the edge of the ditch. Both sides of the ditch are planted with trees, which are 4-5m high. There are fragmentary remains of a drystone wall revetment on the eastern face of the ditch. The southern boundary is a 3m wide and 1.6m deep ditch with a hedgerow of 4-6m high trees. The western boundary consists of a 6-9m high hedgerow of trees set on a low bank followed by a 2m wide and 0.6m deep ditch.

Field 7. Undulating ground in pasture. The northern boundary is a 2m wide ditch, which is 0.6m deep and has a 4-9m high hedgerow of trees and bushes on its southern side. The eastern boundary is a townland boundary between Knockharley and Flemingstown. It is a 2.5m wide ditch, which is 1.6m deep. The land is slightly higher to the east in fields 32 and 34, where there is a slight 0.3m high bank at the edge of the ditch. Both sides of the ditch are planted with trees, which are 4-5m high. There are fragmentary remains of a drystone wall revetment on the eastern face of the ditch. The southern boundary consists of a 3m wide and 2m deep wet ditch containing a stream, with

occasional trees along its length. The western boundary is a 6-9m high hedgerow of trees, sitting on a low bank, followed by a 2m wide and 0.6m deep ditch.

Field 8. Rough pasture. Cattle and possibly a bull. Field not surveyed at that time. Revisited 29/11/00. The field consisted of undulating terrain and contained two north – south oriented field drains which were visible as damp depressions and are indicated on the 6" map.

Field 9 Under 2m high crop. Fields not surveyed. This field was revisited on 29/11/00. It was covered in crop stubble.

Field 10 This field was visited on 29/11/00. It is a field in pasture, with undulating terrain, which slopes slightly upwards towards the north. It is flanked to the west, south and east by the townland boundary. The eastern edge consists of a stream (4m wide from bank to bank), with hedgerows on both banks. It is 1m deep to the water level. The southern boundary consists of a 2m wide flat bottomed ditch, with a bank on its southern side, which rises 1.4m above the base of the ditch and supports a hedgerow. The southerly field, in the next townland, is 0.3m above field 10. The northern and western boundary consist of a bank, ditch and hedgerow.

A series of earthworks were visible on an aerial photograph (see fig. 2.11.6). The east-west running linear features are visible as slight hollows, with areas of differential grass growth. The northeast – southwest running ditch is waterlogged in places. The north south running features are visible, but are not so clear. The possible bi-vallate oval enclosure is sited on noticeably drier ground and ditches were partly discernible as damper hollows with differential grass growth.

Field 11. Field in stubble/ recently harvested crop. The northern boundary consists of a 1.8m high gorse hedge, followed by a 2m wide and 1.6m deep ditch. The eastern boundary is 4m tall hedge of trees and bushes followed by a very overgrown 2m wide and 2m deep ditch, which is quite wet at its southern end. The southern boundary is a townland boundary between Knockharley and Curraghtown. It consists of a 6-8m high hedgerow of trees followed by a 2m wide and 0.6m deep ditch, with a small counter-bank which is 0.4m high. The field to the south of the field 11 is slightly lower. The western boundary is a continuation of the townland boundary. It has been recut recently in places and consists of a 2m wide and 0.5m deep ditch, with a 4-5m tall hedgerow of trees on its western side. The land west of the field is slightly lower.

Fields 12, 13, 14. Amalgamated into one field, which is in stubble/ recently harvested crop. The northern boundary consists of a 1-2m wide and 0.5m deep ditch, with a 4-8m high hedgerow of trees on the northern edge. The eastern boundary consists of a 2m wide and 0.6m deep ditch followed by a 6-9m high hedgerow of trees set on a low bank. The southern boundary consists of a 2m wide and 1.6m deep ditch, followed by a.1.8m high gorse hedge. The western boundary is part of the townland boundary between Knockharley and Curraghtown. It is a 2m wide and 0.5m deep ditch, with a 4-5m tall hedgerow of trees on its western side. The land west of the field is slightly lower.

Field 15. Field in stubble/ recently harvested crop. The northern boundary consists of a 1-3m wide and 0.5m deep ditch, with a 2m tall hedge of gorse on the northern side. The eastern boundary is a 3m wide and 0.5m deep flat-bottomed ditch with 6-8m tall trees on both sides. The southern boundary is a 4-8m high hedgerow of trees, followed by a 1-2m wide and 0.5m deep ditch. The western stretch, where it serves as a townland boundary, consists of a 4m wide and 2m deep flat-bottomed ditch. The western boundary is a townland boundary between Knockharley and Curraghtown, which is a 2m wide ditch, which drops 0.7m below the surface of the field. There is a 0.3m drop in ground level in the adjoining field. There are 6-10m tall trees on both sides.

Field 16. Field in stubble/ recently harvested crop. The northern boundary consists of a 4m wide and 2m deep flat-bottomed ditch containing a stony bedded stream. There are 6m high tree hedgerows with many gaps on either side. The eastern boundary is a 6m high hedgerow of trees, followed by a 4m wide and 1.4m deep ditch. The southern boundary consists of a 2m tall hedge of gorse, followed by a 1-3m wide and 0.5m deep ditch. The western boundary is a townland boundary between Knockharley and Curraghtown, which consists of a 6-10m high hedgerow of trees followed by a 2m wide and 3m deep flat-bottomed ditch. There is a drop in ground level of 1m in the adjoining field.

Field 17. Field in stubble/ recently harvested crop. The northern boundary consists of a 4m wide and 2m deep flat-bottomed ditch containing a stony bedded stream. The eastern boundary consists of a 6-10m tall hedge of trees followed by a 2m wide and 1.6m deep flat-bottomed ditch, containing some water, which abuts the laneway that gives access to the farmyard. The southern boundary is a 6m high hedgerow of trees, followed by a 3m wide and 1.7m deep flat-bottomed ditch. There is a 1.1m drop in ground level in the adjoining field to the south. The western field boundary a 4m wide and 1.4m deep ditch, followed by a 6m high hedgerow of trees.

Field 18. Field in stubble/ recently harvested crop. The northern boundary consists of a 3m wide and 0.6m deep flat bottomed ditch, which rises 1.7m to the level of the next field, where there is a 6m high hedgerow of trees. The eastern boundary consists of a 6-10m tall hedgerow of trees followed by a 2m wide and 1.6m deep flat bottomed ditch, containing some water, which abuts the laneway which gives access to the farmyard. The southern boundary is a 6-10m tall hedgerow of trees, followed by a 3m wide and 0.6m deep ditch. The western boundary is a ditch 3m wide and 0.5m deep with hedgerows of 6-10m tall trees on both sides.

Field 19. Field in stubble/ recently harvested crop. The northern boundary consists of a 2m wide and 0.5m deep ditch followed by bank, supporting a 1.6m tall hedge abutting the road, which serves as a townland boundary between Knockharley and Painestown. The ditch is up to 1.4m deep at the western edge of the field. The eastern boundary is a 5m high hedgerow of trees followed by a 3-4m wide and 0.6m deep flat-bottomed ditch. There is a 2-4m tall hedgerow on the eastern edge of the ditch abutting the laneway, which gives access to the farmyard. The southern boundary is a 4-5m wide and 0.7m deep ditch filled with water and overgrown with nettles. The western boundary consists of a 5m wide and 2m deep wet ditch, which contains occasional bushes. There is also a 2-3.5m tall hedgerow on the western edge of the ditch.

Field 20. Field in stubble/ recently harvested crop. The northern boundary consists of a 2m wide and 0.5m deep ditch followed by bank, which are both covered by a 1.6m tall hedge abutting the road. The eastern boundary consists of a 2-3.5m tall hedge, followed by a 5m wide and 2m deep wet ditch, which contains occasional bushes. The southern boundary is a 4m wide and 2m deep flat-bottomed ditch containing a stony bedded stream. The western boundary is a townland boundary and consists of a 3-4m wide and 2m deep ditch with a 4m high hedgerow of trees on both sides.

Field 21. In pasture. The northern boundary consists of a 2m wide and 0.5m deep ditch followed by bank which are both covered by a 1.6m tall hedge abutting the road. The eastern boundary is a townland boundary between Knockharley and Currraghtown and consists of a 3-4m wide and 2m deep ditch with a 4m high hedgerow of trees on both sides. The southern boundary is a 5m wide and 3m deep flat-bottomed ditch containing a stony bedded stream. There is a 4-8m high hedgerow of trees on both sides. The south-eastern corner has been recently recut. The western boundary consists of a 4-5m high hedgerow of trees, followed by a 3-4m wide and 0.6m deep flat bottomed ditch.

Field 22. In pasture. The northern boundary consists of a 2m wide and 0.5m deep ditch, followed by bank, which are both covered by a 1.6m tall hedge, abutting the road. The eastern boundary consists of a 3-4m wide and 0.6m deep flat-bottomed ditch, followed by a 4-5m high hedgerow of trees. The southern boundary is a 5m wide and 3m deep flat-bottomed ditch containing a stony bedded stream. There is a 4-8m high hedgerow of trees on both sides. The western boundary consists of a privet hedge enclosing the adjacent house.

Field 23. Field in stubble/ recently harvested crop. The northern boundary consists of a 2m wide and 0.5m deep ditch followed by bank, which supports a 1.6m tall hedge abutting the road, which serves as a townland boundary between Knockharley and Painestown. The eastern boundary consists of a 2m wide and 0.7m deep ditch with a 2m tall hedgerow on both sides. The southern boundary consists of a 4m high hedge and a ditch, which is 2-3m wide and 1.8m deep and is wet in places. The western boundary is a 3m wide and 0.6m deep flat bottomed ditch, followed by a 4-6m tall hedgerow of trees sitting on a low bank, beside the laneway which gives access to the farmyard.

Fields 24, 25. Amalgamated. In rough pasture. Covered in heather. The northern boundary consists of a hedgerow of trees, followed by a shallow ditch. The eastern boundary is a 3m tall degraded hedgerow, followed by a 2m wide and 0.6m deep ditch. The southern boundary is a 4m tall hedgerow followed by a 2-3m wide and 1.8m deep wet ditch. The western boundary consists of a 2m wide and 0.7m deep ditch with a 2m tall hedgerow on both sides.

Fields 26, 27. Paddocks in rough pasture. Part of farm complex. The northern boundary consists of a 2m wide and 0.5m deep ditch followed by bank, which supports a 1.6m tall hedge abutting the road, which serves as a townland boundary between Knockharley and Thurstianstown. The eastern boundary is a 3m tall, degraded hedgerow, followed by a 2m wide and 0.6m deep ditch. The southern boundary consists of a shallow ditch, followed by a hedgerow of trees. The western boundary is a 2m wide and 0.7m deep ditch with a 2m tall hedgerow on both sides.

Fields 28-44. The old field boundaries have been removed and have been replaced with new network of modern electric fences designed for cattle grazing. The northern boundary (42, 43, 44) has been partly realigned due to the re-ordering of the fields. It consists of a bank, which is 3m wide and 1.5m high. It is heavily overgrown with bushes and nettles and there are trees, 6-8m in height, along the length of it. The eastern boundary (29, 31, 33, 38, 41, 44, 47) consists of a roadside field boundary and a hedge around the existing houses and gardens. The southern boundary (28, 29) consists of a 3m wide and 2m deep ditch containing a stream, with occasional 8-10m high trees along its length. The western boundary (28, 30, 32, 34, 39, 42, 45) is the townland boundary between Flemingstown and Knockharley. It is a ditch 2m wide and .5m deep. There is a 0.3m high bank and a 6m high hedge of trees on the western edge. The ground level on the eastern side of the boundary is 1.3m higher than on the western side and it has a low bank, which supports a 5m high hedge of trees. There are fragmentary remains of a drystone wall revetment on the eastern face of the ditch.

Fields 46, 47, 49. Field in pasture. The southern boundary (42, 43, 44) has been partly realigned due to the re-ordering of the fields. It consists of a bank, which is 3m wide and 1.5m high. It is heavily overgrown with bushes and nettles and there are trees, 6-8m in height, along the length of it. The eastern boundary consists of a hedge surrounding a house and farmyard. The western boundary is the townland boundary between Flemingstown and Knockharley. It is a ditch 2m wide and .5m deep. There is a 0.3m high bank and a 6m high hedge of trees on the western edge. The ground level on the eastern side of the boundary is 1.3m higher than on the western side and it has a low bank, which supports a 5m high hedge of trees. There are fragmentary remains of a drystone wall revetment on the eastern face of the ditch. The northern boundary consists of a stream, which serves as a townland boundary.

Field 48. In pasture. The western boundary consists of a slight roadside bank, supporting a newly planted hedge, beyond which is a 2m wide and 0.5m deep ditch. The northern boundary consists of a 4m wide and 1.8m deep ditch containing a stream, which serves as a townland boundary. The eastern boundary is a 3-4m wide and 1.6m deep ditch, containing a stream. There is a 4m high hedgerow of trees on the eastern edge. The southern boundary consists of a hedgerow of trees up to 5m high, followed by a 2m wide and 1.5m deep ditch.

Field 49. In pasture. The western boundary consists of a slight roadside bank, supporting a newly planted hedge, beyond which is a 2m wide and 0.5m deep ditch. The northern boundary consists of a 2m wide and 1.5m deep ditch with a hedgerow of trees up to 6m high. The eastern boundary is a 3-4m wide and 1.6m deep ditch, containing a stream. There is a 4m high hedgerow of trees on the eastern edge. The southern boundary consists of a 2m wide and 1.5m deep ditch with a hedgerow of trees up to 5m high.

Fields 50, 51. Fields in pasture. Merged into one. The northern boundary consists of a 2m wide and 1.5m deep ditch with a hedgerow of trees up to 5m high. The eastern boundary is a 3-4m wide and 1.6m deep ditch, containing a stream. There is a 4m high hedgerow of trees on the eastern edge. The southern boundary consists of a thick hedge. The western boundary consists of a hedge, with occasional trees and rough timber fencing which surrounds a house and garden.

Fields 52, 53, 54, 55. Fields in pasture. Merged into one. The northern boundary consists of a farm trackway followed by a thick hedge. The eastern boundary consists of a 2m wide and 1.5m deep ditch followed by a 4-6m high hedgerow of trees set on a low 0.2m high bank. The southern boundary consists of a 4-6m high hedgerow of trees, followed by a 2m wide and 1.5m deep ditch. The western boundary consists of a 2m wide and 0.9m deep ditch followed by a 1.6m high roadside hedge. A shallow depression running through the centre of the field is all that remains of the east-west running boundary, which divided fields 52 & 53 from fields 54 & 55.

Field 56. In pasture. The northern boundary consists of a degraded hedge measuring 1.8m high and 1m wide. The eastern boundary is located in a depression where field 56 and field 57 slope downwards towards each other. It consists of a 3-4m wide and 1.6m deep ditch containing a stream. There is a 4m high hedgerow of trees on the eastern bank. The southern boundary consists of a 4-6m high hedgerow of trees, followed by a 2-3m wide and 1.5m deep ditch, which is quite wet in places. The western boundary consists of a 2m wide and 1.5m deep ditch followed by a 4-6m high hedgerow of trees set on a low 0.2m high bank.

Field 57. The northern boundary consists of a 1.8m tall and 1m wide hedge. The eastern boundary consists of is a 3-4m wide and 2m deep ditch, containing a stream, which serves as the townland boundary between Flemingstown and Tuiterath. There is a 6-8m tall hedgerow of trees on its eastern side. The western boundary consists of a 3-4m wide and 1.6m deep ditch containing a stream. The southern boundary consists of a 4-6m high hedgerow of trees, followed by a 2-3m wide and 1.5m deep ditch, which is quite wet in places.

Fields 58, 59. Both fields are under crops, up to 2m tall, so it was not possible to survey them. Their western boundary consisted of a 3-4m wide and 2m deep ditch containing a stream. The western edge supports a 6-8m high hedgerow of trees. This field boundary divides the townlands of Flemingstown and Tuiterath. The eastern boundary of field 58 is formed by private housing, while the eastern boundary of field 59 is marked by the N2 roadway. The boundary which divides fields 58 and 59 consists of a bank, ditch and hedgerow consisting of 6-8m tall trees.

Farmyard Complex. The farmyard is approached from the public road, via a long roughly metalled trackway, which is bounded on the west by a 2m wide and 1.6m deep flat bottomed wet ditch, beyond which is a hedgerow of trees 6-10m tall. It is bounded on the east by a 0.40m bank supporting a hedgerow of mixed trees and bushes up to 6m high, beyond which is a 1.4m wide and 1.4m deep ditch.

The farmyard complex now consists of two enclosures. The first, accessed through a simple metal gate, contains a cattle pond in the north-eastern corner, a possible holy well in the south eastern corner and a slight mound which may be the site of the farmhouse. It is bounded to the north and the east, by a low bank supporting a hedge and to the west by a modern timber and wire fence. The second enclosure, entered through a large drum pillared gate, consists of the farmyard proper, which is bounded by a stone wall and has two opposing ranges. A long cattle byre is sited at the eastern edge of the yard, while a two roomed outbuilding and the fragments of a second one, are

sited at the western edge of the yard. There is a rough slurry pit and the remains of a perimeter wall at the southern end of the yard, beyond which is a narrow marsh, which is bounded by a bank on all sides.

Possible Holy Well. The possible holy well is located in a field ditch south east of the pond, near to the entrance of field 5. It is partially stone lined, with several small boulders at the edge and it is very overgrown. It contains some water and is sited within a wider marshy area contained within the field ditch. It is most likely fed by the same water source as the large cattle pond to the north-west. This would appear to be due to a high water table, with water settling in a natural depression, rather than it being fed by a spring.

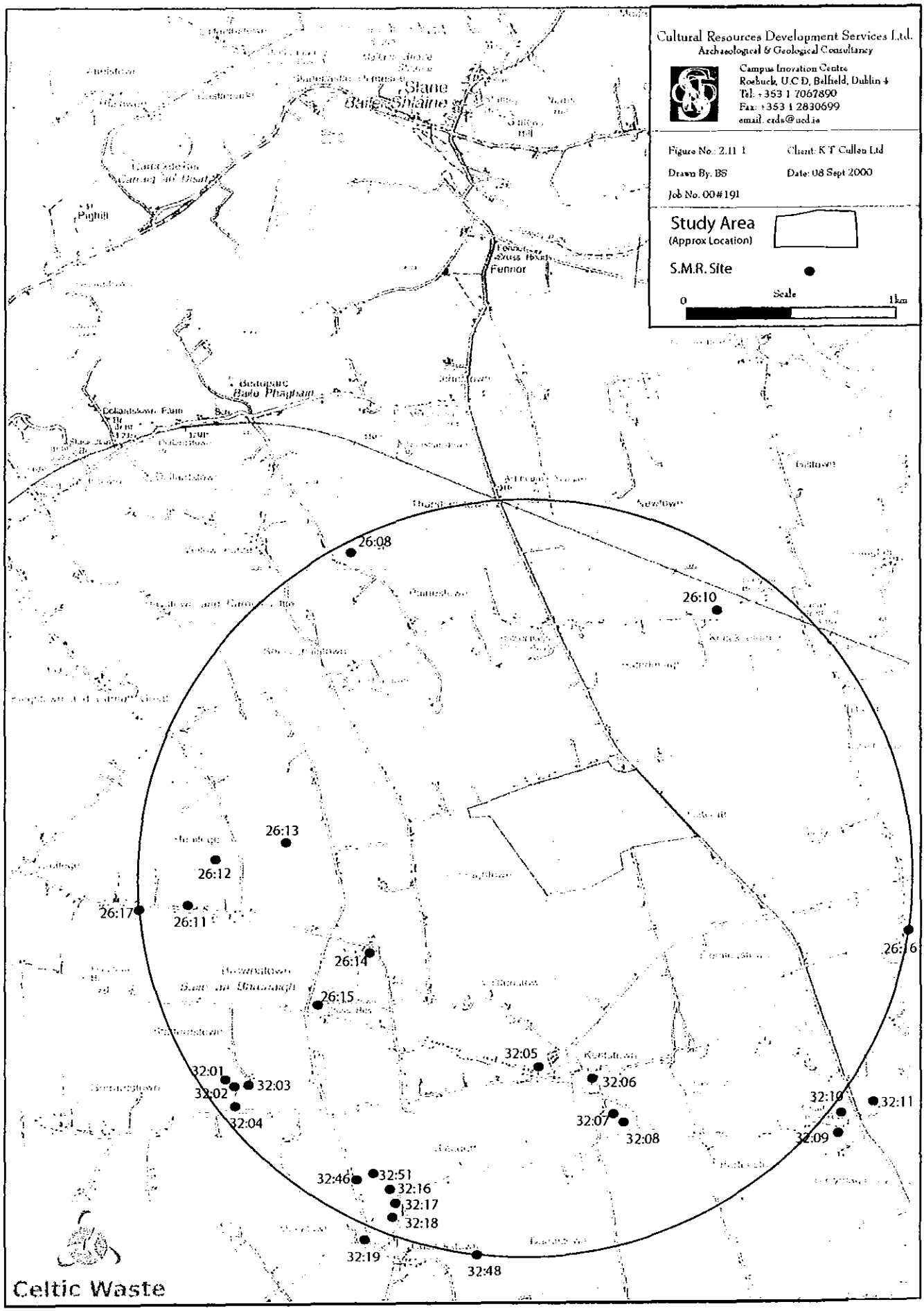


Fig. 2.11.1 Recorded Archaeological Sites and Monuments around 3.5km Cachement Area
(after O.S. Discovery Series, no. 43 & S.M.R sheets 26 & 32)

Fig. 2.11.2 Effigy of Sir Thomas de Tuite, 1363 (Hunt 1974)

Fig. 2.11.3 Balrath Wayside Cross (King 1984)

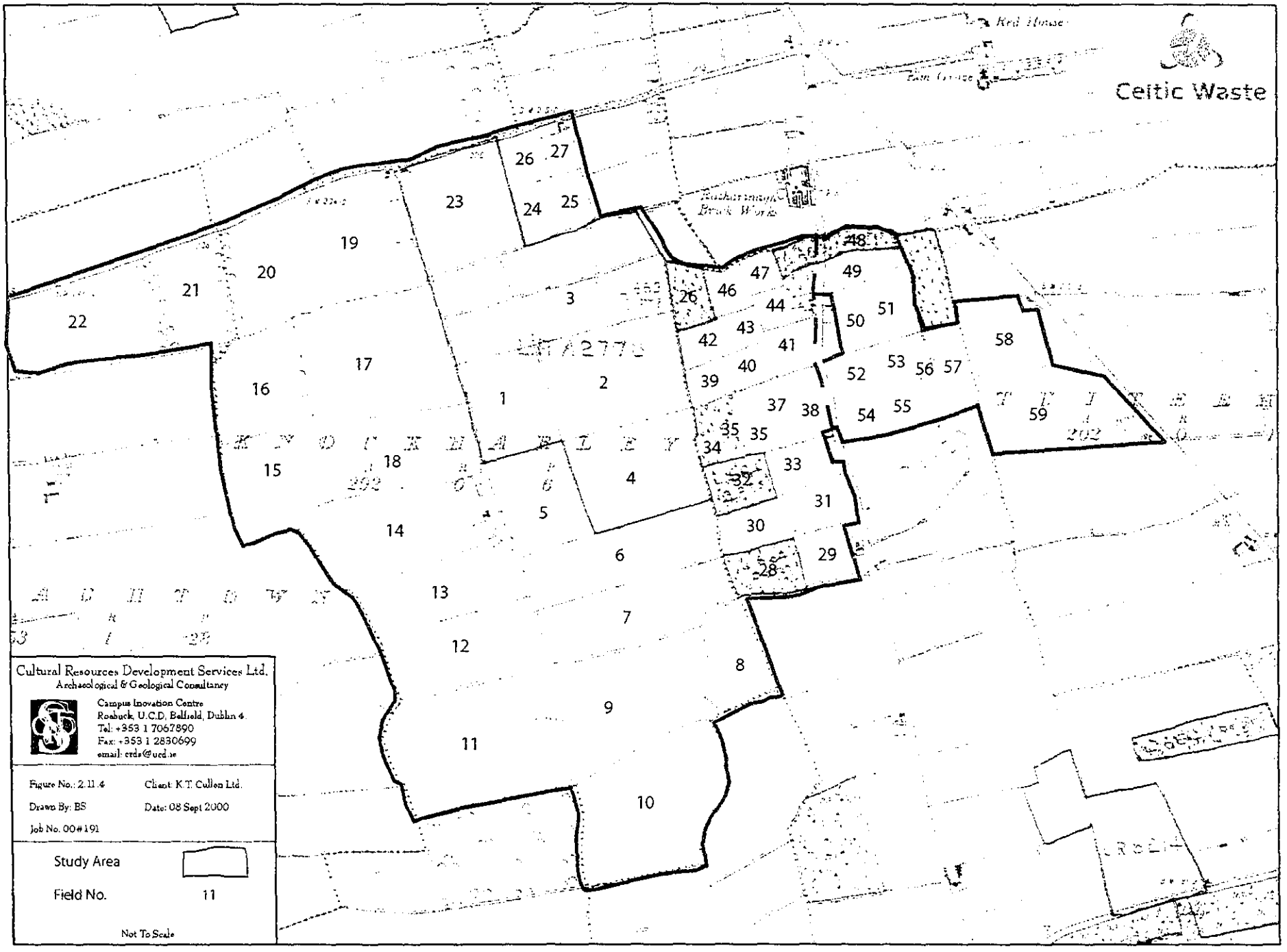


Fig.2.11.4 Study Area and Field Numbers (Based on O.S. 6" Map, 1909)

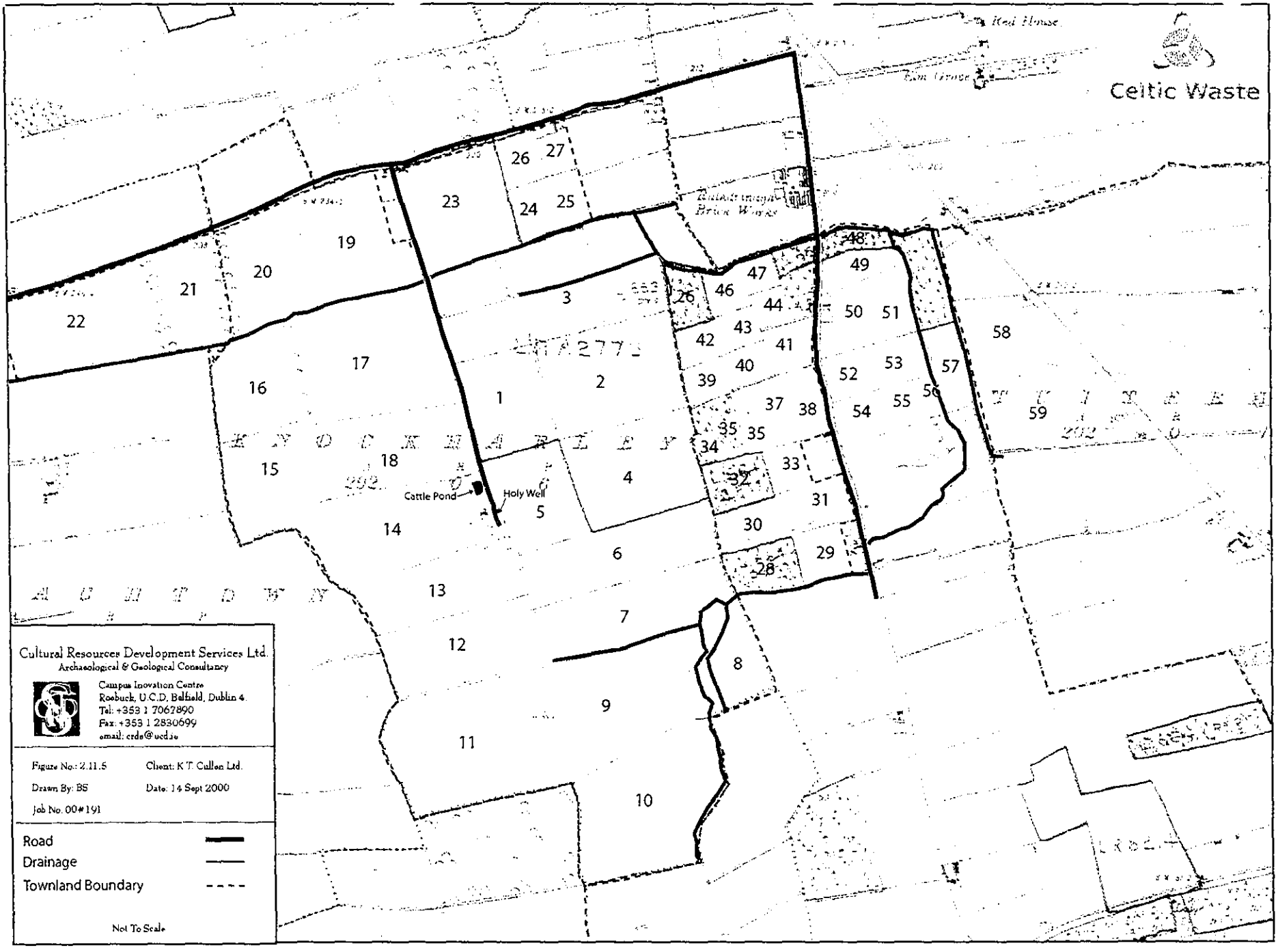


Fig.2.11.5 Roads, Streams and Townland Boundaries (Based on O.S. 6" Map 1909)

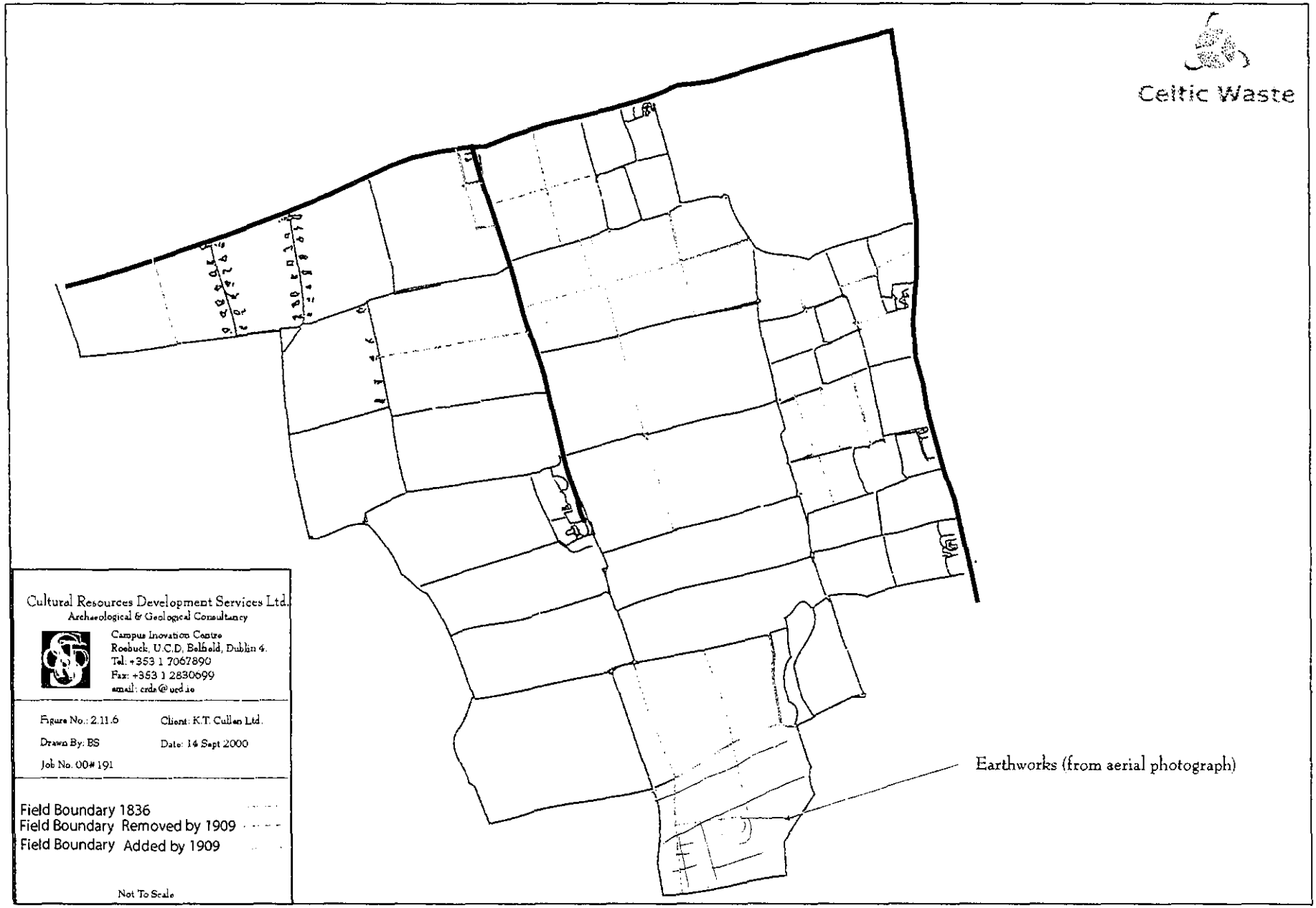


Fig. 2.11.6 Field Boundaries 1836-1909

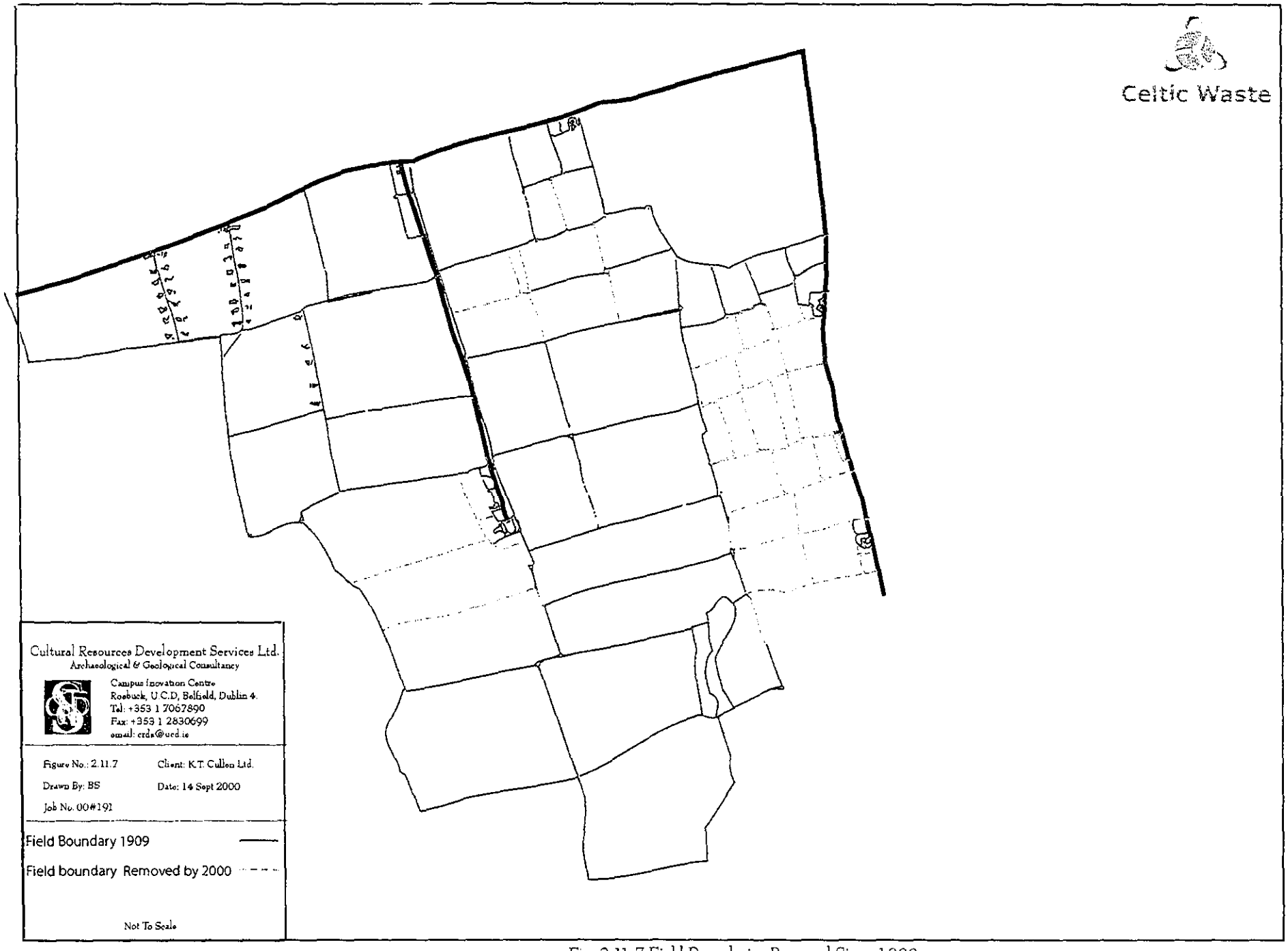


Fig. 2.11.7 Field Boundaries Removed Since 1909

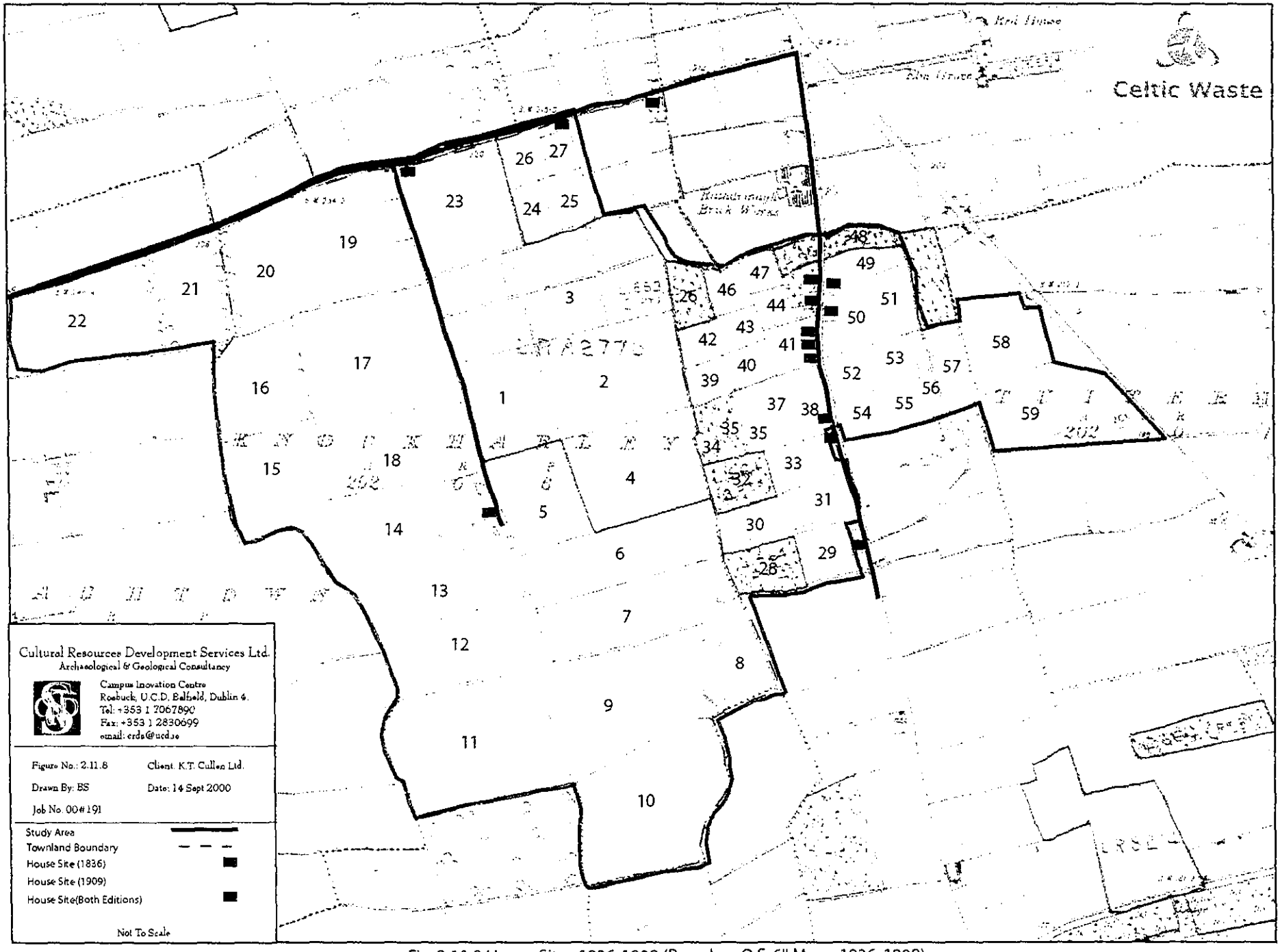


Fig. 2.11.8 House Sites 1836-1909 (Based on O.S. 6" Maps, 1836, 1909)

4.11 CULTURAL HERITAGE

4.11.1 Potential Impact of the Proposed Development

The main development will be undertaken in Knockharley townland. This will lead to a complete transformation of the land use and the fabric of the townland.

The most visible sign of settlement within the townland is the farmyard and farmhouse site, in the centre of the townland. This is a fine example of a vernacular farmyard, containing large drum gate pillars and a series of intact farm buildings. The site of the farm house is also apparent as a slightly raised terrace just north of the farmyard. This house was certainly in existence in the early nineteenth century (see Gowen 1999) and seems to be the most likely location for significant early modern, if not earlier settlement. The possible holy well is also sited there.

The possible holy well was archaeologically tested by Margaret Gowen & Co., but results were inconclusive as to its date and function (Gowen 1999, 21)

Further settlement should be expected within the townland. Modern settlement has been concentrated along the roadside, but this does not preclude earlier settlement following a different set of criteria.

There is no visible evidence for medieval and prehistoric activity within the site to be developed, but it is likely, given the size of the development, that some such activity will be encountered.

Field boundaries within Knockharley will be removed, although these have been recorded in a general way within this field survey as well as in earlier maps.

Townland boundaries will potentially be impinged upon. The eastern boundary between Knockharley and Flemingstown and the townland boundary between Flemingstown and Tuiterath will be cut through to provide access to the site.

4.11.2 Avoidance, Remedial, or Reductive measures

4.11.2.1 Methodology

The prospective development will lead to the complete transformation of Knockharley townland and will have a lesser impact on Flemingstown and Tuiterath townlands. Any archaeological mitigation measures should form part of an integrated plan in order to quantify and resolve areas of both known and as yet undiscovered archaeology in an efficient manner, to avoid delays, in advance of development. Such a plan should include

- A photographic and measured survey of the holy well and the farmyard complex

- Archaeological testing of sites already deemed to be of archaeological potential (see below) and also of any other potential sites which may be subsequently identified through the methods now outlined below

- Ploughzone analysis of fields previously under tillage (for land use, see field survey). This method can identify prehistoric sites through lithic scatters and areas of burning and would be ideally used in fields already subject to ploughing.

- Geophysical prospection of fields, which will be impacted upon by major ground disturbance and were not previously covered by this method (for extent of previous survey, see Gowen 1999). This method would cause less disruption in areas presently under pasture and can highlight both positive and negative features such as banks and ditches as well as areas of concentrate burning.

- Monitoring of all topsoil removal on site. This method should reveal any archaeological sites or features not identified through ploughzone analysis or geophysical survey. This method may be sufficient, alone, within Tuiterath lowland, if development there is confined to a narrow road corridor.

4.11.2.2 Sites of archaeological potential

Several areas of potential archaeology have been highlighted. These should be tested by a licensed archaeologist to establish their nature.

1. The circular zone of geophysical responses which when previously tested yielded a 4m wide ditch (Gowen 1999). Though previously tested, more extensive testing is needed to confirm its nature. (See section 2.2 for previous work).

2 Holy Well. This was flooded when previously tested (Gowen 1999).

3 Possible bi-vallate enclosure and field system (field 10) identified through aerial photography during the course of this study. This must be tested to confirm whether it is of archaeological significance.

4 Townland boundaries. Any such boundaries which will be disturbed should be tested prior to development.

5 Farmyard. The farmyard is the site of an earlier house and a sequence of outbuildings. It could overlay earlier settlement, as the field system in Knockharley townland is oriented on the axis of the farm laneway. Therefore more extensive testing should be carried out in the farm complex.

4.11.3 Logistics

If at any stage of the archaeological assessment outlined above, archaeological material should be uncovered, steps should be taken, in consultation with Dúchas to resolve such material in an appropriate

manner. Should archaeological features or material be uncovered during construction works, works should cease immediately and Dúchas informed. Time must be allowed for a suitably qualified archaeologist(s) to inspect and assess any such material. If it is established that archaeologically significant material is present, full archaeological excavation and recording will be required. Adequate financial and logistical provision should be made for any such archaeological excavation, related post - excavation and/or conservation work and for publication of the results.

4.12 MATERIAL ASSETS

4.12.1 Potential Impacts

As discussed in Section 2.12 material assets in the environs of the proposed landfill can be divided into the following categories :

- Housing
- Kentstown Village
- Tourism
- Infrastructure
- Agriculture

The potential impacts, mitigation measures and likely significant effects of the landfill under each of these headings are discussed below.

4.12.2 Housing

The history of poorly designed and poorly operated landfills in Ireland has led to a great deal of concern over the impact of landfills on property prices. In order to assess the relationship between a modern well operated municipal waste landfill and local property prices a number of auctioneers / estate agents in Naas and Lucan were contacted and asked their opinion on the situation at Arthurstown, Kill, Co. Kildare. Arthurstown landfill near Kill is operated by South Dublin County Council to the same standard as that proposed by Celtic Waste. The auctioneers commented that while there was some initial fears over local property prices the landfill has not negatively affected house prices in the area. To emphasise this fact a new housing estate is currently being developed (Earl's Court) approximately 1km from the landfill at Arthurstown. House prices in this estate are similar to current prices at other developments of this nature in the wider Naas area and are not considered to be deflated.

In terms of houses located adjacent to Arthurstown landfill, a couple of auctioneers commented that none of these houses had recently come on the market, but a slight negative impact on the property value could, in their opinion, be expected. This impact is expected in the short to medium term but in the long term, after the landfill has ceased operating, the property values are expected to revert to normal levels.

Mitigation against the possibility of falling property prices at Knockharley will be primarily in the form of good design and operation of the proposed landfill site and buffer zones isolating the active area from neighbours. The site will be designed and operated in accordance with the EU Landfill Directive (1999/31/EC) and the EPA Manuals on landfill design, operation and monitoring. The site will be operated under licence from the EPA and the conditions of this licence will ensure a high level of design and operational practices.

A second form of mitigation against falling property prices will be in the form of financial re-investment by the landfill operator into the local area. Investment into the local area will be aimed at enhancing its visual, environmental and cultural assets.

Considering these mitigation measures, the likely negative effects on the value of property closest to the site are expected to be slight and transitory and effects on property values in the wider surrounding area are expected to be insignificant.

4.12.3 Kentstown Village

The material assets in Kentstown village are located to the south of the landfill. There are buffers of 700m, 850m and 1,100m between the landfill footprint and the sports-ground, community hall and national school respectively. Other assets such as the church, retail outlet and public house are located more centrally in the village approximately 1.5 km from the proposed landfill. A landscaped berm will be constructed at the southern end of the development. This berm will mitigate against any visual intrusion from the direction of the village caused by the landfill. The air and noise sections of the EIS (Sections 4.2 and 4.3 respectively) have concluded that there are no likely significant effects on Kentstown village in relation to these media. No other significant effects on the village and its material assets are predicted as a result of the development.

4.12.4 Tourism

The results of the tourism search, discussed in Section 2.12.2, found that the Knockharley site is located in a region steeped in history and heritage. However, the proposed landfill is in an area removed from tourist sites. The tourist routes recommended in the 'Holiday Guide to Meath County' published by Midlands-East Tourism are all removed from the site by a minimum of 5 km, as are the vast majority of tourist sites listed in Table 2.12.1. The gently sloping topography and the relatively low mound (approx. 15 m high) proposed for the landfill will make it very difficult to detect this development from any tourist sites in the region.

Traffic to and from the landfill will be directly from the N2 national primary road. Many of the tourists travelling to Slane and the Newgrange complex from the Dublin area currently use this route. Section 4.10 of this EIS has concluded that the visual impact of the development on the N2 is insignificant.

Mitigation against impacts on tourists and tourism will be in the form of good design and operation of the facility. Visual screening and control of litter, vermin, birds and odours will all assist in preventing any impacts on tourism. In summary, the likely effects of the proposed landfill development on tourism is expected to be insignificant.

4.12.5 Infrastructure

Section 2.12.3 of the EIS lists a number of infrastructural features in the vicinity of the site. Any impacts on the National and Regional roads in the area are assessed in Section 4.9. The railway line to the north of the site is well removed from the proposed landfill and no impacts on this line are predicted.

The electricity transmission line and the gas pipeline are both adjacent to the proposed disposal area. Mitigation against impacting on these features will include the following :

• Buffer zones of 15 metres will be maintained between the disposal area and the powerline and gas pipeline.

• Any site works carried out proximal to the high voltage powerline will be in accordance with guidance from the ESB.

• Any site works carried out proximal to the gas pipeline will be in accordance with guidance from Bord Gáis.

These mitigation measures will ensure that there are no significant negative effects on these infrastructural features.

A positive impact of the proposed development will be the provision of a modern waste disposal facility in the region. This facility will offer a suitable disposal route for residual household, commercial and industrial waste. It is envisaged that waste will have passed through recovery and recycling facilities prior to delivery at Knockharley in keeping with National and European policies. The landfill will have a major role in servicing the needs of householders, industry and commerce in the region.

4.12.6 Agriculture

4.12.6.1 Introduction

The landfill could have a number of potential impacts on agricultural activities and these can be assessed under the following headings;

- Impact on the agricultural activities of the landowners whose land has been removed by the development.
- Impact on the general agriculture of the area directly bordering the site, and the surrounding lands.
- Impact on agriculture on a county basis.

4.12.6.2 Impact on Landowners

Four landowners are directly affected by the development and these are referred to as Farmers A, B, C and D with their landholdings identified in Figure 2.12.2.

Farmer A is particularly badly affected as 55.71 hectares of owned land will be taken. Included in this are two farmyard areas, one of which has slatted shed accommodation, a silage slab, dairy and a milking parlour. As both Farmers B and C are retired farmers the proposed landfill facility will not affect them as profoundly, although in Farmer's B's case all his owned land (30.54 hectares) will be taken. Farmer C will be affected by the entrance road onto the site from the N2.

4.12.6.3 Impact on Surrounding Agriculture

The Whiteriver landfill site in Co. Louth was visited to assist in determining the likely impact of the proposed landfill on the surrounding agriculture. The Whiteriver Landfill is located between Dunleer and Collon villages and is owned and operated by Louth County Council. Although smaller in area than the proposed site at Knockharley, a visual examination of the surrounding lands provided a useful guide as to the likely impact of the proposed site on the neighbouring lands at Knockharley. A comparison could then be made between the reality of the Whiteriver situation and the likely agricultural impacts of the Knockharley site.

A visual survey of the lands around the Whiteriver landfill showed them to be in good condition. Both cereal and grassland production are practised in the area. There was no evidence of any windblown litter having been deposited in any of the fields bordering the site. The drainage of the area had not been adversely affected as the tillage land appeared dry and although some grass fields have rush growth, this seems to have always been their natural condition. There was no evidence that there had ever been a major problem with scavenging birds or vermin on the surrounding land. Any weeds which arise on the site are topped regularly. Therefore the spread of noxious weeds via seed from the site to surrounding lands is not an issue.

The proposed landfill facility will be constructed and operated in accordance with the EU Landfill Directive and operated under a Waste Licence issued by the EPA. Considering the high level of control imposed by the Landfill Directive and the very low permeability of the natural subsoils, the possibility of sub-surface leachate or gas migration is remote. Litter will be controlled by a dual netting system and no litter or waste materials should leave the site. Other potential nuisances to the local agriculture like flies, rodents, weeds, birds will be effectively dealt with within the site. Dust from site roads is unlikely to be a significant problem as the Waste Licence will limit the levels of dust at the site boundary or dust sensitive locations. Taking the Whiteriver Landfill as an example, the proposed landfill facility should not have a deleterious effect on local agriculture at Knockharley and the surrounding townlands..

4.12.6.4 Impact on agriculture on a county basis

The loss of 135.45 hectares of good quality farmland is not considered significant when this loss is compared to the relatively large area of productive land in Co. Meath.

4.12.6.5 Conclusion

The impact of the land take for the Knockharley facility will be significant for those farmers directly effected. However, the impact on land use and agriculture in Co. Meath will not be significant.. The impact on agriculture in the area surrounding the site should be very low as both the construction and operation of the landfill will comply with the E.U. Landfill Directive and a Waste Licence issued by the EPA.

4.13 INTERACTIONS

The European Communities Environmental Impact Assessment (Amendment) Regulations, 1998, demand that an EIS describes the impacts and likely significant effects on the interaction between any of the following environmental media :

- human beings
- flora
- fauna
- soil
- water
- air
- climate
- the landscape

Table 4.13.1 highlights impacts and effects on interactions between these media and identifies the sections of the EIS where the interactions are addressed. It should be noted that in certain cases there are obvious interactions between environmental media, e.g. climate and flora, however, if the development does not have the potential to impact or affect the interaction then that interaction is not highlighted in Table 4.13.1. The identified interactions are as follows :

4.13.1 Human Beings / Fauna

Landfills can attract unwanted fauna such as rats, flies and birds (particularly gulls and crows). These species can impact on humans from both a health and a nuisance point of view. Mitigation measures to protect against these potential impacts are proposed in Sections 3.3, 4.7 and 4.8, after which the effects on the local community are expected to be insignificant.

4.13.2 Human Beings / Water

Contamination of surface water at the site has the potential to impact on the water quality in the Knockharley stream and the Nanny river. This impact could potentially affect the amenity value of these watercourses and this would affect human beings. Contamination of groundwater beneath the site could impact on local domestic wells, would restrict any future use of the underlying strata for water supplies and would also have the potential to impact on the water quality in the Knockharley stream. Mitigation measures to ameliorate these potential impacts are proposed in Sections 4.5 and 4.6, after which the effects are expected to be insignificant.

4.13.3 Human Beings / Air

Dust emissions, gas emissions, noise emissions and odours from the facility have the potential to impact on human beings in the vicinity of the site. Impacts from dust, gas and odours are addressed in Section 4.2 whereas noise impacts on humans are addressed in Section 4.3. Mitigation measures are proposed

for each of these potential impacts and the likely significant effects on the local population are expected to be minor.

4.13.4 Human Beings / The Landscape

The development has the potential to affect human beings in the form of visual intrusion. Mitigation measures such as woodland planting and screening berms are proposed in Section 4.10, after which the effects are expected to be insignificant.

4.13.5 Water / Flora and Fauna

Contamination of surface water or shallow groundwater at the site has the potential to impact on the water quality in the streams and river downgradient of the site. This impact could potentially affect the aquatic life in these water courses. Mitigation measures to ameliorate this potential impact are proposed in Section 4.5 and Section 4.7.4, after which the effects are expected to be insignificant.

4.13.6 Water / Soil

Soil beneath the site can act as a pathway for contaminants reaching both the groundwater and the surface water. Contamination of the soil can therefore lead to contamination of the water environment. Mitigation measures to protect against this potential impact are proposed in Section 4.6 and include the leachate containment system described in Section 3.1.3.

Table 4.13.1 : Impacts and Effects on Interactions between Environmental Media

	Human Beings	Flora	Fauna	Soil	Water	Air	Climate	The Landscape
Human Beings								
Flora	none							
Fauna	Sect. 4.7/4.8	none						
Soil	none	none	none					
Water	Sect. 4.5/4.6	Section 4.7	Section 4.7	Section 4.6				
Air	Sect. 4.2/4.3	none	none	none	none			
Climate	none	none	none	none	none	none		
The Landscape	Section 4.10	Section 4.7	Section 4.7	none	none	none	none	

Note : This Table identifies the Section of the EIS where impacts or effects on interactions between environmental media are discussed.

Any interactions which will not be impacted upon or affected by the facility are not described in the EIS.

Appendix 2.11.1

Archaeological Sites and Monuments in 3km Cachement

The recorded archaeological sites within 3km of the proposed development are listed below, all noted in the Sites and Monuments Records for Co. Meath The monuments are listed in a standard format as follows:

SMR No.	**Classification**
Townland	Description
NGR	
OD (feet)	
Inventory No.	

List of Sites and Monuments

26:10	**Church**
Knockcommon	Rectangular building (17.8m x 4.5m) with opposing doors towards W end of N and
9882, 6960	S walls. Ogee headed window in west wall.
100-200	
1440	
26:11	**Ringfort**
Realtoge	Uneven oval area (49m NW-SE, 41m NE-SW) with external fosse. Rectangular
9374,6678	house site (9m N-S, 5m E-W), possibly later, sited against inner bank. A long
300-400	depression SSW of centre oriented NNE-SSW may be a souterrain. A stone axe was
861	found in the fosse. This is held by the Finnegan's who live beside the ringfort.
26:12	**Moated Site**
Realtoge	Rectangular area (25m N-S, 23m E-W) defined by banks, with external fosse and
9402, 6701	leat. Indicated on 1st ed. O.S. 6" map as a circular area.
300-400	
1681	
26:13	**Enclosure**
Brownstown	Sub-circular area (40m E-W, 36m E-W) defined by a fosse. Located within a large
9473, 6758	tree ring and could be one itself.
200	
965	
26:14	**Church**
Brownstown	Grass covered foundations of E-W oriented building (12m x 4m) with a possible
9538, 6632	doorways towards the west end of N and S walls. Indicated as a church on 1st ed.
300	O.S. 6" maps.
1356	
26:15	**Moated Site**
Brownstown	Moated site consisting of two platforms (67m NNE-SSW, 62m WNW-ESE and
9497, 6588	70m WNW-ESE, 52m NNW-ESE)) defined by a fosse 12m wide. The eastern
200-300	platform has two levels defined by a scarp in the centre.
1668	

List of Sites & Monuments (Continued)

26:16 Mullaghfin 0062,6661 200-300 440	**Souterrain** 'L' shaped tunnel with three beehive chambers, located close to the top of a broad level plateau.
32:1 Staffordstown 9412, 6514 200-300 1503	**Church Site** Not visible. In the graveyard is a font with acircular basin and a central drain (Roe 1968) and also a stone slab with the Cusack coat of arms dating to 157?. Possibly Sir Thomas Cusack.
32:2 Staffordstown 9415, 6509 200-300 217	**Tumulus** Circular mound (diam. 26m, H 3m-5m). Diameter on top of mound measures 5-7.5m. Some stone visible at the sides. Located on the top of a ridge. Marked as a mound on 1st ed. O.S. 6" map and is marked by hachures on the 2nd ed. O.S. 6" map.
32:3 Staffordstown 9431, 6507 200-300 1785	**Castle site** Marked as site of old castle on 1st ed. O.S. 6" map. Not marked on later editions.
32:4 Staffordstown 9408, 6483 100-200 1504	**Church Site** Marked site of old church on 1st ed. O.S. 6" map. Not marked on 2nd ed. O.S. 6" map. There remains an octagonal font, with an inscription. It was carved in 1597 for Robert Hollywood, the church proctor (Roe 1968).
32:5 Kentstown 9710, 6521 100-200 1565	**Font** Font dated 1571, from Timoole, now in St. Mary's RC church (Roe 1968)
32:6 Kentstown 9759, 6517 100-200 1418	**Church site** No remains of the medieval church. There is a mid-fourteenth century effigy of Sir Thomas de Tuite in the present church (Hunt 1974)
32:7 Danestown 9777, 6481 100-200 618	**Ringfort** Bivallate ringfort with an artificially raised oval area (41m ENE-WSW, 34m NNW-SSE) defined by an earthen bank with external fosse and outer bank. Entrance at causeway to SW.
32:8 Danestown 9772, 6472 100-200 1379	**Church** Faint traces of a rectangular building measuring 11m E-W, 5m N-S. Marked as a ruin on 1st ed. O.S. 6" map.

List of Sites & Monuments (Continued)

32:9 Ballymagarvey 9995, 6463 100-200 1339	**Church** Church divided into nave (11.3m x 5.7m) and chancel (6.6m x 4.5m). West gable of nave survives with belfry. There is a double light, cusped, ogee headed window. There is a font in the graveyard (Roe 1968).
32:10 Balrath 0010, 6478 100-200 1526	**Wayside Cross** Late 16th century cross with relief carvings of the crucifixion and the pieta on W and E faces.
32:11 Balrath 0026, 6490 100-200 301	**Henge** Circular dished area (130m diam.) defined by a 2m high and 12.4m wide bank. No clear indication of entrance.
32:16 Monktown 9564, 6407 200-300 1046	**Enclosure (cropmark site)** Circular cropmark (45m diam.) appears on aerial photographs (CUCAP, BGP 92, K17-Y34).
32:17 Monktown 9572, 6395 200-300 1457	**Church** Church divided into nave and chancel. The east wall has a window with a flattened semi-eliptical arched head with an external chamfer, which has probably been rebuilt.
32:18 Monktown 9572, 6379 200-300 1047	**Enclosure (cropmark site)** Circular cropmark (diam. 80m) appears on aerial photograph (CUCAP, BGP 94)
32:19 Monktown 9546, 6362 200-300 1754	**Castle** N half of a four storey tower house. Probably had projecting towers at NE and SW corners. Vaulted over ground floor with large windows at first and second floor levels and smaller windows higher up. Some round arched sandstone windows, probably reused, in the NE tower. Rectangular earthworks to the north of the tower house *c.* 50m N-S, 40m E-W defined by scarps may be the remains of a bawn.
32:24 Lismullin 9335, 6133 200-300 1445	**Monastery** Holy Trinity Priory for Augustinian nuns founded *c.* 1240. Indistinct earthworks on site. Buried cobbled surface and animal bones visible in section at stream.
32:46 Monktown 9532, 6427 200-300 1848	**Souterrain** Drystone built and consisting of a beehive chamber (diam. 2.5m, H. 1.6m) with a blocked passage (L. 2m).
32:48 Cusackstown	**Holy Well** Marked as St. Patrick's Well on O.S. 6" maps. S.M.R. file unavailable.

Appendix 2.11.2

Archaeological Finds

The recorded archaeological finds in the vicinity of the site are listed below, all noted in the National Museum of Ireland files, Kildare Street, Dublin 2, in local journals, or in other published catalogues of prehistoric material: Raftery (1983), Eogan (1965; 1983; 1994), Harbison (1968; 1969a; 1969b) and the Irish Stone Axe Project Database. The following townlands were assessed;

The finds are listed below in a standard format as follows:

Museum No. **Townland**
Classification
Notes

NMI 1978: 139 **Painestown**
Polished Stone Axehead
Found many years a bog close to a spread of antlers.

NMI 1970: 6 **Painestown**
Ogham Stone
Found in field near Seneschalstown. It reads MAQI CAIRATINI AVI INEQAGLAS.

SMR Record ME 26:11 **Realtoge**
Stone Axe
Found at the north-eastern side of the outer fosse of a ringfort (ME 26: 11). It is in the possession of the Finnegans, who live beside the ringfort. (S.M.R. files).

NMI 1944: 871 **Thomastown**
Bronze Vessel
Found in bog by workmen engaged in turf cutting on 27/06/1944.

Appendix 2.11.3

Archaeological and Historical Background

1 Prehistoric Period

Evidence for the earliest known settlement in the vicinity of the site is for the Neolithic period, in the form of a henge monument (Me 32:11) located in Balrath townland to the south east of the site. This is complemented by Neolithic polished stone axe-heads- one from Painestown townland (NMI 1978:139), immediately north of the site and one discovered in the ditch of a ringfort (Me 26:11) in Realtoge townland, immediately to the north of the site. This class of artefact dates mainly to the Neolithic (4000-2500BC), though their use began in the early Mesolithic and continued well into the Bronze Age (Cooney & Mandal 1998, 1). A circular cropmark enclosure (Me 32:18) nearby, which is 80m in diameter, could also be of prehistoric provenance.

Kentstown parish lies only a few miles from the large passage tombs of Newgrange, Dowth and Knowth. A possible example of a much smaller passage tomb may be found at Staffordstown (Me 32:2), which consists of a mound, sited on a low ridge. It is 5-7.5m wide on top and some stone, perhaps the remains of kerbing, is visible at the sides. These monumental structures may be seen as a testament to wealth and social complexity, as they required large resources and skill to build and as not all members of the community were buried within. They were designed to be permanent features in the landscape, to be reused and not just simple repositories of the dead (Bradley 1985, 9). They are evidence of the emergence of an overtly hierarchical society (Cooney & Grogan 1994, 55).

The henge monument in Balrath townland (Me 32:11) most likely dates to the later Neolithic. It indicates a change in the nature of the monuments and associated rituals, which evolved to define local communities and the privileged people within them. A henge consisted of a large area enclosed by a wide bank and sometimes a ditch, usually with restricted access through a single entrance. Burial or the revisiting of the dead was not central to their use. Rather, they defined a space, often overlooked by higher ground, where large-scale activities could be undertaken and be observed by a larger number of people outside (Cooney & Grogan 1994, 89-90).

A bronze vessel (NMI 1944:871) found during peat cutting in Thomastown, Duleek parish, due east of the site could be evidence for Bronze Age activity in the vicinity of the site. However, in the absence of greater details it is uncertain whether this bowl is of Bronze Age or of later provenance. Tara, located approximately 4km to the south-west provides abundant evidence for a human presence in the region during this period. Burials cut into earlier Neolithic tombs and the construction of many barrows and ring ditches attest to its focus as a cemetary (Newman 1997, 147-170).

There is no recorded evidence for Iron Age activity in the immediate vicinity of the site, but this is by no means an indicator of absence. For example, Tara, the legendary royal site, was the focus of very significant activity in the region at this time. Raith na Rig, which consists of a massive circular

enclosure, defined by an internal bank and an external ditch, was cut through an earlier phase of ironworking. A palisade, apparently of slightly later date was set on the inside of the ditched enclosure. The quadrivallate enclosure of Raith na Senad dates to the first few centuries AD. on the basis of Roman material uncovered during excavations (Newman, 1997, 170-79).

2 Early Medieval Period

There is more evidence for early medieval settlement in the vicinity of the site. Perhaps the earliest indicator of a presence during this period is in the form of an Ogham stone (NMI 1970:6) found in Painestown townland, immediately north of the site. It consisted of a stone pillar with the following inscription in ogham script; *'Maqi Caratini Avi Ineqaglas'*. This may have served as a cenotaph, or perhaps as a territorial marker. It was an indicator of both the nascent literacy within Ireland due to contact with the Christian Roman world and of the adaptation of Roman knowledge to suit local conditions.

There is ample evidence for settlement sites of the period. There are three ringforts within a 3km radius of the proposed development. Danestown is a bi-vallate ringfort (Me 32:7) adjacent to Danestown parish church (Me 32:8). Realtoge (Me 26:11) is a ringfort containing a rectangular house site. Brownstown (Me 26:13) is categorised as an enclosure, but appears to be a ringfort. It measures 40m E-W by 36m N-S and is defined by a fosse (Moore 1987). The cropmark of a circular enclosure in Monktown (Me 32:16), measuring 45m in diameter, could mark the site of another destroyed ringfort. It is also situated near a later parish church. A second circular cropmark enclosure nearby (Me 32:18), which is 80m in diameter could have served as a cattle pen, though it could very well be of prehistoric provenance.

Ringforts served as the enclosed residences of the wealthy in Irish society between the sixth century AD and the eleventh century AD (Stout 1997, 29, 111-12). The early law tracts stipulated that higher status was reflected in the number of enclosing banks and ditches. The bi-vallate ringfort at Danestown (Me 32:7) was therefore a residence of some consequence.

There are also two souterrains immediately beyond the 3km radius. Mullaghfin (Me 26:16) to the west is an 11.3m long 'L' shaped passage with beehive chambers, while Monktown (Me 32:246), to the south consists of a beehive chamber and a blocked passage. Another possible souterrain, observed as a shallow linear depression, has been noted within the earlier-mentioned ringfort at Realtoge (Me 26:11). Such underground passages were normally associated with domestic settlements and functioned both as cool cellars for the storing and protection of dairy produce and also as places of temporary refuge during times of small-scale raiding (Lucas 1973, 165-91). They highlight the possibility of other low visibility settlement sites in the area.

3 Later Medieval Period (1169-1600AD)

Knockharley, Tuiterath and Flemingstown townlands, in the Parish of Kentstown, lay on the border of the lordships of Duleek and Skreen. Hugh de Lacey was granted the Lordship of Meath, which he subinfeuded among his chief retainers. Hugh granted one Adam de Feypo the lordship of Skreen in 1175 (Hickey 1994, 41), while he directly retained the lordship of Duleek. Kentstown parish, which was in the Lordship of Duleek was granted to Stephen de Kent (*ibid.*, 123).

The parish, namely a defined land unit which payed tithes for the upkeep of a parish church, was introduced to Ireland as part of a wider package of church reform in the latter part of the twelfth century. While the process of parochial formation may have begun before the Norman invasion, they are generally credited as the major agents of its creation. (Otway-Ruthven 1964, 111-23). Otway-Ruthven's study of parochial formation in the Deanery of Skreen raised two points. The parish tended to be coterminous with the secular estate and the subdivision and creation of new parishes, which reflected the intensification of Norman lordship, appears to have continued well into the thirteenth century.

4 Placename Evidence

The townland names of Kentstown parish reflect the subdivision of the manor among several of de Kent's retainers *(see Appendix 4)*. The use of pre-existing Irish townland units in land grants was universal (MacErlean 1983, 332). Kentstown townland itself must have remained in the hands of de Kent. Veldonstown and Flemingstown townlands probably record the names of the farms of two of de Kent's followers. Tuiterath is a composite name. It was held by the de Tuite family. The 'rath' element in the name may refer to a pre-existing ringfort, or else it is a rather poetic and anachronistic name for their residence. Curraghtown and Knockharley are the only other townlands in the parish to retain an Irish element in their name. Significantly, neither name records a Norman family name, which suggests they remained peripheral to Norman settlement within the parish. This possibility is strengthened as Curraghtown means the town of the bog or moor. Knockharley might be translated as Hurley's hill. This is name of relatively recent provenance. It was known as Knockerc in the Civil Survey of the seventeenth century. Erc was a native saint, which could account for the retention of the native placename until the seventeenth century.

The centre of Kentstown parish is marked by the site of the parish church (Me 26:6). Stephen de Kent's residence was presumably in the vicinity. There are no other recorded monuments which indicate evidence for medieval secular settlement, but a residence of some substance is alluded to in the form of a finely executed mid-fourteenth century tomb effigy preserved at the site of the medieval parish church *(Fig. 3)*. It records the death of Thomas de Tuite in 1363 (Hunt 1974, 206). He was 'of Kentstown', but this could mean either the townland or, more generally, the parish. The townland of Tuiterath, within the parish, seems a likely site of such a residence.

Furthermore, a manorial residence of the de Kent family would be expected in the vicinity of the church. The Civil Survey (1654-6) (Simmington 1940) *(see Appendix 5)* recorded a castle and a church at Kentstown, which then belonged to Lord Dunsany. This castle was most likely a tower house, of fifteenth to early seventeenth century date, perhaps sited on the earlier de Kent residence. The nearest extant example of a tower house (Me32:3), in the adjoining parish of Monktown, conveys the impression of wealth and comfortable living. It consists of a stone tower of four storeys and projecting angle towers at the NE and SW, which was a standard feature of tower houses of the Pale.

Archaeological evidence for the nature of settlement in this period is more forthcoming in the parishes adjacent to Kentstown. Danestown parish, held by the de Aveni family, was centred on the parish church, which had an adjacent bivallate ringfort, which could have been re-used as a manorial enclosure (Hickey 1994).

Monktown parish, which functioned as a grange or farm estate, belonging to St. Mary's Cistercian Abbey, Dublin (Hickey 1994, 89) illustrated a more dispersed approach approach to estate managment. At the time of the dissolution of the monasteries it had a 'capital mansion' called Monketon Grange, which appears to have been the surviving tower house, but it is set 0.5km away from the parish church. It may be on the site of the earlier buildings, as the bawn of the castle is a substantial rectangular area, measuring 50m N-S by 40m E-W, defined by a scarp. Furthermore, reused sandstone windows (Moore 1987,172) in the NE tower must have come from an earlier structure.

Evidence for landholding in Brownstown is even more complicated. The main estate was held by Arnold le Brun, but there was also a grange belonging to St. Mary's Abbey (Hickey 1994, 87-8). Le Brun's mansion appear to have been located in a moated site 500m south of the parish church. A second moated site in the townland of Realtoge would have enclosed the grange farm belonging to Saint Mary's Abbey.

5 Religion, Privilage and Public Devotion

As noted above, the development of the parochial system was largely executed after the absorption of Ireland into the possessions of the Angevin Kings of England. Parochial boundaries reflected secular estate boundaries (Otway-Ruthven 1964, 118, 119). This aided the collection of tithes through a coherent estate structure, while also reflecting the considerable overlapping of secular and religious interests which ran to the core of medieval society. The centre of Kentstown parish is marked by the site of the parish church (Me26:6). A thirteenth century font, from the church site at Timoole was later moved here (Moore 1987). The lord of the manor, Stephen de Kent's, residence was presumably in the vicinity of the church.

Notable concern for the memory of the departed is well illustrated by the finely executed mid-fourteenth century tomb effigy preserved at the site of the medieval parish church *(Fig. 3)*. It records

the death of Thomas de Tuite in 1363. His status is made clear through the commissioning of the fine carved slab and through his depiction as a knight with gloves, spurs, sword and fine cloak (Hunt 1974, 206).

Later investment in public religious devotion is evidenced by the fine wayside cross erected in Balrath townland *(Fig. 4)*, which comprises the adjacent parish of the same name. Such crosses served as a prudent investment for the wealthy with an eye on the afterlife. It is inscribed with an appeal for a prayer for Jhoannis Broin and is probably of sixteenth century date. A further inscription dated to 1727 was commisioned by Sir Andrew Aylmer and his wife Catherine, which provides testament to its continued significance as a local monument of devotion (King 1984, 105).

The most traumatic period followed the Reformation. The nearby monastic estates of Saint Mary's Abbey were confiscated and regranted to Royal appointees, while the parishes were technically appointed to the reformed religion. The Cromwellian campaigns of the 1640's brought destruction on many churches in the region.

At the time of the Civil Survey (1654-6) (Simmington 1940), the rectory of Kentstown had been in the possession of Mr. Lanssoe, who was parson there, while Lord Dunsany was patron. Bishop Dopping's visitation book of 1682-5 *(see Appendix 6)* provides a quick snapshot of the parish (Ellison 1971). The patron of the parish was still Lord Dunsany, who was a papist, but the church had been in disrepair since 1641 and lacked a roof, glass and furnishings. Laurence Jones who was the Rector, resided in Painestown Parish and preached to the three resident Protestant families, in the porch of the church every fortnight. A simple housestead served as the glebe. There was a Catholic priest called Nugent, but no popish school. No details are given of how or where the Catholics worshiped. The possible holy well in Knockharley townland could have served as a continued source of local prayer.

6 Possible Holy Well

This well was recorded by the Folklore Commission in 1930. It is uncertain as to how far back this tradition of a holy well may be traced, but many such wells reveal strong traditions of pre-Christian ritual (Logan 1980, 11). Knockharley exhibits many of the attributes which have been observed at holy wells. It is dedicated to a saint, in this case, Patrick and is reputed to have healing or protective powers (see, Logan 1980, 12). It is also associated with a stone. Such stones are often bullaun stones, which can be used for curing or cursing, or Saint's 'chairs' or 'beds' (Logan 1980, 17). In this case a stone above the well is reputed to bear the mark of Saint Patrick's fingers, from the time he drank at this spot. Further associations, such as a holy tree with rags and votive offerings (Logan 1980, 114) cannot be vouched for, however, they would leave little trace.

7 17th Century Landownership

A brief picture of seventeenth century Kentstown is provided in the Civil Survey (1654-6), which was commisioned to ascertain land ownership as a prelude to the Cromwellian land settlements (Simington 1940) *(appendix 5)*. The details are scant, but the parish appears to have been prosperous and well settled. The vast majority of the land was deemed suitable for arable agriculture. The parish core consisted of the church and a castle held by Lord Dunsaney. He held most of the parish including Knockharley and Tuiterath. Flemingstown was held by Thomas White who resided there, while Daltonstown was held by Thomas Cusadee of Staffordshire.

No details of subtenants or their residences are given, but information for the surrounding parishes gives some indication of the type of settlement one might expect in Knockharley, Tuiterath and Flemingstown. For example, in Kilmoone townland, Kilmoone parish, there were three farmhouses, while in Cloonestown townland, Lismullin parish there were two thatched farmhouses and some cottages, perhaps housing wealthy gentlemen farmers and their labourers. Kentstown castle was no doubt similar to the estate complex recorded in Dillardstown townland, Painestown parish, which had a castle, a mill and divers out-houses and cabins, giving the impression of a weathy estate house, surrounded by outbuildings and a multitude of cabins for the estate labourers.

8 Population-17th -19th Centuries

Population figures are an excellent source of information regarding settlement and intensity of land use. Unfortunately, information on Irish population is scant before the seventeenth century. The census of 1659 (Pender 1939) provides the first, though by no means accurate view of the state of the Irish population laid out in a systematic fashion *(see appendix 7)*. A series of more accurate censes were then undertaken in the nineteenth century, which also provide crucial information on the number of houses inhabited and uninhabited, on a townland basis.

The first evidence for the actual numbers of people living within the parish is provided by the census of 1659, when there were 141 adults in Kentstown parish. There were 41 English and 100 Irish, which no doubt reflected the recent influx of Cromwellian settlers. Knockharley (recorded as Knockerc) had a population of 22, consisting of 10 English and 12 Irish, and Tuiterath had a population of 6, consisting of 2 English and 4 Irish. Flemingstown (880 acr.), with a population of 42 and Kentstown (459 acr.) with a population of 28 were the most populous townlands of the parish, but when adjusted for size they shared a similar density to Knockharley (291 acr.). Tuiterath (202 acr.) appears relatively underpopulated for its size and indeed had the lowest population in the parish.

In 1837, Lewis (1837) *(appendix 8)* noted that Kentstown had a population of 500. By 1841 *(appendix 9)* this had risen slightly to 514. It had dropped to 382 by 1851, reflecting a 26% collapse, due to famine and attendant disease and emigration during the 1840's. It might be assumed that the Great

Famine struck deepest against the most vulnerable, such as smallholders and labourers. It was by no means an even process. The population of Tuiterath townland was reduced by a devastating 76%, while Knockharley lost 34% of its residents. Kentstown townland fared best, suffering a 15% reduction. This devastation was also reflected in the landscape. The number of houses in Tuiterath fell from five to three, one of which was uninhabited. Knockharley had seven houses, which showed a reduction of two from the 1841 figure.

9 *19th Century Landholding*

Griffiths Primary Valuation of 1854 (Griffith 1854) provides a clear picture of Kentstown before the Land Acts had finally removed the landlord class *(appendix 10)*. It suggests prosperity and modest recovery for those who had weathered the famine. Tuiterath then contained five houses, all inhabited, while Knockharley, with seven houses, showed no change. The valuation provides greater information about the structure of landownership in the parish.

Knockharley was almost entirely owned by one William A. Shaw. A large farm with house, offices and land comprising 263 acres was leased to Laurence Kinshella, who in turn leased a house each to George Mc Loughlin and Francis Phew, who perhaps worked on the farm. One Mary Levinge leased a house with ofiices and 12 acres of land from Shaw. She in turn leased a house to Alice Philips. Shaw also leased a house with 8 acres of land to Margaret O'Brien. The remaining 7 acres within the townland was held by Thomas Carpenter who leased it from Arthur Murray. Carpenter leased a house on the premises to Charles Martin.

Tuiterath reflected a similar structure. Michael Campbell leased a house with offices and 179 acres of land from M.G. Everatt. Campbell leased a house to Charles Smith, while another house lay vacant. A smaller portion of the townland was held in fee by Sir William Somerville Bart., whose main estate consisted of Flemingstown townland, where he resided in Somerville demesne. He held 11 acres of Tuiterath as a plantation and leased 6 acres of land to Richard McGrane and a house and 4 acres to Thomas Carter. Carter leased a house to one John Manning. Edward Hogan and Thomas Flood were listed as Trustees of the Navan-Ashbourne Turnpike road which ran through the townland.

A similar pattern is repeated in each of the townlands. Each townland was largely owned by non-resident landlords, who leased the bulk of their holdings to a single large farmer, who in turn leased houses to several individuals who may have been employed on their estates. The remaining portions were leased to smallholders who occasionally leased cottages to other individuals.

Appendix 2.11.4

Townland Names

Townland names within 3km cachement around Knockharley

Name	Language	Meaning	Source
Brownstown	English	Named after the *le Brun* family who held the manor from the de Feypo family of Skreen.	Hickey 1994, 59, 89
Curraghtown	Irish/English	Curragh means marsh or moor.	Joyce 1869, Fitzsimons 1978
Cusackstown	English	Named after the Norman *de Cusack* family. A prominent Meath family. A branch held the manor of Kileen.	Hickey 1994, 41, 59
Danestown	English	Named after the de Aveni family who held the manor from the de Feypo family of Skreen.	Hickey 1994, 56, 106, 107
Flemingstown	English	Named after the Norman *Ffleming* family? Held from the de kent family who held the manor of Kentstown.?	
Kellystown	Irish/English	Possibly named after the Kelly family. Pre-Norman landowners?	
Kentstown	English	Named after theNorman *de Kent* family who held the manor from the de Lacey lordship of Duleek..	Hickey 1994, 59, 123
Knockcommon	Irish	*Cnoc Cuman.* Hill of the hollow. Or Cuman's Hill.	Joyce 1869 Fitzsimons 1978
Knockharley	Irish	*Cnoc Urlaithe.* Hurley's Hill. Called *Knockerc* in the Civil Survey Erc's hill. Erc was a saint associated with Slane.	Fitzsimons 1978 Hickey 1994
Painestown	English	Named after the Paine family? Occurs in Kentstown graveyard.	
Rahill	Irish	*Rath Aille.* Fort of the declivity.	Fitzsimons 1978
Rathdrinagh	Irish	*Rath Draoigheanach.* Fort of the sloe/blackthorn bush.	Fitzsimons 1978
Seneschalstown	English	Town of the Seneschal.	
Sicily		Sisligh. 'A fancy name'.	Fitzsimons 1978
Slanduff	Irish	*Gleann dubh.* Black valley. *Leamhain dubh.* Black elms.	Fitzsimons 1978 Joyce 1994
Thomastown	English	Named after English or Norman landowner?	
Thurstianstown	English?	Named after English or Norman landowner?	
Tuiterath	Irish/English	The de Tuite family held land in the area. A funeral effigy in Kentstown church is of one of the family.	Hunt. 206, 207, pl. 113.
Veldonstown	English	Named after the Norman *de Veldon* family? Held from the de Kents?	

Appendix 2.11.5

Civil Survey 1654-56

Kentstown Parish

Townland	Owner	Observations
Kentstown	Lord Dunsany, Irish Papist	1 castle and 1 church
Veldonstown	Lord Dunsany, Irish Papist	67 acres, 60 arable, 8 meadow, 20 pasture
Curraghtown	Lord Dunsany, Irish Papist	135 acres, 120 arable, 5 meadow, 10 pasture
Tuiterath	Lord Dunsany, Irish Papist	100 acres, 80 arable, 5 meadow, 15 pasture
Knockerk (Knockharley)	Lord Dunsany, Irish Papist	74 acres, 60 arable, 4 meadow, 10 pasture
Rathcony	George Usher, Dublin, Irish Papist	63 acres, 50 arable, 3 meadow, 10 pasture
Daltonstown	Thomas Cusadee, Staffordshire	60 acres, 50 arable, 10 pasture
Flemingstown	Thomas White, Flemingstown	145 acres, 120 arable, 5 meadow, 20 pasture

Notes:

- Survey details are different for the adjacent parishes of Danestown and Monktown. Land units are also enumerated in ploughlands, which could reflect a difference in local land measures or in customary taxation. This could indicate that the surveys were undertaken by different teams.

- A perusal of the surrounding parishes provides a good general cross section of the the type of buildings which may have existed in Knockharley and Tuiterath. The inclusion of information beyond the level of townland size, townland boundaries and land potential, appears to have been arbitrary and relied very much on the whims of the surveyors, in this case, Messrs. Crane, Wynne, Tresham and Stirrop. This survey cannot be used as evidence of absence.

For example.

In Kilmoone townland, Kilmoone parish, there were three farmhouses.
In Dillardstown townland, Painestown parish there was a castle and a mill and divers out houses and cabins.
In Cloonestowne townland, Lismullin parish there were two thatched farmhouses and some cottages.

Details of the rectory of Kentstown mentioned in the appendix:

- The rectory of the parish of Kentstown had been in the possession of Mr. Lanssoe, who was the parson there. Lord Dunsany was patron. The tithes were worth £30.

Appendix 2.11.6

Bishop Dopping's Visitation Book, 1682-85.

- The patron of Kentstown parish was Lord Dunsany, an Irish Papist.
- Laurence Jones was the Rector, who resided in Painestown. He preached once a fortnight in the porch of the church.
- The Roman Catholic priest was one Nugent.
- There was no Popish school.
- There were three protestant families in the parish.
- The church was unrepaired since 1641 and lacked a roof, glass and furnishings.
- A housestead served as the glebe.

Appendix 2.11.7

Census of Ireland *c.*1659

Kentstown parish, Barony of Duleek.

Townland	Population	English	Irish
Curraghstown	13	6	7
Flemingstown	42	11	32
Kentstown	28	5	23
Knockerk (Knockharley)	22	10	12
Rathcoon ???	24	8	16
Tuiterath	6	-	6
Veldonstown	6	2	4

Appendix 2.11.8

Lewis Topographical Dictionary 1837.

Kentstown parish had 500 inhabitants. The soil was good and there was no waste or bog. Somerville house, a fine mansion in an extensive demesne, was the seat of Sir. William Meredith.

Appendix 2.11.9

Census of Ireland 1841 and 1851

Kentstown Parish. Barony of Duleek.

Townland	Area A.R.P.	Pop. 1841 M	F	Total	Pop. 1851 M	F	Total	Houses 1814 Inhabited	uninhabited	Houses 1851 Inhabited	uninhabite
Curraghtown	351 2 10	18	19	37	15	15	30	6		6	1
Flemingstown	876 2 29	101	66	167	58	52	110	28	3	21	6
Kentstown	459 3 26	93	87	180	79	74	153	30	2	28	3
Knockharley	291 0 15	23	28	51	17	17	34	9		7	
Tuiterath	202 1 24	14	20	34	4	4	8	5		2	1
Total	2521 0 3	272	242	514	196	186	382	84	5	69	11

Appendix 2.11.10

Griffith's Valuation, 1880.

Kentstown Parish: Land ownership

Townland	No.Chief occupants	Land owners
Knockharley	8	William A. Shaw, Arthur Murray
Curraghtown	11	William A. Shaw. Arthur Murray
Flemingstown	19	Sir William. Somerville. Bart. In fee
Kentstown	23	William A. Shaw, Church educ. Soc.
Tuiterath	7	Mathias G. Everatt, Sir Wm. Somerville
Veldonstown	6	William A. Shaw

Knockharley Townland

Occupiers	Immediate lessors	Tenament Description	Area A.R.P.	Rateable Annual Valuation Land	Buildings	Total Annual
Thomas Carpenter	Arthur Murray	Land	7.0.19	4.5.0	-	4.5.0
Charles Martin	Thomas Carpenter	House	-	-	0.5.0	0.5.0
Margaret O'Brien	William A. Shaw	House & Land	8.0.20	5.0.0	0.10.0	5.10.0
Mary Levinge	Same	House, Office &Land	12.2.9	7.10.0	0.10.0	8.10.0
Alice Phillips	Mary Leving	House	-	-	0.5.0	0.5.0
Laurence Kinshella	William A. Shaw	House, Offices & Land	263.1.7	181.0.0	13.0.0	194.0.0
George Mcloughlin	Laurence Kinsehlla	House	-	-	0.10.0	0.10.0
Francis Phew	Same	House	-	-	0.10.0	0.10.0
		Total	291.0.15	197.15.0	154.10.0	213.5.0

Tuiterath Townland

Occupiers	Immediate lessors	Tenament Description	Area A.R.P.	Rateable Annual Valuation Land	Buildings	Total Annual
Michael Campbell	M. G. Everatt	House, offices & Land	179 3 23	119 5 0-	5 10 0	124 15 0
Vacant	Michaeol Campbell	House			-0 6 0	0 6 0
Charles Smith	Same	House			0 6 0	0 6 0
Sir William Somerville. Bart.	In Fee	Plantation	11 2 30	4 10 0		4 10 0
Richard Magrane	Wm Somerville. Bart.	Land	6 2 2	3 15 0		3 15 0
Thomas Carter	Same	House & land	4 1 9	3 5 0-	0 10 0	3 15 0
John Manning	Thomas Carter	House			0 10 0	0 10 0
Edward Hogan & Thomas Flood	Trustees of Turnpike Road	Dublin & Slane Turnpike Road. Tolls of. (264 lineal perches)				2 5 0

Arch Consultancy Archaeological Reports

Cultural Resource Development Services Ltd.
Archaeological and Geological Consultants

Unit 4, Dundrum
Business Park,
Dundrum Road, Dublin 14, Ireland.
Telephone: 353 1 2968190
Fax: 353 1 2968195
Email: info@crds.ie

ARCHAEOLOGICAL MONITORING REPORT

for the

Landfill Development

at

Knockharley, Co. Meath

on behalf of

Greenstar Ltd
Ballyogan Business Park,
Ballyogan,
Sandyford,
Dublin 18

Planning Ref (An Bord Pleanala): PL17.125891
License No: 03E0187
Licensee: Kieran Campbell
CRDS Project Ref: 191M

May 2004

V.A.T. Number: EI6330188P
Directors: EurGeol Stephen Mandal B.A. (Mod.) Ph.D. M.I.A.I. P.Geo.
Finola O'Carroll M.A. M.I.A.I.

Executive Summary

At the request of Greenstar Ltd., Kieran Campbell of CRDS Ltd. has undertaken archaeological monitoring for the proposed landfill site at Knockharley, Kentstown parish, Co. Meath (licence number 03E0187). The proposed site is located approximately 6km south of Slane. It is to be located in the townland of Knockharley and extending partly into the adjacent townlands of Tuiterath, Flemingstown and Cuyrraghtown.

Planning permission was granted for the proposed development by An Bord Pleanála (Meath Co. Council Planning Register Reference Number 01/5006), subject to a number of conditions of which condition 14 related to archaeology (see Appendix 1). In summary, the condition required that an archaeological assessment of the site be undertaken, and that further mitigation measures be recommended on foot of this assessment. In response to this condition, Ms Pauline Gleeson of the National Monuments Section referred the client to the mitigation measures as outlines in the EIS (see Appendix 2), and requested that and Archaeological Mitigation Plan be prepared and Implemented (the mitigation strategy is given in Appendix 3).

Geophysical survey of the targeted components of the proposed development was undertaken by Ian Elliott of CRDS Ltd in 2003 (license number 03R010). The results identified the possible remains of a cottage, located west of the county road in area D. A field boundary 60m to the west probably coincides with one mapped on the OS sheet in 1909. Elsewhere there was evidence for additional, possibly archaeologically significant remains within the survey area, mostly identified as pit-like features. It was recommended that a scheduled programme of test trenching should proceed, both in the areas of geophysical survey, and more particularly in those areas inaccessible to the geophysical survey.

Pre-development testing was carried out under license to the National Monuments Section of the Department of Environment, Heritage and Local Government (License No. 03E0187: Licensee: Laurence McGowan – report submitted April 2004).

Nine archaeological features / areas were encountered during the course of pre-development testing and archaeological monitoring. Two, a deer trap and a well, were excavated during the course of testing / monitoring as it was felt that they were at immediate risk of destruction by construction works. Four of these are in areas that will be directly impacted on by the development works. One is located in an area to be planted with trees, and the client has agreed to leave a buffer of 15m around this site in which no planting or groundworks will be carried out. Finally, one is located in an area outside of the main development, but through which it is planned to run a drain. Discussions are currently on-going with the client with a view to avoiding this feature. If it is not possible to adequately ensure the protection of this feature, an excavation strategy will be proposed.

No other archaeological features of significance were uncovered during pre development testing or monitoring.

It is recommended that those archaeological features encountered during pre-development testing and monitoring that cannot be avoided by development works be excavated under license in consultation with the National Monuments Section of the Department of Environment, Heritage and Local Government

Received 30/05/06

Cultural Resource Development Services Ltd.
Archaeological and Geological Consultants

Unit 4, Dundrum
Business Park,
Dundrum Road, Dublin 14, Ireland.
Telephone: 353 1 2968190
Fax: 353 1 2968195
Email: info@crds.ie

Report

on the

Pre-Development Testing
at

Knockharley, Co. Meath

on behalf of

Greenstar Ltd.

U4b Ryebrook Industrial Estate
Leixlip
Naas
Co. Kildare
Ireland

Licence 03E0187
CRDS Ltd. Project Ref: 03#191

April 2004

V.A.T. Number: EI6330168P

Executive Summary

At the request of Greenstar Ltd., Laurance Mc Gowan of CRDS Ltd. has undertaken pre-development testing for the proposed landfill site at Knockharley, Kentstown parish, Co. Meath (licence number 03E0187)

The proposed site is located approximately 6km south of Slane. It is to be located in the townland of Knockharley and extending partly into the adjacent townlands of Tuiterath, Flemingstown and Cuyrraghtown.

Planning permission was granted for the proposed development by An Bord Pleanála (Meath Co. Council Planning Register Reference Number 01/5006), subject to a number of conditions of which condition 14 related to archaeology (see Appendix 1). In summary, the condition required that an archaeological assessment of the site be undertaken, and that further mitigation measures be recommended on foot of this assessment. In response to this condition, Ms Pauline Gleeson of the National Monuments Section referred the client to the mitigation measures as outlines in the EIS (see Appendix 2), and requested that and Archaeological Mitigation Plan be prepared and Implemented (the mitigation strategy is given in Appendix 3).

Geophysical survey of the targeted components of the proposed development was undertaken by Ian Elliott of CRDS Ltd in 2003 (license number 03R010). The results identified the possible remains of a cottage, located west of the county road in area D. A field boundary 60m to the west probably coincides with one mapped on the OS sheet in 1909. Elsewhere there was evidence for additional, possibly archaeologically significant remains within the survey area, mostly identified as pit-like features. It was recommended that a scheduled programme of test trenching should proceed, both in the areas of geophysical survey, and more particularly in those areas inaccessible to the geophysical survey.

Pre development testing was carried out under license to the National Monuments Section of the Department of Environment, Heritage and Local Government (License No. 03E0187) in two separate areas. The first area tested covered the access roadways and phase 1 services, this area extends from the main N2 Dublin / Derry Road across into the compound area. A single trench was excavated along the centre line of this access road. One archaeological feature – a well – was uncovered in this area. The road crosses through field 59, the corner of field 58, 57, 56, 55, 54 and into the compound area which extends over fields 37, 38, 35, and 34. In the compound area a further 5 test trenches were excavated, one features was noted but it is probable that it is a natural geological feature.

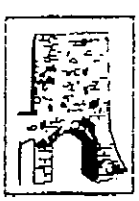
The second tested area is located in the southern area of the site, field 10, also known as the stormwater area. Five test trenches were excavated. A possible posthole feature was revealed; on further assessment this was determined to be non-archaeological.

No other archaeological features of significance were uncovered during pre development testing.

In accordance with the planning conditions, and due to the relatively high potential for encountering archaeological features, archaeological monitoring of the remaining ground works is recommended.

REPORT ON ARCHAEOLOGICAL EXCAVATIONS AT KNOCKHARLEY, CO. MEATH

License No. 03E0187



Arch Consultancy Ltd.
Professional Archaeological Services

Martin Fitzpatrick, M.A. **Fiona Rooney, B.A.**
Ballydavid South, Athenry, Co. Galway.

1. GENERAL INTRODUCTION

This report describes the manual archaeological excavation of a number of features in townland of Knockharley, some 6km south of Slane in County Meath. This project was commissioned by Greenstar, Ballyogan Road, Sandyford, Dublin 18 and the archaeological excavations were carried out over a period of four days in May-June 2004.

A regional residual landfill facility is being developed at the site. It is designed to receive up to 180,000 tonnes of municipal waste per year and will have an operating life of 14 years. The facility will be developed in seven separate phases, each lasting two years.

An Environmental Impact Study of the area was carried out by Margaret Gowen and Company Ltd. in 1999. The subsequent planning conditions issued by An Bord Pleanála required that a suitably qualified archaeologist be employed prior to the commencement of the development. The condition required an archaeologist to assess the site and monitor all site works. CRDS Ltd were appointed as archaeologists for the development and put into action a mitigation strategy which was previously recommended in the EIS and endorsed by Department of Environment, Heritage and Local Government.

The mitigation strategy included a photographic and measured survey of a holy well and farmyard complex, archaeological testing, ploughzone analysis, geophysical prospection of fields impacted by major ground disturbance and monitoring of all topsoil removal. Archaeological predevelopment testing was undertaken under licence (03E0187) and identified a number of archaeological features/areas. Two of these features (a well and a deer trap) were excavated during the course of monitoring. A number of further features were highlighted and full excavation was recommended. This report details the archaeological excavations at one of these areas (Feature 1 as identified in the Archaeological Pre-Development Testing Report, License 03E0187). With the agreement of Mr. Stephen Mandall, CRDS Ltd. and Mr Tom Condit, National Monuments Division, Department of Environment, Heritage and Local

Government the initial excavation of these features was undertaken under License No. 03E0187, with all subsequent excavations undertaken under a new license 04E0788.

2. LOCATIONAL INFORMATION

Townland: Knockharley

Parish: Kentstown

Six Inch Sheet. No.: 026

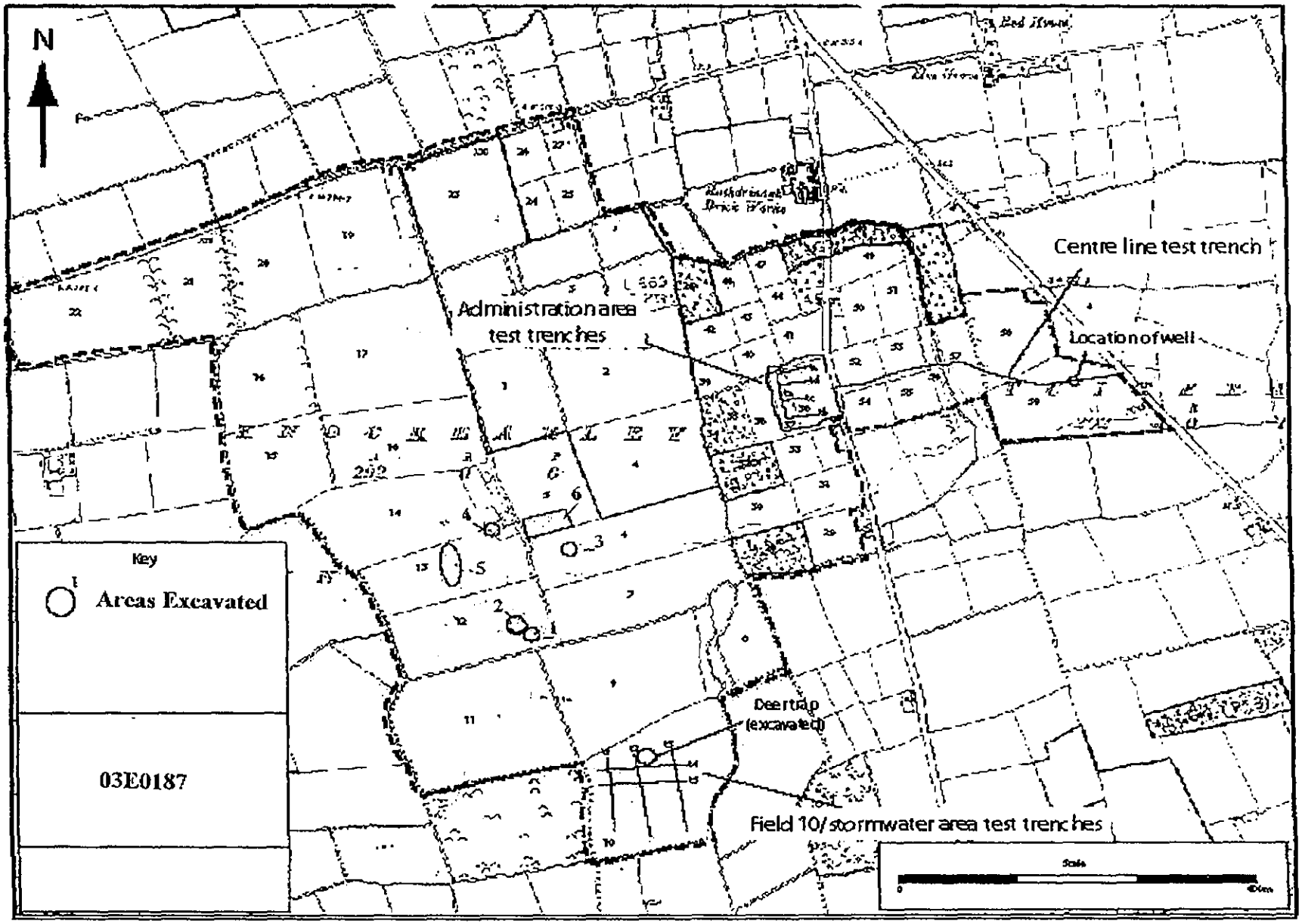
SMR No.: ----------

Excavated by: Martin Fitzpatrick M.A.

Plate No. 7: Post-Excavation view of site Area 1 taken from the S.

6. CONCLUSIONS

The archaeological excavations of Area 1 were concentrated on a small area with the surrounding land having been greatly reduced in level as part of the construction associated with the residual landfill facility. Two linear features, one of which was a modern drain filled with stone, ran roughly N-S through the area excavated. The second linear feature appeared to have been cut by hand and one fragment of dark green glass, possibly 19th century in date, was recovered from the upper fill. To the W of the linear features a number of irregular shaped features were identified. All of these features were cut into the natural subsoil and had in their upper fills concentrations of small angular stones. Occasional fragments of charcoal were recovered from the fill but the quantity recovered was inadequate for dating purposes. The purpose of the cut features is not known and no artefacts were recovered from their fills or from the surrounding area excavated.



Illus. 2. Extract from O.S. 6 inch Map, Sheet No. 26 indicating location of Area 1 in field No. 12 (After CRDS Ltd.)

1. GENERAL INTRODUCTION

This report describes the manual archaeological excavation of an a number of features in townland of Knockharley, some 6km south of Slane in County Meath. This project was commissioned by Greenstar, Ballyogan Road, Sandyford, Dublin 18 and the archaeological excavations were carried out between May-July 2004.

A regional residual landfill facility is being developed at the site. It is designed to receive up to 180,000 tonnes of municipal waste per year and will have an operating life of 14 years. The facility will be developed in seven separate phases, each lasting two years.

An Environmental Impact Study of the area was carried out by Margaret Gowen and Company Ltd. in 1999. The subsequent planning conditions issued by An Bord Pleanála required that a suitably qualified archaeologist be employed prior to the commencement of the development. The condition required an archaeologist to assess the site and monitor all site works. CRDS Ltd were appointed as archaeologists for the development and put into action a mitagation strategy which was previously recommended in the EIS and Endorsed by Department of Environment, Heritage and Local Government.

The mitigation strategy included a photographic and measured survey of a holy well and farmyard complex, archaeological testing, ploughzone analysis, geophysical prospection of fields impacted by major ground disturbance and monitoring of all topsoil removal. Archaeological predevelopment testing was undertaken under licence (03E0187) and identified a number of archaeological features/areas. Two of these features (a well and a deer trap) were excavated during the course of monitoring. A number of further features were highlighted and full excavation was recommended. This report details the archaeological excavations at four different areas (Areas 2-5) within the proposed landfill site. With the agreement of Mr. Stephen Mandall, CRDS Ltd. and Mr Tom Condit, National Monuments Division, Department of Environment, Heritage and Local Government the initial excavation of Area 1 was undertaken under license No. 03E0187 with subsequent excavations (Areas 2-5) undertaken under a new license (04E0788). This report describes the results of the excavations of Areas 2-5.

LIST OF FINDS FROM KNOCKHARLEY

EXCAVATION LICENSE NO. 04E0788

FIND NUMBER	TYPE	CONTEXT	TRENCH
Knockharney finds			
04E0778:1	pottery sherd	C3	Area 4
04E0778:2	pottery sherd	C3	Area 4
04E0778:3	pottery sherd	C3	Area 4
04E0778:4	pottery sherd	C3	Area 4
04E0778:5	pottery sherd	C3	Area 4
04E0778:6	pottery sherd	C3	Area 4
04E0778:7	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:8	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:9	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:10	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:11	flint fragment	C1/C2	Monitoring in the vicinity of Area 4
04E0778:12	flint fragment	C1/C2	Monitoring in the vicinity of Area 4
04E0778:13	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:14	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4
04E0778:15	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4 & 5

04E0778:16	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4 & 5
04E0778:17	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4 & 5
04E0778:18	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4 & 5
04E0778:19	pottery sherd	C1/C2	Monitoring in the vicinity of Area 4 & 5

DISCUSSION

The archaeological excavations at Knockharley, County Meath involved the manual excavation of a number of areas prior to the installation of a residual landfill facility. The features excavated had previously been identified in the course of archaeological monitoring and testing undertaken at the site by CRDS Ltd. In addition to the areas excavated by Arch Consultancy, CRDS Ltd excavated a deer trap and a well in the area of the landfill development (License No. 03E0187) and identified a number of further features which will not be directly impacted by the current development.

There are no recorded archaeological sites in the area of the development however there is evidence of occupation in the vicinity of the development. Neolithic activity is evident in the henge monument at Baltrath 2km to the SW and the discovery of two polished stone axeheads from Painestown and Rraltoge. The early medieval period is represented by numerous ringforts in the area while later medieval occupation is represented in the parish of Kentstown which was granted to Stephen de Kent after the Norman invasion.

In the course of monitoring at the site CRDS Ltd. identified two possible burnt spreads/fulacht fiadh, numerous pits with evidence of burning and numerous field ditches. All features which were impacted by proposed development works were excavated under license by Arch Consultancy Ltd. in May-July 2004. In all cases the areas excavated were isolated from the surrounding landscape as excavation works associated with the development had had already greatly reduced the ground level. Area 6 was identified by CRDS Ltd. as an area in the vicinity of the former farmhouse which had evidence for a number of modern field ditches and a pit of unknown date. Following discussion with the developers only the S end of this area was required for the current development. Monitoring of topsoil stripping in this area (Plate No. 27) revealed no archaeological features. Any development N of the current line will require archaeological work.

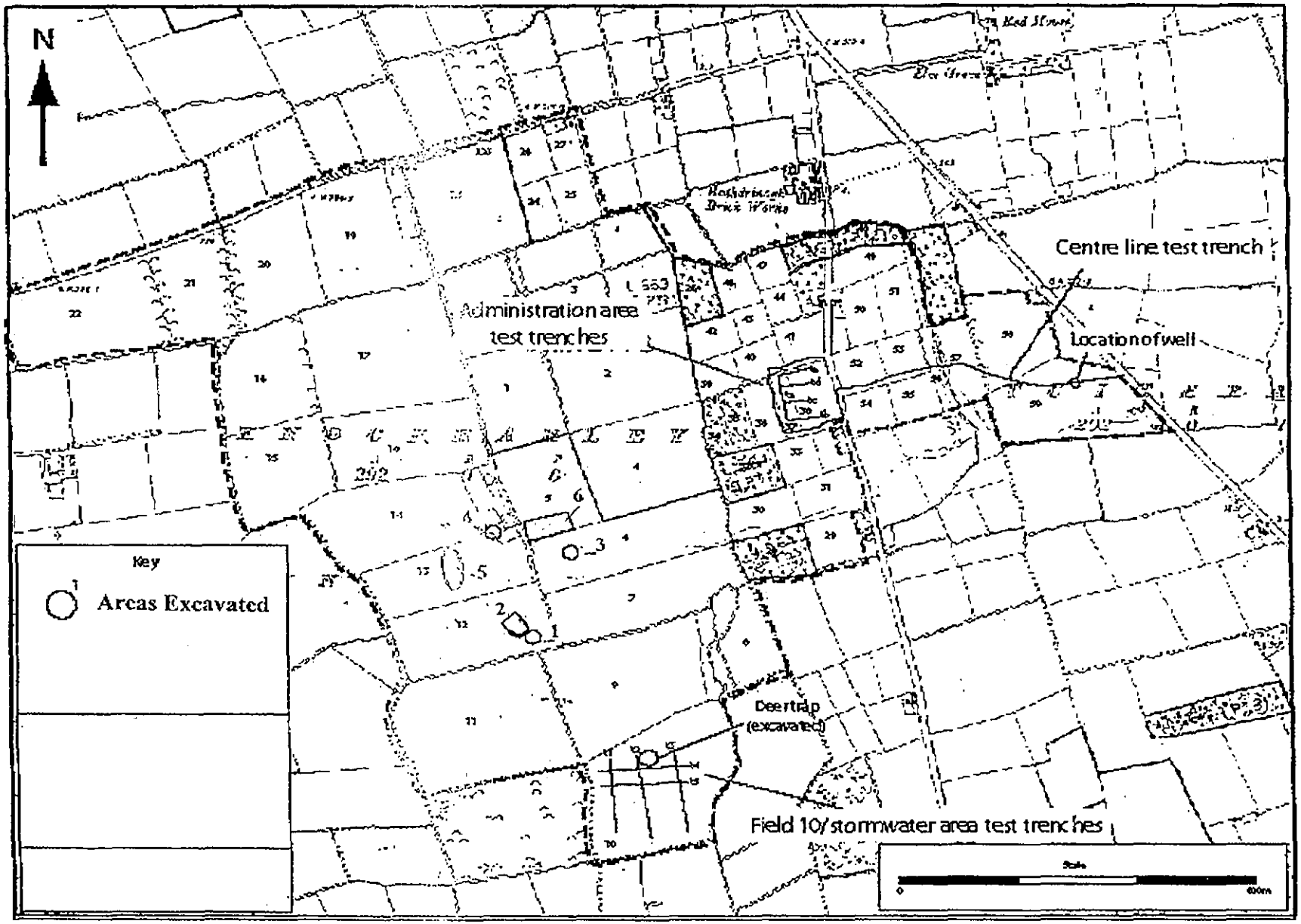
The current archaeological excavations revealed an interesting burnt mound with two large pit features which may have functioned as troughs. Charcoal fragments from the pits will give an indication of the date of this feature. In Area 3 numerous pit features with burnt

stone and charcoal indicate possible roasting pits. Charcoal samples recovered from the pits has been sent for species analysis and radiocarbon dating. In area 4 a large pit was excavated revealing a number of pottery fragments from the fill. The pottery has a green glaze and it appears that all fragments recovered are from the same vessel. Similar pottery fragments were recovered from the surrounding lands during monitoring of works. In area 5 a further two pits with burnt stone and charcoal were recorded.

The archaeological excavations confirm human activity in the area of the development. More details of the exact nature and date will be available once post excavation analysis of finds and charcoal is completed.

The archaeological monitoring, testing and excavation works at the site do highlight the need for further archaeological work when the current landfill is being extended. Possible archaeological features have already been identified in the area of the former farmhouse and it is likely that further archaeological features survive in the vicinity.

Please note that any recommendations made in this report require the ratification of the National Monuments Division, Department of Environment, Heritage and Local Government.



Illus. 2: Extract from O.S. 6 inch map, Sheet No. 26, indicating the location of areas 2-6 (After CRDS Ltd.)