Addendum I to Environmental Impact Statement

Mr Binman. Ltd. EPA Licence Review Application

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Table of Contents

1. Introduction 1

1.1 Background 1
1.2 Structure of the Report 1

2. Non-Technical Summary 3

2.1 Geology and Soils 3
2.2 Hydrology and Hydrogeology 4
2.3 Material Assets 6
2.3.1 Utility Services 6

3. Description of the Proposed Development 7

3.2 Existing Operations and Infrastructure 7
3.2.9 Wastewater Treatment Plant 7
3.2.10 Laboratory 10

6. Geology and Soils 11

6.1 Introduction 11
6.1.1 Methodology and Limitations 11
6.1.2 Published Material 11
6.2 Geology 11
6.2.1 Topography 11
6.2.2 Regional Geology 11
6.2.3 Local Geology at the Site of the Proposed Development 12
6.2.4 Borehole Data: Bedrock 13
6.2.5 Quaternary Geology 13
6.3 Soils 14
6.3.1 Soil Formation 14
6.3.2 Soil Associations 14
6.3.3 Soil Suitability 15
6.4 Likely and Significant Impacts and Associated Mitigation Measures 16
6.4.1 Impacts on Geology 16
6.4.2 Impacts on Soils 16

7. Hydrology and Hydrogeology 20

7.1 Hydrology-Introduction 20
7.2 Hydrology in the Existing Environment 20
7.2.1 Surface Water Features 20
7.2.2 Water Quality 21
7.2.3 Onsite Wastewater Treatment Plant 27
7.2.4 Hydrocarbon Interceptor 30
7.2.5 Water Usage 30
7.3 Flood Analysis 31
7.4 Hydrogeology 31

7.4.1 Quaternary Deposits 32
7.4.2 Aquifer Classification and Vulnerability 32
7.4.3 Groundwater Flow Direction 33
7.4.4 Hydrochemistry 34
7.4.5 Groundwater Uses 38
7.5 Likely and Significant Impacts and Associated Mitigation Measures 38
7.5.1 Likely and Significant Impacts on Hydrology 38
7.5.2 Likely and Significant Impacts on Hydrogeology 39

11. Material Assets **44**

11.2 Utility Services 44
11.2.2 Surface Water Run-off 44
11.2.3 Foul Water Drainage 45

1 INTRODUCTION

1.1 Background

Mr. Binman Ltd. operates a waste transfer station and recycling centre at Luddenmore, Grange, Killmallock, Co. Limerick. Under Waste Licence No. W0061-02 issued by the Environmental Protection Agency (EPA), Mr. Binman Ltd. is permitted to accept 87,500 tonnes up to 105,000 tonnes of waste per annum at this facility. Mr. Binman Ltd. proposes to increase this capacity to 200,000 tonnes per annum by 2012, subject to approval from the EPA.

In September 2007, the EPA confirmed that the most appropriate way of increasing the annual waste acceptance limit at the site beyond 105,000 tonnes was through a review of the facility's existing waste licence. Mr. Binman Ltd. submitted an application for a review of the waste licence to the EPA in July 2008. Following consultation between Mr. Binman Ltd. and the EPA with the Forward Planning Section of Limerick County Council, an Environmental Impact Assessment (EIA) of the proposed increase in tonnages to be accepted at the facility was deemed necessary.

McCarthy Keville O'Sullivan Ltd. was appointed as Environmental Consultants on this project and commissioned to complete an EIA, which fulfils the requirements set out by the EPA in the *'Guidelines on the Information to be contained in Environmental Impact Statements'* and Schedule 6 of the Planning and Development Regulations 2001, relating to the information to be contained in an Environmental Impact Statement (EIS). The EIS was prepared on behalf of the applicant Mr. Binman Ltd., and identified and planned for the mitigation of all potential impacts that will arise as a result of the proposed development.

The EIS for the Mr. Binman Ltd. licence review application was submitted to the EPA in January 2009. On 30th November 2009, the EPA issued a request for further information on the waste licence application to Mr. Binman Ltd. The items of information requested by the EPA relate to the treatment of wastewater at the site and the protection of groundwater. The request for further information also stated:

> *"Where necessary update the EIS documents, having regards to the information requested under 'Article 12 Compliance Requirements' above."*

This report contains the relevant updated sections of the EIS and will be submitted to the EPA along with the further information requested in their correspondence of 30th November 2009.

1.2 Structure of this Report

The relevant sections of the EIS that was submitted in January 2009 have been updated with regards to the further information requested by the EPA and are presented in this Addendum to the EIS. The relevant sections are:

- Chapter 3: Description of the Proposed Development;
- Chapter 6: Geology and Soils;
- Chapter 7: Hydrology and Hydrogeology; and
- Chapter 11: Material Assets.

The updated information that has been added to these chapters of the EIS relates directly to the further information that has been prepared by Mr. Binman Ltd. to be submitted to the EPA. This additional information refers to the description of the existing environment at the subject site and therefore there are no changes to the description of impacts presented in the original EIS. The relevant sections of the Non-technical Summary of the EIS have also been updated accordingly.

The complete updated Chapters 6 (Geology and Soils) and 7 (Hydrology and Hydrogeology) of the EIS are presented in this document. With regards to Chapter 3 (Description of the Proposed Development) and Chapter 11 (Material Assets), the updates to these chapters relate to minor sections only, and therefore only the relevant updated sections of these chapters are presented in this document. The numbering used in the updates to Chapters 3, 6, 7 and 11 as presented in this Addendum document is unchanged from that of the original EIS.

This report therefore comprises:

- Updated Non-technical Summary. No changes have been made to the original Non-technical Summary for Chapter 3. The updated summaries presented in this document refer to Chapters 6, 7 and 11.
- Updated Section 3.2.9: Wastewater Treatment Plant and Section 3.2.10: Laboratory of Chapter 3 of the original EIS.
- Full text of the updated Chapter 6: Geology and Soils.
- Full text of the updated Chapter 7: Hydrology and Hydrogeology.
- Updated Section 11.2.2: Surface Water Drainage, Section 11.2.3: Foul Water Drainage and Figure 11.8: Storm and Foul Drainage Layout of Chapter 11 of the original EIS.

2. NON-TECHNICAL SUMMARY

2.1 Geology and Soils

The geology and soils of the site of the proposed development were surveyed by means of a field visit and a desk study of literature and information pertinent to the area. Baseline information was gathered through the analysis of previously published literature relevant to the area including the Geology of the Shannon Estuary and the Geology of Tipperary booklets published by the Geological Survey of Ireland, the Soil Map of Ireland (Second Ed., 1980) published by An Foras Talúntais and a hydrogeologicalreport prepared by RPS McHugh Planning & Environment in 2003.

Local topography comprises rolling hills with occasional abrupt changes in slope, due to differential weathering of volcanic rock compared with limestone. The site is located within an area known geologically as "the Limerick Volcanics", a complex of shallow intrusive and extrusive rocks, consisting of basalts, lithic tuffs and syenites, which erupted just after the deposition of the Waulsortian Limestone and contemperaneous to the deposition of the Herbertstown Formation. The entire site is underlain by tuff breccias of the Knockroe Volcanic Formation, from the Carboniferous era. Local glacial deposits consist of limestone tills providing generally thin cover.

In the region, soils are primarily derived from calcareous non-tenaceous glacial till, predominantly of Carboniferous limestone. There are small admixtures of sandstone, shale or volcanic materials. The soils underlying the site belong to Association 34, which is in the broad physiographic division of Flat to Undulating Lowland. The principal soils of Association 34 are minimal grey brown podzolics (70%), gleys (20%) and brown earths (10%). These soils have a wide range of uses as a result of their depth, free drainage, medium texture and good moisture holding capacity.

There will be no significant impacts on geology of the area as a result of the proposed development as no construction works are proposed. Likewise, it is considered that the proposed development will have no significant impacts on soils in the area. However current operational phase risks including the risk of liquid contamination and soil compaction may increase as a result of the increase in tonnage accepted at the existing facility. Liquid contaminants, resulting from processes on site, are drained to the onsite wastewater treatment plant where they undergo full treatment. Since July 2008, several improvements have been made to the operation of the onsite WWTP at the Mr. Binman Ltd. waste transfer station. A full-time Environmental Analyst was employed to set up an environmental laboratory and to monitor and operate the WWTP. An intensive in-house assessment of the WWTP was undertaken, including measurement of key parameters at every stage of the WWTP. At present, the effluent from the wastewater treatment process is tankered off-site for further treatment at Castletroy Wastewater Treatment Plant. It is proposed that this method of disposal will continue until it has been proven that the on-site treatment plant is functioning to the standards acceptable to the EPA.

All surface run-off from the site is directed to a Klargester NS2000 Class 1 Oil Interceptor, which ensures that no hydrocarbon contamination from on-site discharges to the underlying aquifer. The hydrocarbon interceptor is subject to a rigorous maintenance schedule. All clean roof water is diverted to a separate soakaway in order not to overload the oil interceptor hydraulically. It is also proposed to seal all joints on areas of hardstanding within the site to ensure that no contaminants leak to underlying soils.

Extreme care is and will be exercised to ensure that soil contamination does not occur by the spillage of polluting substances e.g. fuel. This will continue to be achieved through the use of a designated bunded area, for the handling and storage of fuel and the re-fuelling of vehicles. In addition, the Emergency Response Procedure (ERP) provides details on precautionary measures and emergency procedures in the event of spills and leaks both on-site and off-site.

Due to the increase in vehicular activity due to the increased tonnage, there is an increased risk of soil compaction. However as all operations are conducted on areas of hardstanding, it is extremely unlikely that any increase in load will cause any significant impact on underlying soils. All operations will be conducted on areas of hardstanding to avoid compaction of soils on-site.

2.2 Hydrology and Hydrogeology

The hydrology and hydrogeology of the site was surveyed by means of a desk study of pertinent literature and a field visit. The site of the proposed development is situated within *Hydrometric Area 24 – Shannon Estuary South.* There are no water features present within the site. The closest watercourse is located approximately 0.13 kilometres from the southwestern site boundary and eventually drains to the Camoge River, a tribuatary of the Maigue, four kilometres downstream.

Water samples are taken by the EPA from monitoring points on the Camoge and Groody Rivers. Physico-chemical data is available for three separate periods of analysis, 1995 to 1997 and 1998 to 2000 and 2001-2003. The Q Value Index System is used by the EPA as an indication of the water quality of rivers. The most recent water samples taken at the closest sample locations on the Camoge and Groody rivers showed Q values of 3-4, representing slightly polluted water.

There are no records of flood events for the area surrounding the site of the proposed development. The site at Luddenmore is not considered to be at risk of flooding due to elevation, distance from areas liable to flooding and the absence of significant watercourses in the area. There is no potential for impacts in respect of flood risk as a result of the proposed development.

Estimated water consumption at the facility for 2008 is at 1,767 m^3. The tonnage of wastewater effluent leaving the site in 2008 is estimated to be approximately 6,200 tonnes. The total volume of wastewater, including that from building washdowns, generated and sent off-site for treatment in 2009 was 5,468 m^3, and it is anticipated that similar volumes will continue to be generated.

Due to the lack of watercourses on or near the site, it is not considered that the proposed development will have a significant negative impact on surface hydrology. In general, the ongoing groundwater monitoring results for the site indicate good groundwater quality.

Uncontrolled release of liquid contaminants from the processes on-site could result in the contamination of groundwater. However, as the drainage network and stormwater drainage system is already *in situ*, all surface runoff will continue to be directed to the Klargester NS2000 Class1 Oil Interceptor with silt trap. The sources of all waters that are treated via the interceptor prior to discharge comprise vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas, yard areas in front of maintenance buildings and the fuel filling area. In order to prevent hydraulic overloading of the oil interceptor/silt trap, all clean roof water is diverted to separate soakaways.

All water used during on-site waste processing operations will continue to be directed to the on-site wastewater treatment plant (WWTP). The sources of wastewater and foul water treated at the onsite WWTP comprise foul water from canteen and toilets, wastewater from process buildings, wastewater from process yard areas in front of waste delivery areas of process buildings and from vehicle/container wash bay and surrounding yard area.

The effluent from the WWTP is currently being removed off-site for further treatment. It is proposed to continue this practice until emission limit values are achieved on a consistent basis. A laboratory was set up in 2008 to ensure all compliance parameters are actively monitored and to determine what additional measures need to be implemented in order to ensure compliance. All joints on paved surfaces where waste is handled have been sealed in order to further ensure groundwater protection. Since July 2008, several improvements have been made to the operation of the onsite WWTP at the transfer station. A full-time Environmental Analyst was employed to set up the environmental laboratory and to monitor and operate the WWTP. An intensive in-house assessment of the WWTP was undertaken, including measurement of key parameters at every stage of the WWTP. As a result of the improvement programme, the quality of the WWTP effluent has improved significantly during the past 18 months. This improvement is illustrated in the recorded BOD, suspended solids and ph data and trends, which clearly show that the plant has improved significantly during that period.

The increased use of vehicles (associated with the increase in tonnage) at the facility increases the potential for the spillage of hydrocarbons in the form of leaks from vehicles or fuel tanks or spillages. These substances may leach down into the soil, subsoil and groundwater. All operations occur on hardstanding, from where all run-off is directed to the oil interceptor prior to discharge to ground. A designated refuelling area is provided within an area of hardstanding concrete. Fuel is stored in a bunded fuel tank in a bunded concrete area.

In the event of a serious leak or spillage, the measures contained in the Emergency Response Procedure will be followed to ensure that the spill or leak is contained immediately. In addition, all vehicles used for transport and collection of waste will be checked and maintained to avoid leaks of fuel, lubricants etc. Best practice for machinery management and maintenance will be adopted.

All storm wastewater that arises on the site will continue to be directed to the oil interceptor prior to discharge via a percolation area. However, in the unlikely event that the interceptor fails to operate as specified, the leaking of hydrocarbons to groundwater could have a significant negative impact on groundwater quality. The severity of the impact would increase with volume and duration of the leak. However, as there is a substantial overburden, this should provide sufficient protection for the aquifer in the post-construction phase.

2.3 Material Assets

2.3.1 Utility Services

Potable water at the site is sourced from the Ballybricken Group Water Scheme. All other water is obtained from the private bored well to the northeast of the waste transfer station yard. There are four stormwater percolation areas located around the site, through which rainwater from roofed surfaces is discharged to ground. All other surface water from the yard is discharged via a new hydrocarbon interceptor/settlement tank. The sources of all waters that are treated via the interceptor prior to discharge comprise vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas, yard areas in front of maintenance buildings and the fuel filling area. The recent installation of this best available technology (BAT) hydrocarbon interceptor at the site ensures that discharges of environmental significance do not occur.

Although groundwater monitoring results for the facility to date confirm that there has been no impact to groundwater, all joints on hardstanding areas have been sealed to further ensure there will be no impact on groundwater. This measure will be implemented as part of the EPA waste licence review application.

A vehicle washing area is located near the onsite wastewater treatment plant. All vehicle washing is carried out at this location. Water from the truck wash station is discharged to the onsite wastewater treatment plant. Fuel is stored in a bunded fuel tank, which is located in a bunded concrete area. Water discharged from the bund of the fuel store is removed off-site for further treatment, as necessary. The loading/unloading area, beside the bund, drains to the hydrocarbon interceptor in the event of a small spill when filling a truck with fuel.

Foul water from the transfer station is drained to the onsite wastewater treatment plant. The sources of wastewater and foul water treated at the onsite WWTP comprise foul water from canteen and toilets, wastewater from process buildings, wastewater from process yard areas in front of waste delivery areas of process buildings and from vehicle/container wash bay and surrounding yard area. At present, there are no discharges to ground from the treatment plant. The wastewater is collected from the onsite plant and brought to Castletroy Wastewater Treatment Plant for further treatment.

There will be no discharges from the onsite wastewater treatment plant emission point until such time as it can be demonstrated that it is operating in compliance with the emission limit values. Since July 2008, several improvements have been made to the operation of the onsite WWTP. As a result of the improvement programme, the quality of the WWTP effluent has improved significantly during the past 18 months. This improvement is illustrated in the BOD, suspended solids and ph data and trends recorded for the WWTP effluent, which clearly show that the plant has improved significantly during that period. In addition to the existing WWTP improvement measures, Mr. Binman Ltd. is currently investigating further optimisation measures in order to ensure that consistent compliance with emission limit values for WWTP effluent can be achieved. No discharges to ground will occur from the WWTP until consistent compliance with EPA standards are met.

3. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The sections of Chapter 3 of the original EIS that have been updated are Sections 3.2.9: Wastewater Treatment Plant and Section 3.2.10: Laboratory, both of which were set out under Section 3.2: Existing Operations and Infrastructure.

3.2 Existing Operations and Infrastructure

3.2.9 Wastewater Treatment Plant

Foul water from the transfer station is drained to the onsite wastewater treatment plant. The sources of wastewater and foul water treated at the onsite WWTP comprise:

1. Foul water from canteen and toilets.
2. Wastewater from process buildings.
3. Wastewater from process yard areas in front of waste delivery areas of process buildings.
4. Vehicle/container wash bay and surrounding yard area.

The water is firstly screened to remove papers, plastics and any other gross solids before it enters the wastewater treatment plant. The treatment processes include a grease trap, aerated influent storage, level control pumping chamber, primary settlement (2), two aerated moving bed biofilm reactors (MBBR), clarifier, pumping chamber trial polishing filter and an effluent storage tank. At present, there are no discharges to ground from the treatment plant. The wastewater is collected from the onsite plant, as shown in Plate 3.11, and brought to Castletroy Wastewater Treatment Plant for further treatment.

Since July 2008, several improvements have been made to the operation of the onsite WWTP at the Mr. Binman Ltd. waste transfer station. The diversion of uncontaminated rainwater from roofed surfaces has minimised the hydraulic loading to the wastewater treatment plant and reduced fluctuations in flow due to adverse weather conditions. A full-time Environmental Analyst was employed to set up an environmental laboratory and to monitor and operate the WWTP. An intensive in-house assessment of the WWTP was undertaken, including measurement of key parameters at every stage of the WWTP. This assessment included analysis of the influent in terms of volume and composition and the impact of each stage of the wastewater treatment system on key parameters. This assessment provided valuable information on control issues associated with the WWTP, which was used to develop and implement an improvement programme for control of the wastewater treatment plant. This improvement programme included:

- Development and implementation of standard operating procedures (SOPs) for operation and maintenance of the WWTP and associated equipment on a daily basis and training of relevant personnel.
- Development and implementation of standard laboratory procedures for conducting regular in-house monitoring of key control parameters to provide information on the efficiency of the WWTP.
- Managing hydraulic throughput in the WWTP to ensure that the plant is not overloaded or underloaded hydraulically. The WWTP is limited to the design throughput of 18.9 m^3 per day.

- Managing Chemical Oxygen Demand/Biological Oxygen Demand (COD/BOD) throughput to ensure the WWTP is not overloaded or underloaded. Reduced loadings to the WWTP are achieved through ramp, dicersion of roof drains and Level 3 ramp run-off, replaced use of power-washing units with dedicated road-sweeper/washer and limiting the use and type of detergents.
- Purchase of a dedicated vacuum tanker for the transfer of wastewater off-site. The tanker also allows for more regular maintenance of the silt trap, grease trap and primary settlement tank.
- Installation of a polymer dosing system to reduce solids, BOD, etc. in the final effluent. The polymer dosing system was installed to flocculate suspended solids in the discharge to the clarifier in order to reduce the residual suspended solids and thereby further improve emission discharges. The polymer dosing system is currently undergoing an optimisation stage.

Plate 3.11 Treated wastewater is collected from the onsite treatment plant by truck

All other surface water from the yard is discharged via a new hydrocarbon interceptor/settlement tank, as shown in Plate 3.12. This new hydrocarbon interceptor is a Klargester NS 200 Class 1 full retention separator and built-in silt trap, and is the best available unit on the market. The sources of all waters that are treated via the interceptor prior to discharge to the emission point, referred to as FE2, comprise:

1. Vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas.
2. Yard areas in front of maintenance buildings.
3. Fuel filling area.

The recent installation of the oil interceptor at the site ensures that discharges of environmental significance do not occur. The Klargester hydrocarbon interceptor is located close to the eastern boundary of the site.

Drainage from the site is discussed further in Chapter 7 (Hydrology & Hydrogeology) of the EIS.

Plate 3.12 Oil Interceptor

3.2.10 Laboratory

In order to assure compliance with the emission limit values of the facility's EPA Waste Licence, an onsite laboratory has been set up and a full-time Environmental Analyst employed. The roles of the Environmental Analyst include the development and implementation of standard operating procedures for the sampling and monitoring of the wastewater treatment plant, stormwater, groundwater, dust and noise and all other environmental checks that are required to ensure full compliance with licence conditions. The Environmental Analyst also carried out an intensive in-house assessment, as detailed in Section 3.2.9 above. The laboratory is located on the ground floor of the canteen and office building in the centre of the site.

While substantial improvements have been made to the wastewater treatment plant in recent years, until 2008 the information available to optimise control of the treatment plant was limited. The establishment of a laboratory onsite aims to improve plant operation and control, as daily monitoring data is available to allow changes to be made to the plant on a daily basis. This data will also provide critical analysis of the wastewater treatment plant performance over an extended period of time and will highlight improvements that can be made in order to assure compliance. In addition to the existing WWTP improvement measures detailed in Section 3.2.9 above, Mr. Binman Ltd. is currently investigating further optimisation measures in order to ensure that consistent compliance with emission limit values for WWTP effluent can be achieved. These measures, which will be implemented if successful, include:

- Optimisation of the polymer dosing system. This system is currently undergoing an optimisation stage as there are a number of variables associated with such a system, such as:
    - Location of the dosing point to maximise mixing of the polymer with the effluent.
    - Dosing frequency relative to flow/suspended solids concentration.
    - Dosing quantity relative to flow/suspended solids concentration.

- All WWTP effluent is currently discharged to a storage tank for the purpose of pumping it to the road tanker for further offsite treatment. In the event that having met EPA compliance limit values the effluent is discharged to emission point FE1, it was proposed to discharge the effluent direct from the clarifer of the WWTP via FE1 to the percolation area, as per the original set-up. A potential improvement currently being assessed is to continue discharging to the storage tank to allow further settlement before discharging to FE1. It is expected that this will further improve the quality of the final effluent discharge. Trials are underway to measure the quality of effluent direct from the clarifer compared to that from the storage tank prior to pumping to the tanker for off-site disposal.

6. GEOLOGY AND SOILS

6.1 Introduction

6.1.1 Methodology and Limitations

The geology and soils of the site of the proposed development were surveyed by means of a field study of the site and surrounding area and through a desk study of literature and information pertinent to the area. A field visit to the site was carried out on the 19th of November 2008 during which the soils and geology of the site were visually assessed.

6.1.2 Published Material

A desk study of the site of the proposed development and the surrounding area was undertaken with regard to soils and geology. Baseline information on soils and geology was gathered through the analysis of previously published literature and material relevant to the area surrounding the site of the proposed development. This included the Geology of the Shannon Estuary and the Geology of Tipperary booklets published by the Geological Survey of Ireland, the Soil Map of Ireland (Second Ed., 1980) published by the National Soil Survey of Ireland, An Foras Talúntais and a previous report on the geology of the site prepared by RPS McHugh Planning & Environment in 2003 in order to comply with Condition 11.7 of Waste Licence No. 61-2 as issued by the Environmental Protection Agency (EPA). RPS McHugh's report is included as Appendix IV to this report.

6.2 Geology

6.2.1 Topography

The topography in the area of the site comprises gentle rolling hills with occasional abrupt changes in slope, primarily due to differential weathering of the volcanic rock compared with the limestones, which weather more easily. The site itself is located on the southern slopes of a hill, which is approximately 170 metres OD at its highest point, with the upper parts of the site at a level of approximately 140mOD and the lower boundary of the site at a level of approximately 100 metres OD. To the southeast of the site there is a flat valley floor at an elevation of 90-100 metres OD approximately 500 metres wide, before the topography again rises to an elevation of 204 metres in the south.

6.2.2 Regional Geology

The site is located on the northwest edge of the area known geologically as "the Limerick Volcanics", a complex of shallow intrusive and extrusive rocks, consisting of basalts, lithic tuffs and syenites, which were erupted just after the deposition of the Waulsortian Limestone and contemperaneous to the deposition of the Herbertstown Formation. The principal formations of the volcanic complex are the Knockroe Formation (250 to 550 metres thick) comprising lavas, tuffs and agglomerates and the Knockseefin Formation (0 to 500 metres thickness) comprising lavas and tuffs, which decrease in thickness as one moves from the centre of the volcanic complex. The Herbertstown Limestone is inter-fingered with both volcanic formations lying stratigraphically between the two and are comprised of clean, pale-blue, thickly bedded, well sorted, medium to coarse, oolitic and skeletal grainstones.

The Waulsortian Limestone, which is older underlies the entire complex and is generally at least 300m thick, comprising poorly bedded, fine grained, fossiliferous limestone with frequent calcite filled cavities. The dominant lithology in the Waulsortian complex is described by the GSI as *'generally a very fine pale grey massive, unbedded biomicrite wackestone, with crinoid fragments and fenestrate bryozoa, frequently with large sparry cavities floored by multi-layered carbonate muds'*. These limestones formed banks, which are separated from each other by more argillaceous or cherty shelf limestones (GSI, 1999).

All these rocks were later deformed as a result of folding and faulting which resulted in the formation of gentle folds as well as fissures and cracks in the bedrock which are primarily responsible for the secondary permeability of the aquifers in the area which generally have very little primary porosity or pore spaces. In the case of the limestones, particularly the Waulsortian Limestone, some of the fractures have been enlarged due to solution (karstification).

6.2.3 Local Geology at the Site of the Proposed Development

The entire site of the proposed development is underlain by tuff breccias of the Knockroe Volcanic Formation, from the Carboniferous era. Approximately 100 metres from the northern boundary of the site basaltic lavas of the same formation are encountered. These are also found approximately 270 metres from the southern boundary of the site. A map of the geology of the area surrounding the site of the proposed development is shown in Figure 6.1, and further details of the geological units are described in additional detail below.

The published GSI geology map for the area indicates that the site is underlain by the Knockroe Volcanic Formation (KR) and more specifically (KRv) Knockroe Volcanic Foundation Victric-Lithic Tuff Member. However outcrops on the site investigated by RPS reveal that there are also areas of the site underlain by vesicular and amygdaloidal basalts, which were also encountered during drilling of the groundwater monitoring boreholes. The tuffs encountered on-site are generally friable; however the basalts can be quite resistant and difficult to excavate.

In terms of porosity, the tuffs are generally welded material with a large portion of fine ash, which would have a low porosity. The basalts while often vesicular (containing air bubble) are often amydaloidal (vesicles infilled by mineralization) and the connectivity between these vesicles quite limited. Basalts also typically weather to clay so any weathered basalts will also have a limited permeability.

The local Ballybricken Group Water Supply Scheme (GWSS) boreholes appear to be sited in the same Knockroe Formation (Victric Tuff Member) as the site, however no detailed log of the boreholes or the lithologies encountered is available.

6.2.3.1 Knockroe Volcanic Formation

The Knockroe Volcanic Formation consists of basaltic lavas on the northwest slopes of Knockroe Hill to the east of the site, as they are traced to the southwest the lavas are cut by coarse volcanic tuff breccias. Further up the hill the higher tuffs are resedimented and overlain by columnar mugearite, an alkali basalt, which used to fill a caldera floor but now forms the spectacular crags near the summit of the hill. The site is completely underlain by vitric-lithic tuffs of the Knockroe formation (KRv), which include vitric-lithic tuffs and agglomerates, basaltic and mixed volcanics, which are locally trachyte predominant. Approximately 270 metres from the southern site boundary, the Knockroe Basalt Lava Flow Member (KRb) constitutes the bedrock at this location.

6.2.4 Borehole Data Bedrock

Borehole data is also available from the boring of groundwater monitoring wells GW1 (E164605 N147209) and GW2 (E164754 N146985) on-site on the 20th October 2003 for the purposes of the hydrogeological assessment conducted by RPS McHugh. At GW1, amygdaloidal basalt was encountered at a depth of two metres underlying the boulder clay subsoil layer. At a depth of 12.0 metres a 1.5 metre deep layer of brown vitric tuff was encountered, which is underlain by basalt with occasional amygdaloidal basalts. This layer continued as far as the base of the bore at a depth of 50.0 metres. Bedrock, consisting of basalt with occasional amygdaloidal basalt, was encountered at a depth of 24.0 metres and this stratum continued until the end of the borehole at a depth of 37.0 metres. The borehole data revealed that in addition to the Knockroe vitric-lithic tuffs, there are also areas of the site underlain by vesicular and amygdaloidal basalts. The tuffs encountered on-site are generally friable; however the basalts can be quite resistant and difficult to excavate.

6.2.5 Quaternary Geology

6.2.5.1 Regional Quaternary Geology

The Quaternary is the final period of the geological time scale and began some 1.6 million years ago when there was significant cooling of the Earth's climate. More than 90% of the bedrock of the country is covered by the unlithified sediments of the Quaternary Period. The sediments and the associated landscape morphology seen today are largely the result of the last glaciation and of processes occurring during Postglacial times.

It is thought that the Shannon Estuary area of southern Ireland was glaciated on at least two occasions, but that the majority of the sediments we see today are the result of the last glaciation which was at its maximum some 24,000 years ago. There is sedimentological and morphological evidence of a standstill of the icesheet or an icefront running across Co. Limerick from southeast to northwest to meet the River Shannon just west of Tarbert. However there is no agreement as to whether this was a halt stage on the retreat of the ice sheet or in fact the maximum limit of the glaciation. This area was dominated by an ice dome, the Central Dome, centred in Co. Galway, north Co. Clare and Co. Tipperary. The general direction of ice flow was towards the south and southwest away from the southern margin of this ice dome. However local variations also occurred with the ice diverting around hills to expand southeastwards in the east Limerick lowlands.

Although the glaciation had a major impact on the landscape by the widespread deposition of glacial till, there are significant areas where the till cover is generally very thin or absent and bedrock is exposed a the surface, especially in West Limerick. . As the ice moved over the ground it eroded the underlying bedrock and formed, within and beneath the ice, a sediment made up of particles of all sizes from boulder down to clay size. This material, which is called a till (boulder clay), is the most widespread sediment type, varying widely in its characteristic according to its component bedrock material and how fine that material is. The stone content of the sediments generally reflects the rock type over which the ice has passed. The matrix of the tills also reflects the dominant stone content and the underlying bedrock type.

The subsoils in the area generally comprise limestone till of varying thickness and composition. Limestone tills tend to have a sandy and/or silty matrix.

6.2.5.2 Local Quaternary Geology

The deposits within the site of the proposed development are tills of a limestone origin. Subsoil cover on the site is variable but generally quite thin with a number of outcrops noted on the site, most notably to the rear of the current office complex, where excavations into volcanic tuffs and basalt have revealed very thin soil cover. The monitoring borehole (GW1) drilled on the upper slopes of the site as part of RPS McHugh's site investigations showed a thin subsoil cover of only 2 metres depth. However on the lower slopes of the site the subsoil thickness tends to increase with a thickness of 24 metres being encountered at monitoring borehole GW2. The subsoil encountered during drilling generally comprised limestone tills with a 4 metre thick clay deposit being encountered beneath the till at GW2. The origin of this clay may be glacial or a breakdown product of volcanic rocks, which commonly decay to form clays. The depth to bedrock at the Ballybricken GWSS is uncertain, but is thought to be quite deep.

Borehole data regarding subsoils is also available from the boring of groundwater monitoring wells GW1 and GW2 conducted by RPS McHugh. The borehole logs are presented as part of Appendix IV to the EIS. The borehole log for GW1 demonstrates a thin soil cover at this location with bedrock comprising amygdaloidal basalt encountered at a depth of two metres from the ground surface. The subsoil layer at GW1 is described in the borehole log as 'boulder clay'. In contrast to GW1, the depth of subsoil at GW2 is much greater with a depth of 20.0 metres to bedrock being recorded at this location. This subsoil layer is also described in the borehole log as 'boulder clay'. A four metre deep layer of damp brown clay separates the boulder clay horizon from the basalt bedrock beneath.

6.3 Soils

The soils in the area of the site of the proposed development are described below using the *Soil Associations of Ireland and their Land Use Potential* booklet published by An Foras Talúntais.

6.3.1 Soil Formation

The formation of soil types is in part determined by the underlying parent material, which affects the chemical composition of the soil. In the region of the site of the proposed development, soils are primarily derived from calcareous non-tenaceous glacial till of predominantly Carboniferous limestone composition. In places there is a small admixture of sandstone, shale or volcanic materials Glacial drift, the most common parent material of Irish soils, varies considerably in constitution and in geological composition, giving rise to many different soils. Climate and topography are also important factors contributing to soil formation. The interaction of all these processes, in combination with varying and uneven deposits of drift, have created a mixture of soil types in Co. Limerick, with great local variation.

6.3.2 Soil Associations

The soils underlying the site of the proposed development belong to Association 34 of the General Soil Map of Ireland. The soils within and surrounding the area of the proposed development are shown in Figure 6.2. Other soil associations found in the surrounding area include Association 39 approximately 0.56 kilometres to the north of the site and Association 43 approximately two kilometres southwest of the site.

A soil association is defined as a cartographic unit, consisting of two or more soils, usually formed from the same type of parent material and associated on the landscape in a particular pattern. Soil Association 34 is grouped with other associations in the broad physiographic division of Flat to Undulating Lowland. The principal soils of Association 34 are minimal grey brown podzolics (70%), gleys (20%) and brown earths (10%). The soils of this association occur widely throughout the limestone areas of the country but especially in Tipperary, Limerick, Kilkenny, Laios, Ofaly, Kildare and to a lesser extent in Cork and Kerry.

These soils are primarily derived from calcareous non-tenaceous glacial till of predominantly Carboniferous limestone composition but also occasionally include small admixtures of sandstone, shale or volcanic materials. Elevations for this soil association type are mainly below 60 metres but almost always below 150 metres O.D and topography of this association is usually flattish to gently undulating, with a slope around 4^{o}-6^{o}. This compares with the elevation at the site of 50 to 70 metres O.D.

A well-drained Grey Brown Podzolic of loam texture and high base status, is the predominant soil of this association. The profile is characterised by a dark brown loamy surface horizon from 25 to 40 centimetres thick. This overlies a weakly leached A2 horizon and a clay loam B horizon, which often has a minimal amount of clay accumulation. These soils tend to be deep, with a combined depth of the A and B horizons (solum) of at least 75cm.

The surface horizon has a clay content in the range 18 to 26% and a silt content of 30 to 45%. The structure is moderately well developed, roots are plentiful and penetrate freely to a considerable depth. The capacity of this soil type to retain moisture is regarded as good.

The main associated soil is a poorly drained Gley, which occupies about 20% of the area. It is described as being of clay loam to clay texture and of high base status. Also occurring in this association is a Brown Earth (10%), which is found sporadically throughout the association on kames and knolls.

Soil Assocations 39 and 43 found to the north and southwest of the site respectively, are also typical of flat and undulating lowland. The former, soil association 39, comprises gleys (90%) and grey brown podzolics (10%). The principal soil is a poorly drained gley of clay loam to clay texture and of high base status, found mainly in small pockets in Limerick, Roscommon, Galway, Tipperary, Laois, Kilkenny, Kildare and Cork. Soil Association 43 consists of gleys (60%), brown earths (20%) and peaty gleys (20%), which were formed from alluvial deposits and occur mainly in coastal areas or inland on river and lake alluvial materials. The predominant soil of this association is a poorly drained gley of silty clay loam texture and of medium to high base status, though surface textures may be lighter in places. Inland examples these soils tend to be variable in texture and stratified.

6.3.3 Soil Suitability

The soils of Association 34, which are present at the site of the proposed development have a wide range of uses. This is as a direct result of their depth, free drainage, medium texture and good moisture holding capacity. They are considered first class grassland soils, however they are also good tillage soils and are suitable for cereals and root crops.

The soils of Association 39 are limited in their range of uses due to their poor drainage properties. Susceptibility to poaching can be a problem and good management is required to sustain maximum production.

Soils of Association 43 can be used for the production of a wide range of tillage crops and for pasture production, where the water table can be controlled.

6.4 Likely and Significant Impacts on Soils and Geology and Associated Mitigation Measures

6.4.1 Impacts on Geology

Where the proposed development is referred to in the EIS, it is making reference to the increased throughput of material at the facility, increasing from the existing 105,000 tonnes per annum to the proposed 200,000 tonnes per annum by 2012. It is not envisaged that there will be any significant impacts on geology of the area as a result of the proposed development as no construction works are proposed.

6.4.2 Impacts on Soils

As the proposed development under consideration in the EIS involves an increase in tonnage being accepted and processed on-site, and does not include any associated construction activities, it is envisaged that the proposed development will have no significant impacts on soils in the area. However current operational phase risks including the risk of liquid contamination and soil compaction may increase as a result of the increase in tonnage accepted at the existing facility.

6.4.2.1 Liquid Contaminants

As the proposed development under consideration in the EIS involves an increase in tonnage being accepted and processed on-site, and does not include any associated construction activities, it is envisaged that the proposed development will have no significant impacts on soils in the area. However current operational phase risks including the potential risk of liquid contamination and potential soil compaction may increase as a result of the increase in tonnage accepted at the existing facility without current and proposed mitigation measures.

Mitigation

Liquid contaminants, resulting from processes on site, are drained to a wastewater treatment plant (WWTP) where they undergo full treatment. The sources of wastewater and foul water treated at the onsite WWTP comprise:

1. Foul water from canteen and toilets.
2. Wastewater from process buildings.
3. Wastewater from process yard areas in front of waste delivery areas of process buildings.
4. Vehicle/container wash bay and surrounding yard area.

At present, the effluent from this treatment process is tankered off-site and brought to Castletroy Wastewater Treatment Plant for further treatment. It is proposed that this method of disposal will continue until it has been proven that the on-site treatment plant is functioning to the standards acceptable to the EPA. An improvement programme has been in place at the onsite WWTP since July 2008. The improvement measures put in place at the WWTP include:

- Development and implementation of standard operating procedures (SOPs) for operation and maintenance of the WWTP and associated equipment on a daily basis and training of relevant personnel.

- Development and implementation of standard laboratory procedures for conducting regular in-house monitoring of key control parameters to provide information on the efficiency of the WWTP.
- Managing hydraulic throughput in the WWTP to ensure that the plant is not overloaded or underloaded hydraulically. The WWTP is limited to the design throughput of 18.9 m^3 per day.
- Managing Chemical Oxygen Demand/Biological Oxygen Demand (COD/BOD) throughput to ensure the WWTP is not overloaded or underloaded. Reduced loadings to the WWTP are achieved through ramp, dicersion of roof drains and Level 3 ramp run-off, replaced use of power-washing units with dedicated road-sweeper/washer and limiting the use and type of detergents.
- Purchase of a dedicated vacuum tanker for the transfer of wastewater off-site. The tanker also allows for more regular maintenance of the silt trap, grease trap and primary settlement tank.
- Installation of a polymer dosing system to reduce solids, BOD, etc. in the final effluent. The polymer dosing system was installed to flocculate suspended solids in the discharge to the clarifier in order to reduce the residual suspended solids and thereby further improve emission discharges. The polymer dosing system is currently undergoing an optimisation stage.

All surface run-off from the site is directed to a Klargester NS2000 Class1 Oil Interceptor, designed in accordance with EN 858 (Part1), which ensures that no hydrocarbon contamination from on-site discharges to the underlying aquifer. The sources of all waters that are treated via the interceptor prior to discharge to the emission point, referred to as FE2, comprise:

1. Vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas.
2. Yard areas in front of maintenance buildings.
3. Fuel filling area.

The Klargester NS2000 is a full retention separator with a built-in silt trap, which works on the basis of the hydrocarbons being less dense than water. The separated water, from which hydrocarbons and silt residue has been removed, is then discharged to a soakaway. Details of this interceptor, including the producer's data sheet, a detailed drawing and installation and operating guidelines are provided in Appendix V of the EIS. The oil interceptor is subject to a rigorous maintenance schedule, as described in Section 7 – Hydrology & Hydrogeology of the EIS. All clean roof water is diverted to a separate soakaway in order not to overload the oil interceptor hydraulically.

Furthermore, all joints on areas of hardstanding have been sealed within the site to ensure that no contaminants leak to underlying soils.

Extreme care is and will be exercised to ensure that soil contamination does not occur by the spillage of polluting substances e.g. fuel. This will continue to be achieved through the use of a designated bunded area, which is sealed off, for the handling and storage of fuel and the re-fuelling of vehicles. Water discharged from the bund of the fuel store is not discharged to the hydrocarbon interceptor but is removed off-site for further treatment, as necessary. The loading/unloading area, beside the bund, drains to the hydrocarbon interceptor in the event of any minor spills when filling a truck with fuel.

In addition, the Emergency Response Procedure (ERP) provides details on precautionary measures and emergency procedures in the event of spills and leaks both on-site and off-site. The full ERP document is provided as Appendix II to the EIS and a more detailed description of its contents is provided in Section 7 – Hydrology & Hydrogeology.

The following control measures are in place or are proposed at the waste transfer station in order to give effect to Articles 3, 4, 5, 6 and 7 of Council Directive 80/68/EEC on the protection of groundwater against the risk of pollution by certain dangerous substances and Article 6 of Directive 2006/118/EC on the protection of groundwater against pollution and deterioration:

- Only non-hazardous waste is accepted on site. All sources of waste are assessed in advance to prevent hazardous materials being accepted on-site. In addition a waste acceptance procedure is in place to assess all waste loads and ensure no hazardous waste materials are processed on-site. Any potentially hazardous waste materials identified are rejected or isolated in a contained quarantine area for further treatment off-site.
- There are no direct discharges to groundwater from the facility.
- There is no disposal of waste on-site.
- All areas where waste is handled are covered by a hardstanding with sealed joints.
- Wastewater is discharged via dedicated drainage system to a wastewater treatment plant and is further treated off-site.
- Stormwater from hardstanding areas is discharged via a dedicated drainage system to a two stage solids separation system followed by a Klargester Class 1 Hydrocarbon Interceptor prior to discharge to a certified soakaway.
- Uncontaminated water from roofs is diverted from the dedicated abatement systems to ensure the abatements systems are optimised.
- Regular cleaning of all surface areas with a dedicated roadsweeper is in place.
- Regular cleaning and housekeeping of all areas is in place.
- All fuel storage is bunded to 110% or to 25% of the total volume, whichever is greater.
- Fuel loading areas are enclosed by dedicated drainage to the hydrocarbon interceptor.
- Fuel nozzles are kept within a bunded area when not in use.
- Bunds and wastewater drainage systems are integrity tested every three years.
- Residual waste acceptance and processing areas are enclosed to minimise rainwater ingress and leachate generation.
- A standard operating procedure for the operation and maintenance of the wastewater treatment plant on a daily basis is in place.
- A standard operating procedure for the operation and maintenance of the solids settlement systems and hydrocarbon interceptor is in place.
- An on-site laboratory is in place to allow regular monitoring of the operation of the waste water treatment plant and oil interceptor.
- The waste water treatment plant and associated percolation area is limited to its design capacity of treating a hydraulic load of 18.9 m^3 per day.
- Standard laboratory procedures are in place for the laboratory test procedures including calibration protocols.
- In addition to the existing environmental team on-site, an environmental analyst was employed with responsibility for the wastewater treatment plant, hydrocarbon interceptor, laboratory, environmental monitoring and checks,

SOP development and Emergency Response Plan (EMP) management on-site.

- Currently there are no discharges of wastewater effluent from emission point FE1.
- As referenced in Sections 7.2.3.2 and 7.2.3.3, improvements in the wastewater treatment plant monitoring, operation and maintenance have resulted in a significant improvement in the quality of the effluent and further improvements are in progress.
- Subject to the success of the above improvements, polish filtration systems, constructed wetlands or diversion of the emissions from FE1 are being considered.
- The percolation/soakway associated with FE1 will be reconstructed and certified in line with relevant standards in the event that emissions via FE1 occur.

Regular groundwater monitoring upstream and downstream of the facility is in place which demonstrates the facility is not having an impact of environmental significance on the quality of the groundwater.

6.4.2.2 Soil Compaction

Due to the increase in vehicular activity due to the increased tonnage to be accepted at the facility, there is an increased risk of soil compaction occurring at the site. However as all operations are conducted on areas of hardstanding, it is extremely unlikely that any increase in load will cause any significant impact on underlying soils.

Mitigation

All operations are conducted on areas of hardstanding to avoid compaction of soils on-site.

7. HYDROLOGY & HYDROGEOLOGY

7.1 Hydrology - Introduction

The hydrology of the site of the proposed development was surveyed by means of a desk study of pertinent literature, including Ordnance Survey and hydrometric maps of the area and previous reports commissioned by Mr. Binman Ltd., specifically a report by RPS McHugh Planning & Environment prepared in 2003 in order to comply with Condition 11.7 of Waste Licence No. 61-2 as issued by the Environmental Protection Agency (EPA), in addition to a field visit to the site. RPS McHugh's 2003 report is included as Appendix VI to the EIS. Results for the physical, biotic and chemical properties of water samples were obtained from the Environmental Protection Agency's (EPA) programme of surface water quality monitoring and water quality monitoring carried out at the onsite wastewater treatment plant by Mr. Binman Ltd. There are no watercourses present on the site; therefore no surface water quality testing was required. Two groundwater monitoring wells are present on the site at Luddenmore and long-term monitoring results from these wells were reviewed as part of the EIS.

7.2 Hydrology in the Existing Environment

The site of the proposed development is situated within *Hydrometric Area 24 – Shannon Estuary South* as designated by the EPA but close to the boundary with *Hydrometric Area 25 – Shannon Lower*. Hydrometric Area 24 is defined as the surface catchment drained by the Rivers Deel and Maigue and all steams entering tidal water in the Shannon Estuary between Kilconly Point and Thomond Bridge, Limerick and measures 2,017 square kilometres in area. Hydrometric Area 25 is defined as the surface catchment drained by the River Shannon and all tributary streams entering it between Thomond Bridge and its confluence with the River Suck between Shannonbridge, Co. Offaly and Clonfert, Co. Galway. The boundaries of these and surrounding hydrometric areas are presented in Figure 7.1.

This hydrological investigation focuses on waters within the Shannon Estuary South hydrometric area and in particular on the vicinity of the site of the proposed development.

7.2.1 Surface Water Features

There are no water features present within the site of the Mr. Binman facility at Ludddenmore, Co. Limerick. The closest watercourse is located approximately 0.13 kilometres from the southwestern site boundary and eventually drains to the Camoge River some four kilometres downstream of this point. The Camoge River is a tributary of the Maigue joining it upstream of Croom (E152,000 N139,540) some 28 kilometres from its source near the village of Knocklong, Co. Limerick (E173,300 N132,100). At its closest point, the Camoge River is approximately 3.4 kilometres from the site of the proposed development.

Other notable watecourses in the vicinity of the Mr. Binman facility include the Ahanload, Ahnavar and Groody Rivers. The closest of these to the site of the proposed development is the Ahnavar River, which is approximately 2.6 kilometres from the site at its closest point. The Ahanload River is a tributary of the Ballynaclough River, which enters Ballinacurra Creek, to the west of Limerick City (E157,060 N154,530). Its source is approximately two kilometres to the northeast of the village of Fedamore (E160,440 N146,020), from whence it flows northwards towards its confluence with

Ballinacurra Creek. The Ahnavar River is a tribuatary of the Groody River, which rises on a low hill in the townland of Doonvullen Upper (E167,880 N144,020) and flows approximately 3.9 kilometres northwards to join the Groody River in the townland of Newtown (E167,910 N146,910). The Groody River rises in the townland of Ballyhobin (E169520 N144500) and flow approximately 22 kilometres along a generally north/northwesterly course before discharging to the River Shannon in the townland of Reboge, approximately one kilometre downstream of Plassey Bridge in Limerick City.

The surface water features of the area surrounding the site of the proposed development are illustrated in Figure 7.2.

7.2.2 Water Quality

Water samples are taken from monitoring points on the Camoge and Groody Rivers, as part of the EPA's nationwide Surface Water Quality Monitoring Programme. The closest monitoring point to the site of the proposed development is Station No. 0200 (E164,528 N143496) on the Camoge River, which is approximately 3.6 kilometres south of the site. There are no other EPA surface water monitoring locations within a five kilometre radius of the site at Luddenmore site. However there is a monitoring point on the Groody River, which is approximately 5.2 kilometres from the site and this has been included for consideration in this section of the EIS.

Details of the closest monitoring points to the site are contained in Table 7.1 and the monitoring locations are illustrated on Figure 7.3.

Table 7.1 EPA Surface Water Quality Monitoring Programme - Sample Locations

Sample Location Number	Description of Location	River	Grid Reference	Distance from site of proposed development (km)
0200	Longford Bridge	Camoge	E164,528 N143,496	3.6
0100	Bridge 2 km north of Caherconlish	Groody	E167,740 N151,670	5.2

7.2.2.1 Physical Properties

The results for the physical properties of water samples presented below were obtained from the EPA's programme of surface water quality monitoring. Data is presented from three separate periods of analysis, 1995 to 1997 and 1998 to 2000 and 2001-2003 where three different physical parameters were analysed each year. Each year's results are presented below showing the minimum (min) value, the maximum (max) value and the median (med) or midpoint of all samples taken. Physio-chemical data is available for both of the monitoring stations listed in Table 7.1 in Table 7.2.

Table 7.2 Physical properties of EPA water samples: Conductivity (µS cm^{-1}) @ 25°C

Location	Sample Period 1995-1997				Sample Period 1998-2000				Sample Period 2001-2003			
	No.	Min	Med	Max	No.	Min	Med	Max	No.	Min	Med	Max
Camoge	-	-	-	-	-	-	-	-	11	510	561	607
Groody	-	-	-	-	-	-	-	-	12	345	569	622

- Data unavailable

Table 7.3 Physical properties of EPA water samples: pH

Location	Sample Period 1995-1997				Sample Period 1998-2000				Sample Period 2001-2003			
	No.	Min	Med	Max	No.	Min	Med	Max	No.	Min	Med	Max
Camoge	20	6.9	7.8	8.4	27	7.4	8.0	8.3	30	7.9	8.3	8.7
Groody	2	7.5	7.7	7.9	20	7.5	8.2	8.6	30	7.6	8.2	8.6

- Data unavailable

Conductivity

The ability of water to conduct electricity is established by measuring its conductivity. Conductivity varies with the temperature of the water and also with the dissolved solids concentration due to the fact that this contributes to the ionic content of the sample. Conductivity is a good indicator of the range of likely values for hardness and alkalinity. The Maximum Admissible Concentration (MAC) value for conductivity, as outlined in the EU Drinking Water Directive (98/83), is 2500 μS/cm @ 25°C and 1000 μS/cm under the Surface Water Regulations. Results for water samples from sample locations closest to the site of the proposed development and analysed for conductivity are outlined in Table 7.2. The MAC values for conductivity under both relevant sets of regulations were not exceeded in any of the samples taken for analysis.

pH

The pH of freshwater systems influences the flora and fauna that can survive and reproduce, as well as the suitability of the water for human consumption. The range of pH suitable for fisheries is considered to be 5.0 to 9.0, though 6.5 to 8.5 is preferable. Freshwater is usually found to have a pH range of 6.5 to 8.0, though the range of natural pH in freshwater can extend from 4.5 for acid, peaty upland waters to over 10.0, where intense algal photosynthetic activity is occurring. The MAC range of values for pH set out in the EU Drinking Water Directive is 6.5-9.5, while the Surface Water Regulations specify a range of 5.5 to 8.5 for A1 waters and 5.5 to 9.0 for A2 and A3 waters. The MAC range for waters under the Freshwater Fish Directive, for both salmonid and cyprinid waters and the Salmonid Waters Regulations 6.0 to9.0. The pH values recorded in the water samples, as outlined in Table 7.3 below, stayed within the limits specified for all relevant regulations though maximum values at Station 0200 (Camoge) for the 1998-2000 period of analysis and at both Station 0200 (camoge) and Station 0100 (Groody) for the 2001-2003 period of analysis did not meet the requirements under the Surface Water Regulations for A1 waters. However these maximums did meet the standards for A2 and A3 waters. Median values were within the limits set out by the legislation. The relatively high alkalinity of the samples is indicative of the calcareous nature of water in the region, influenced by underlying geology but may also be related to eutrophication by algae.

7.2.2.2 Biotic Properties

The Q Value Index System is used by the EPA as an indication of the water quality of rivers. It involves looking at the diversity of macroinvertebrate communities present in the water body to investigate the effects of organic pollution on these communities and therefore the quality of the water. This method makes use of the fact that certain invertebrate groups and species are found in clean, unpolluted water whereas others can survive in more polluted water. The water can then be given a Q value of 1-5, 1 being seriously polluted and 5 being unpolluted water of high water quality.

Table 7.4 Biotic properties of the water samples

Location	1971	1975	1979	1981	1983	1984	1985	1987	1988	1993	1996	1999	2002	2003
Camoge	-	-	-	3-4	-	3-4	-	-	3-4	3-4	4	4	-	3-4
Groody	4	4	4	-	4	-	3-4	3	-	3	3-4	3	3-4	-

- Data unavailable

The most recent water samples taken at the sample locations given in Table 7.4 above showed Q values of 3-4, representing slightly polluted water of transitional water quality and unsatisfactory condition, where condition refers to the likelihood of interference with beneficial or potential beneficial uses. Since the inception of surface water monitoring at these stations, water quality has remained relatively consistent. A slight improvement was registered at Station 0200 (Camoge) for samples taken in 1996 and 1999, though the most recent sample obtained showed a Q value of 3-4. Samples taken at Station 0100 (Groody) prior to 1985 all showed Q values of Q4 until 1985, after which all samples obtained recorded a value of Q3-4, marking a transition from what is termed satisfactory water quality (Q5 and Q4) to Unsatisfactory water quality (Q 3-4 or below). A Q value of Q4 indicates unpolluted water of fair water quality in satisfactory condition. This system is useful for getting an overall idea of water quality but does not pinpoint the causal factors of pollution.

The EPA's *Interim Report on the Biological Survey of River Quality – Results of the 2002 Investigations* included Hydrometric Area 25 – Lower Shannon, in which the River Groody is located. Station 0100 is described as 'little more than a drain' that is 'not ideal for biological assessment'. However there were some signs of ecological impairment such as heavy siltation and growths of *Lemna minor* (Duckweed) at this location. Further downstream the river is characterised as moderately polluted with strong sewage odours at Killonan Bridge (Station 0150) and excessive siltation and filamentous algal growths at Ballysimon (Station 0200).

The EPA's *Interim Report on the Biological Survey of River Quality – Results of the 2003 Investigations* included Hydrometric Area 24 –Shannon Estuary South, in which the Camoge River is located. This report characterises the entire Camoge River as eutrophic with deterioration in biological water quality at three monitoring stations (0100, 0200 and 0250) since the previous survey. However, despite the river's nutrient-enriched status, the Camoge supports good populations of White-clawed Crayfish (*Austropotomobius pallipes*).

7.2.2.3 Chemical Properties

Table 9.5 below gives the results for the chemical properties of water samples based on the EPA's programme of surface water quality monitoring in the vicinity of the proposed development for the three sampling periods 1995-1997, 1998-2000 and 2001-2003. Chemical analysis of the water samples took place at the same time as the physical analysis described above. Each sample was analysed for a range of chemical parameters. Results (Table 9.5) are presented in the same format as the physical analysis above, with minimum, maximum and median results shown for each sample location.

Table 7.5 Chemical properties of the water samples

	Sample Period 1995-1997				Sample Period 1998-2000				Sample Period 2001-2003			
BOD (mg O_2 l^{-1})												
Location	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max
0200 (Camoge)	22	0.5	1.4	6.2	27	<2.0	<2.0	5.2	30	<2.0	<2.0	4.2
0100 (Groody)	3	1.9	3.0	5.3	19	<20	<2.0	7.4	29	<2.0	<2.0	5.0
Ortho Phosphate (mg P l^{-1})												
Location	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max
0200 (Camoge)	20	0.01	0.08	0.33	23	0.03	0.09	0.25	31	0.01	0.07	0.14
0100 (Groody)	4	0.05	0.14	0.22	15	0.01	0.11	0.37	29	0.07	0.15	0.40
Oxidised Nitrogen (mg N l^{-1})												
Location	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max
0200 (Camoge)	19	0.2	1.4	3.1	-	-	-	-	30	1.5	6.0	10.0
0100 (Groody)	4	0.1	0.7	2.1	-	-	-	-	28	0.4	6.4	9.7
Total Ammonia (mg N l^{-1})												
Location	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max	No. of Samples	Min	Med	Max
0200 (Camoge)	18	0.01	0.05	0.67	25	0.02	0.04	0.33	31	<0.02	0.04	0.22
0100 (Groody)	4	0.04	0.07	0.15	14	0.02	0.08	0.56	30	<0.02	0.07	0.18

- Data unavailable

Ammonia

Microbial activity and the reduction of nitrogen containing compounds are responsible for the small amounts of ammonia found naturally in waters. High levels of ammonia (greater than 0.1 mg/l N) are indicative of sewage or organic waste contamination and therefore of the possible presence of pathogens. Ammonia tolerances for fish are very low and research has shown that the un-ionised species of ammonia that is the most harmful to freshwater aquatic life and to game fish, in particular.

Results for water samples from sample locations closest to the site of the proposed development and analysed for ammonia are outlined in Table 7.5. While no mandatory limits under the Freshwater Fish Directive were exceeded, maximum values at both monitoring stations were above 0.1 mg/l N for all three sampling periods presented. Median values for all three periods of analysis at both stations were below this critical level. Under the Surface Water regulations, all minimum and median values for both monitoring stations during all three periods of analysis available indicated A1 waters. However, all maximum values, apart from that from Station 0100 for the 1995-1997 sampling period, which indicated A1 status, were indicative of A2 waters. The maximum value for Station 0200 for the 1995-1997 and for Station 0100 for the 1998-2000 sampling period exceeded the levels stipulated under the Drinking Water Directive. However median values for all sampling periods were within mandatory limits.

Biological Oxygen Demand

Biological Oxygen Demand (BOD) is a measure of the amount of oxygen used up in the microbial breakdown of organic matter i.e. pollution present in a water sample. It is a five- day test and involves incubating the water sample in the dark at 20°C and measuring the drop in the level of dissolved oxygen in the sample. This oxygen has been used by bacteria in the water sample to degrade any oxidisible matter. According to the EPA, current scientific opinion regards an upper limit for BOD of 4mg/l O_2 as a criterion of satisfactory quality for freshwater, and BODs below this are deemed suitable for salmonid fishes and thus for other beneficial uses.

As can be seen in Table 7.5 above, median values for BOD from all three periods of analysis at both monitoring stations are all within this limit and can therefore be considered unpolluted. All maximum values exceeded the 4mg/l threshold. However the maximum values for both monitoring stations remained within the 5 mg/l MAC under the relevant legislation during the most recently reported period of analysis, 2001-2003. All median values were well within all legal limits and also below the 4mg/l threshold for satisfactory freshwater quality.

Nitrate & Nitrite (Total Oxidised Nitrogen)

Nitrate found in water samples is most likely organic or inorganic in origin, rather than mineral in origin. Organic waste disposal and the use of inorganic nitrogen containing fertilisers are the most likely sources. The fixing of nitrogen to nitrate by plants and soil bacteria is also a contributing factor. Levels of nitrate above 11mg/l in water can be harmful to infants and causes 'Blue Baby Syndrome' or methaemoglobinaemia (caused by the conversion of nitrate to nitrite). The mandatory limit value for nitrate in freshwater is 50 mg/l.

High concentrations of nitrite in freshwater are rare, mostly due to the fact that nitrogen is more commonly found in the more reduced form as ammonia or the more oxidised form as nitrate. Nitrite is the intermediate of the two. Waters have high nitrite levels usually as a result of contact with sewage or inorganic wastes which are rich sources of ammonia nitrogen. The guide or recommended value for nitrite in freshwater is 0.1 mg/l under the Freshwater Fish Directive. However the mandatory limit value is 0.05 mg/l under the Salmonid Water regulations. The EPA tests for nitrate and nitrite together as Total Oxidised Nitrogen and therefore it is not possible to quantify the levels of either nitrite or nitrate in the samples tested. However, nitrite concentrations in rivers are rarely more than 1-2% of the nitrate level, according to the EPA (EPA, 2001).

Table 7.5 shows that the values recorded in the samples taken in the region of the site. Bearing in mind that the Total Oxidised Nitrogen includes both nitrate and nitrite in the sample, it is considered that based on the assumption that nitrite comprises 1-2% of the nitrate level, that all median values fall within maximum legal limits under the relevant regulations and that the maximum levels at least satisfy mandatory limits under the Nitrates Directive.

Ortho-Phosphate

Phosphates occur naturally in nature, most notably in plants, microorganisms and animal wastes. Their use in inorganic fertilisers has been highlighted more recently due to the increased problems with eutrophication of lakes. Phosphorus is the limiting nutrient in freshwater systems. The introduction of phosphate (usually recorded in the orthophosphate form – PO_4^{3-}) to freshwater promotes algal growth with the resulting effect of reduced dissolved oxygen concentration and algal blooms.

Results for water samples from sample locations closest to the site of the proposed development and analysed for orthophosphate are outlined in Table 7.5. High levels of phosphate are indicated by high median and maximum values for the 1995-1997 and 1998-2000 periods of analysis at both monitoring stations, indicating serious pollution according to the Interim Statutory Standards for Rivers. A gradual decrease in median and maximum phosphate values has taken place at Station 0200 (Camoge) over the between the last two periods of analysis. However, the opposite is the case at Station 0100 (Groody) indicating a gradual disimprovement.

Table 7.6 Mandatory levels for physio-chemical parameters for specified water regulations

Parameter	Unit	Surface Water Regulations ((Mandatory Level) S.I. 294 of 1989	Drinking Water Regulations ((Mandatory Level) S.I. 439 of 2000	Bathing Water Regulations ((Mandatory Level) S.I. 155 of 1992	Salmonid Water Regulations ((Mandatory Level) S.I. 293 of 1989
BOD	mg/l	5	N/A	N/A	≤ 5
PH	-	5.5-8.5	≥ 6.5 & ≤ 9.5	≥ 6 & ≤ 9	≥ 6 & ≤ 9
Conductivity	µS/cm	1,000	2,500	N/A	N/A
Phosphate	mg/l P	N/A	N/A	N/A	N/A
Total Ammonia	mg/l NH_4	N/A	N/A	N/A	≤ 1.0
Nitrate	mg/l NO_3	50	50	N/A	N/A
Nitrite	mg/l NO_2	N/A	0.5	N/A	≤ 0.05

No bacteriological testing was carried out by the EPA for the monitoring stations set out above. The physico-chemical results for both samples show that median values at both stations for most parameters, including BOD, Total Oxidised Nitrogen and Ammonia, are within the mandatory levels under domestic and European water quality legislation. However maximum values tended to exceed legal limits, apart from BOD, where during the most recent sampling period, the maximum values at both stations were within the maximum admissible level of this parameter. Levels of

Orthophosphate were considered to be high with levels from both stations over all three sampling periods indicating serious pollution.

7.2.3 Onsite Wastewater Treatment Plant

7.2.3.1 Generation of Foul Water

Foul water collected at site of the waste transfer station is drained to the onsite wastewater treatment plant (WWTP). The water is firstly screened to remove papers, plastics and any other gross solids before it enters the WWTP. The treatment processes include a grease trap, aerated influent storage, level control pumping chamber, primary settlement (2), two aerated moving bed biofil reactors, clarifer, pumping chamber, trial polishing filter and an effluent storage tank. At present, there are no discharges to ground from the treatment plant. The treated wastewater is collected from the WWTP and brought to Castletroy Wastewater Treatment Plant for further treatment. The sources of wastewater and foul water treated at the onsite WWTP comprise:

1. Foul water from canteen and toilets.
2. Wastewater from process buildings.
3. Wastewater from process yard areas in front of waste delivery areas of process buildings.
4. Vehicle/container wash bay and surrounding yard area.

The total volume of wastewater, including that from building washdowns, generated and sent off-site for treatment in 2009 was 5,468 m^3, and it is anticipated by Mr. Binman Ltd. that similar volumes will continue to be generated. The diversion of uncontaminated rainwater from roofed surfaces has minimised the hydraulic loading to the WWTP and reduced fluctuations in flow due to adverse weather conditions.

The wastewater generated due to building washdowns is collected in the wastewater storage tanks at the WWTP where up to 18.9 m^3 per day of wastewater is treated in the WWTP. If any excess wastewater is generated it will be collected in the wastewater storage tanks and sent off-site for further treatment. A dedicated tanker was purchased for this purpose to ensure wastewater can be sent off-site for further treatment. Based on the design capacity of the WWTP, it will be capable of treating up to approximately 7,000 m^3 per annum.

7.2.3.2 WWTP Improvement Programme

Since July 2008, several improvements have been made to the operation of the onsite WWTP at the Mr. Binman Ltd. waste transfer station. A full-time Environmental Analyst was employed to set up an environmental laboratory and to monitor and operate the WWTP. An intensive in-house assessment of the WWTP was undertaken, including measurement of key parameters at every stage of the WWTP. This assessment included analysis of the influent in terms of volume and composition and the impact of each stage of the wastewater treatment system on key parameters. This assessment provided valuable information on control issues associated with the WWTP, which was used to develop and implement an improvement programme for control of the wastewater treatment plant. This improvement programme included:

- Development and implementation of standard operating procedures (SOPs) for operation and maintenance of the WWTP and associated equipment on a daily basis and training of relevant personnel.

- Development and implementation of standard laboratory procedures for conducting regular in-house monitoring of key control parameters to provide information on the efficiency of the WWTP.
- Managing hydraulic throughput in the WWTP to ensure that the plant is not overloaded or underloaded hydraulically. The WWTP is limited to the design throughput of 18.9 m^3 per day.
- Managing Chemical Oxygen Demand/Biological Oxygen Demand (COD/BOD) throughput to ensure the WWTP is not overloaded or underloaded. Reduced loadings to the WWTP are achieved through ramp, dicersion of roof drains and Level 3 ramp run-off, replaced use of power-washing units with dedicated road-sweeper/washer and limiting the use and type of detergents.
- Purchase of a dedicated vacuum tanker for the transfer of wastewater off-site. The tanker also allows for more regular maintenance of the silt trap, grease trap and primary settlement tank.
- Installation of a polymer dosing system to reduce solids, BOD, etc. in the final effluent. The polymer dosing system was installed to flocculate suspended solids in the discharge to the clarifier in order to reduce the residual suspended solids and thereby further improve emission discharges. The polymer dosing system is currently undergoing an optimisation stage, as detailed in Section 7.2.3.3 below.

Under the current waste licence for the facility, sampling of the discharges from emission point from the WWTP (referred to in the waste licence as monitoring location FE1) is required. However, as the treated effluent from the WWTP is sent offsite for further treatment rather than being discharged to this point, data for monitoring location FE1 is limited. The effluent sent offsite is sampled for the measurable parameters with emission limit values in order to assess the continuous improvement in the operation of the plant, i.e. to the parameters BOD, suspended solids and pH. Limited ammonia testing has also been conducted since July 2008, as there are no discharges via emission Point FE1. As a result of the improvement programme detailed above, the quality of the WWTP effluent has improved significantly during the past 18 months. This improvement is illustrated in the BOD, suspended solids and ph data and trends presented in Table 7.8, which clearly show that the plant has improved significantly during that period.

Table 7.8 Water Quality Results for WWTP Effluent: March 2008 to November 2009

Date	BOD Level (mg/l)	BOD Limit Value (mg/l)	Total Suspended Solids (mg/l)	Total Suspended Solids Limit Value (mg/l)	pH	PH Lower Limit	PH Upper Limit
31/03/2008	1593	20	742	30	-	-	-
17/04/2008	1884	20	266	30	-	-	-
25/04/2008	716	20	94	30	-	-	-
01/05/2008	2209	20	830	30	-	-	-
03/09/2008	116	20	-	-	-	-	-
18/09/2008	70	20	-	-	-	-	-
24/09/2008	18	20	-	-	6.7	6	9
01/10/2008	27	20	-	-	-	-	-
08/10/2008	64	20	-	-	-	-	-
15/10/2008	96	20	-	-	-	-	-
22/10/2008	75	20	-	-	-	-	-
05/11/2008	140	20	46	30	-	-	-
26/11/2008	29	20	52	30	-	-	-
03/12/2008	11	20	15	30	-	-	-

10/12/2008	18	20	21	30	-	-	-
17/12/2008	6	20	90	30	-	-	-
08/01/2009	15	20	49	30	-	-	-
28/01/2009	27	20	38	30	-	-	-
04/02/2009	12	20	3.3	30	-	-	-
25/02/2009	20	20	20	30	7.71	6	9
18/03/2009	52	20	48.4	30	6.98	6	9
16/04/2009	28	20	158	30	7.58	6	9
01/05/2009	29	20	27	30	6.16	6	9
15/07/2009	26	20	98	30	6.98	6	9
24/09/2009	8	20	11	30	6.85	6	9
28/10/2009	24	20	80	30	7.1	6	9
03/10/2009	4	20	34	30	7.2	6	9
12/11/2009	18	20	56	30	7.68	6	9
19/11/2009	9	20	3	30	7.02	6	9
27/11/2009	30	20	29	30	7.88	6	9

7.2.3.3 Further WWTP Optimisation Measures

In addition to the existing WWTP improvement measures that are detailed in Section 7.2.3.2 above, Mr. Binman Ltd. is currently investigating further optimisation measures in order to ensure that consistent compliance with emission limit values for WWTP effluent can be achieved. These measures, which will be implemented if successful, include:

- Optimisation of the polymer dosing system. This system is currently undergoing an optimisation stage as there are a number of variables associated with such a system, such as:
  - Location of the dosing point to maximise mixing of the polymer with the effluent.
  - Dosing frequency relative to flow/suspended solids concentration.
  - Dosing quantity relative to flow/suspended solids concentration.

- All WWTP effluent is currently discharged to a storage tank for the purpose of pumping it to the road tanker for further offsite treatment. In the event that having met EPA compliance limit values the effluent is discharged to emission point FE1, it was proposed to discharge the effluent direct from the clarifer of the WWTP via FE1 to the percolation area, as per the original set-up. A potential improvement currently being assessed is to continue discharging to the storage tank to allow further settlement before discharging to FE1. It is expected that this will further improve the quality of the final effluent discharge. Trials are underway to measure the quality of effluent direct from the clarifer compared to that from the storage tank prior to pumping to the tanker for off-site disposal.

As shown in Section 7.2.3.2 above, emissions from the WWTP have improved significantly since July 2008 and it is anticipated by Mr. Binman Ltd. that compliance can be achieved on a consistent basis, subject to the success of the additional improvements set out above. Subject to the success of these improvements, it will be decided whether the existing plant is capable or not of achieving compliance on a consistent basis. If compliance cannot be achieved consistently, additional works will be required in order to rectify this. Such works being considered include the use of polish filtration systems and a constructed wetland system.

Polish filtration systems are being considered as an alternative mechanism to achieve compliance on a consistent basis if the process optimisation proves inadequate. Proposals are currently being prepared by consultants engaged by Mr. Binman in order to identify appropriate technologies for the effluent emissions from the WWTP. The efficiency, scale and cost of the proposals will determine the viability of such a system.

The licence review application submitted by Mr. Binman Ltd. to the EPA in July 2008 provided details regarding a feasibility study that was carried out onsite in order to assess the option of using a constructed wetland for further treatment of effluent from the WWTP prior to discharge to ground. If compliance cannot be achieved through implementation of the improvements listed above, then further consideration will be given to implementation of a constructed wetland system. The feasibility study carried out onsite concluded that it would be feasible to develop a constructed wetland onsite in order to polish surface water run-off, as the natural subsoils will provide adequate protection to the underlying aquifer. A minimum thickness of 1.5 metres of suitable low permeability materials for the constructed wetland was recommended. Trial holes at the proposed wetland location indicated depths of three metres, indication that the mimimum soils depths can be achieved. Additional materials could be added if required.

7.2.4 Hydrocarbon Interceptor

All other surface water from the transfer station yard is diverted to a hydrocarbon interceptor/settlement tank, located near the eastern boundary of the site. This hydrocarbon interceptor is a Kargester NS 200 Class 1 full retention separator and built-in silt trap. The sources of all waters that are treated via the interceptor prior to discharge to the emission point, referred to as FE2, comprise:

1. Vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas.
2. Yard areas in front of maintenance buildings.
3. Fuel filling area.

The estimated quanity of water to be discharged is less than 20,000 m^3 per annum.

7.2.5 Water Usage

All potable water used on-site is sourced from the Ballybricken Group Water Supply Scheme. All other water used on-site is sourced from a well located upstream (north) of the facility.

Estimated water consumption at the Luddenmore facility for the year 2008 is estimated at 1767m^3, of which 1131.9 m^3 is accounted for by the truck wash and 635.25 m^3 other site usage. This represents a slight increase from estimated figures for 2007 included in the facility's Annual Environmental Report (AER), 2007, which were 1078 m^3 for the wheelwash and 605 m^3 for other on-site usage. Water consumption is likely to increase with the increase in tonnage of waste accepted and processed at the facility due to the greater number of vehicle movements to and from the site and the increased requirement for water for other on-site processes.

The tonnage of wastewater effluent leaving the site in 2008 is estimated to be approximately 6200 tonnes or m^3. During 2009, the volume of wastewater effluent removed offsite was 5,468 tonnes or m^3.

7.3 Flood Analysis

The Office of Public Works (OPW) monitor flood events on a national basis. The National Flood Hazard Mapping Project devised by the OPW identifies any areas that may be at risk from flooding. This information is presented on the Irish National Flood Hazard Mapping Website (www.floodmaps.ie).

According to this website, there are no records of flood events for the area surrounding the site of the proposed development. Nor is this area shown as liable to flooding. The closest flood events reported on this website are at Caherconlish on the Groody River, which is approximately 3.8 kilometres from the site at Luddenmore. Flood events in the wider area are concentrated along rivers such as the Groody and Camoge Rivers. The site at Luddenmore is not considered to be at risk of flooding for the following reasons:

The site of the proposed development is at an elevation of between 100m OD and 140m OD and thus is at higher elevation than the Groody River.
The site is seperated from the Groody River valley by a low range of hills with maximum elevations of approximately 200m OD

There is an absence of significant watercourses within a four kilometre radius of the site. The Camoge River is the closest significant river and is over four kilometres from the southern site boundary. A local tributary is located approximately 0.13 kilometres from the southern site boundary at its closest point.

As the proposed development involves the increase in waste accepted and processed at the current facility, there is no potential for any resulting impacts in respect of flood risk. It was proposed under Planning Reference No. 05/3128 to construct a new access roadway and carpark and cover over the optibag storage area (now complete) and the timber storage area (to be completed) in order to provide enclosed storage areas, which will reduce potential emissions. This planning permission application has been granted by Limerick County Council. However it is not considered that any of the above works will have any impact in terms of flood risk.

7.4 Hydrogeology - Introduction

The hydrogeology of the site of the proposed development was assessed by means of a desk study of pertinent literature. This included available geological and hydrogeological information and maps from the Geological Survey of Ireland (GSI) and the results of a previous hydrogeological assessment of the site prepared by RPS McHugh Planning & Environment (RPS) to comply with Condition 11.7 of Waste Licence No. 61-2 as issued by the Environmental Protection Agency, and the results of groundwater monitoring undertaken at two groundwater monitoring wells, GW1 (E164605 N147209) and GW2 (E164754 N146985), on the site. The objective of the study was to determine the hydrogeology of the existing environment, to assess groundwater vulnerability and quality in the region of the site of the proposed development and to determine the potential impacts of the proposed development on the hydrogeology. The sources of information used were:

- Geology of Tipperary, (GSI) 1996
- Geological Survey of Ireland 1:100,000 Bedrock Map (www.gsi.ie).
- Ireland General Soil Map (Second Edition) 1:575,000, M.J. Gardiner. An Foras Taluntais 1980.
- County Limerick Groundwater Protection Scheme (GSI, 1998)

7.4.1 Quaternary Deposits

The principle soil type in the region surrounding the Luddenmore site is Soil Type 34, Minimal Grey Brown Podzolics, with associated Gleys and Brown Earths. It is considered that the parent material for this soil is Limestone Glacial Till. The origin of the unconsolidated materials in this area is associated with the movement and deposition from the Irish Ice Sheet and glacial melt outwash deposits during the last Ice Age during the Quaternary Period, the most recent period in terms of the geological chronology. The ice sheets ripped and ground down the underlying bedrock, resulting in a combination of rock fragments and fine clays as it advanced and depositing the material during its retreat, which was deposited as an unsorted mix of material ranging form boulders to fine clay as the ice retreated. The subsoils in the area are generally Limestone Till of varying thickness and composition.

According to the assessment conducted by RPS McHugh, subsoil cover on the site itself is variable but in general quite thin with a number of outcrops, most notably to the rear of the current office complex, where excavations have revealed very thin soil cover. The monitoring borehole GW1 drilled on the upper slopes of the site as part of the assessment revealed a thin subsoil cover of only two metres depth. However on the lower slopes of the site the subsoil thickness tends to increase with a thickness of 24 metres being encountered at monitoring borehole GW2. The subsoils encountered during drilling operations were generally limestone tills with a four metre deep clay deposit being encountered beneath the till at GW2. The origin of this clay may be glacial or alternatively a breakdown product of volcanic rocks. The depth to bedrock at the local GWSS is uncertain, but is thought to be quite deep.

A more comprehensive description of the soils of the site is given in Section 8, Geology and Soils.

7.4.2 Aquifer Classification and Vulnerability

The site of the proposed development is located on a locally important aquifer, on bedrock, which is generally productive in local zones only (LI). This is based on the aquifer classification scheme outlined in the publication 'Groundwater Protection Schemes' (DELG/EPA/GSI, 1999), which takes account of the overall potential groundwater resources in each rock unit, the area of each rock unit, the localised nature of higher permeability zones and the highly karstic nature of some of the limestones.

The Geological Survey of Ireland (GSI) has also produced a groundwater vulnerability map of the Limerick area, depicting a range of vulnerability categories, namely Extreme (rock near surface or karst), Extreme, High, Moderate and Low. According to this map, the aquifer type present at the site of the proposed development is considered to be of extreme (rock near surface or karst) vulnerability according to the maps produced by the GSI.

Given the data available from the two boreholes drilled onsite, the vulnerability rating of the site itself was deemed uncertain in RPS McHugh's assessment. The depth to bedrock encountered at GW1 on the upper part of the site was less than three metres and so confirmed the 'Extreme' rating as assigned by the GSI. The depth to bedrock encountered at GW2 on the lower part of the site was 24 metres and composed of low permeability material and so would be classed as Low Vulnerability. Adopting a precautionary approach, it is probably best to assume that the entire site has a vulnerability rating of 'Extreme' resulting in an aquifer resource protection rating of Lm/E.

Figure 7.4 shows the various categories of aquifer that are found in the region around the site of the proposed development, while Figure 7.5 shows the local groundwater vulnerability status.

7.4.3 Groundwater Flow Directions

7.4.3.1 Regional Groundwater Flow

Groundwater flow in the area is dominated by the Shannon River Basin, with all local groundwater and surface water flow systems eventually flowing to the north towards the Shannon estuary and eventual discharge to the sea. The groundwater flow direction in the area surrounding the existing facility at Luddenmore is influenced by local topography with the water table probably resembling a subdued version of the topography. The RPS McHugh report to be submitted by Mr. Binman Ltd. to the EPA in response to the request for further information (dated 30th November 2009) includes drawings that show the direction of groundwater flow in relation to the onsite groundwater monitoring points and in relation to local abstraction points.

7.4.3.2 Local Hydraulic Gradients

The hydraulic gradients in the site area are limited to four data points; namely the groundwater monitoring boreholes GW1 and GW2 on-site and the Ballybricken GWSS abstraction boreholes GWSS1 and GWSS2 to the southeast of the site. The elevations of all four wellheads were surveyed to a temporary benchmark and are expressed in metres above temporary bench mark (m aTBM) to allow the relative levels and gradients of the watertable in the area to be determined. Gradients between all four points were calculated based on water table levels taken both during pumping and non pumping times at the Ballybricken GWSS. As expected the watertable is in general a subdued version of the topography with a significant change in groundwater level between GW1 and GW2 of 25.84 metres. The head difference and hydraulic gradient between GW2 and the two Ballybricken GWSS abstraction boreholes is much gentler with a hydraulic gradient from both GWSS boreholes towards GW1 with a head difference of approximately five metres. Even under pumping conditions there is only a flow gradient towards GWSS1 due to a head difference of 1.27 metres and GWSS2 maintains a head difference towards GW1 of approximately 3.8 metres. In all, this indicates that in terms of calculated gradients there is no significant flow from the Mr. Binman Site at Luddenmore toward the GWSS boreholes.

Analysis of the water levels using the "three point graphical analytical method" allowed the piezìometric contours and the flow lines orthogonal to these to be determined. By using the observed static and pumping water levels for the four possible scenarios (2 No. GWSS boreholes either static or pumping) the flow direction of the groundwater was determined for each scenario. The results of this analysis clearly demonstrate that the flow direction of the groundwater beneath the site is in a south-easterly direction (130° to 145°) and that it is most improbable that the groundwater could flow (at complete variance to the hydraulic gradient) towards the GWSS boreholes to the northeast of the site (51° to 62°).

7.4.3.3 Calculated Gradients and Flow

The results of the analysis of the gradients indicate that under static conditions that the watertable is approximately five metres higher at both GWSS boreholes than at GW2 on the Mr Binman site. Under pumping conditions there is a gradient of between 0.0004 (0.4%) and 0.014 (1.4%) to GWSS1 only. Naturally there are higher calculated gradients between GW1 on-site and the GWSS boreholes as they are at significantly different elevations. The gradients between GW2 on-site and the GWSS boreholes are more representative of the groundwater flow regime in the site area.

Groundwater flow rates were estimated using an estimated effective porosity of 5%, the calculated gradients and were permeability estimated from the Logan Approximations (using static an pumping water levels) carried out on the GWSS boreholes. This indicates that flow rates in the aquifer are in the order of 1.4/day (1.6 x 10^5 m/s). Theoretical travel times from GW1 and GW2 to the GWSS boreholes were calculated using a cautious slightly over-estimated gradient of 0.0035 (median is 0.026). In terms of travel times to the public water supply from the complex of buildings on the site an estimate of 250 days (between 205 and 330 days) would appear reasonable. It must again be stressed that these are calculated values from estimates and assumptions and that under static water condition there is actually a gradient *from* the GWSS boreholes towards GW1 and during pumping times the gradient is in the range 0.013 to 0.004 (0.4% to 1.3%).

7.4.3.4 Flowlines and ZOC Analysis

While these figures are interpreted from real data, it is probably more useful to consider the flow direction as a function of the topography, which influences the shape of the watertable. While there is a calculated hydraulic gradient between GW2 and GWSS2 during pumping, that does not necessarily mean that flow will occur between the two points (e.g. there is hydraulic gradient between Corrán Tuathail and Dublin, however that is not the groundwater flow direction). In this case the site is located on a topographic divide that influences the possible flow-paths in the watertable. The head is higher at the GWSS indicating that the boreholes are located in a discharge zone for the area. While the lower watertables at GW2 indicates that the recharge is still occurring. However the probable Zone of Contribution (ZOC) to the GWSS boreholes is several hundred metres to the north of the site and it is not possible to draw a logical flow-line from the site towards the GWSS boreholes.

Based on the topography the groundwater flowing beneath the site flows in a southeasterly direction down hydraulic gradient of the GWSS boreholes, which are directly to the east and northeast of the site. Taking a site width of 150m the calculated flow beneath the site across the aquifer is in the order of 262.5m³/day.

7.4.4 Hydrochemistry

Both GW1 and GW2 are subject to ongoing groundwater monitoring for a suite of parameters as specified by the EPA as part of their monitoring commitments as set out in Waste Licence No. 61-2. These include pH, electrical conductivity, total organic carbon, ammoniacal nitrogen, total phosphorous and total nitrogen, all of which are to be sampled on a biannual basis. An initial assessment and monitoring was conducted by RPS McHugh in 2003 for the purpose of complying with Condition 11.7 of Waste Licence No. 61-2 but Tobin Consulting Engineers have performed this monitoring subsequently.

The current sampling methodology used by Tobins Consulting Engineers staff involves the use of an inertial lift pump and dedicated hosing to purge three well volumes from each groundwater monitoring well. A new pair of disposable gloves is used at each well and disposed of in a sealed bag in order to avoid cross-contamination. The inertial lift pump is used to take samples and the sample bottles are filled directly from the dedicated hosing. The bottles are filled, without preservative, after being rinsed three times with the sample water. The plastic sample bottles are also squeezed when the cap is being screwed on in order to ensure an airtight seal. The bottles are provided by the accredited laboratory providing the analysis. All available results of groundwater monitoring conducted on the site since October 2004 are provided in Table 7.9. For the purposes of the complying with Waste Licence No. 61-2, biannual analysis is required. However as can be seen from Table 7.9, more frequent sampling was undertaken in the past, mostly by the EPA.

The results available from TOBIN's current groundwater monitoring regime, show that none of the reported values have exceeded the corresponding drinking water values and in general the results indicate good groundwater quality. No appreciable difference was detected in RPS McHugh's initial assessment between the up-gradient and down-gradient samples, indicating that the activities at the site have not had an appreciable effect on the local aquifer groundwater quality. Subsequent biannual monitoring results by TOBINs indicate that this continues to be the case despite some variations in levels of various parameters between GW1 and GW2 since the commencement of monitoring. Tobins latest report (December 2007) states that the results indicated that the Mr. Binman facility is not adversely impacting on the groundwater quality in the area. Although laboratory results are available for 2008 samples, no report has been issued to date by TOBINs.

It is proposed to replace the current downstream groundwater monitoring well (GW2) with another well (GW08-2) prior to construction of the permitted roadway under Planning Reference No. 05/3128. The new monitoring well will be located adjacent to the current downstream well.

Table 7.9 (a) Results of Groundwater Monitoring Analysis: GW1

Parameter	SI 294/1989	SI 439/2000	Unit	2003	12/10/2004	02/03/2005	13/09/2005	14/03/2006	20/09/2006	16/01/2007	18/06/2007	19/11/2007	25/06/2008	20/11/2008
Sampled By				RPS	EPA	EPA	EPA	EPA	EPA	EPA	TOBIN	TOBIN	TOBIN	TOBIN
PH			PH units	7.5	7.78	7.51	7.01	-	7.42	7.61	7.8	7.3	7.29	7.29
Electrical Conductivity	1,000	2,500	µS/cm @ 20C	549	491	860	808	924	865	624	657	804	670	455
Ammonia	0.16	0.30	mg/l	-	<0.2	<0.03	0.11	-	0.056	0.092	-	-	<0.12	-
Total Phosphorus	-	-	mg/l	3.53	1.37	0.83	<0.02	0.26	0.22	0.46	<0.05	0.06	1.65	<0.10
Fluoride	1	1	mg/l	-	0.14	<5.0	<0.10	-	<0.10	0.12	-	-	-	-
Total Nitrogen	-	-	mg/l	7	6.91	20.00	1.00	12.10	15	41.9	9	6	7.9	4.5
Chloride	250	250	mg/l	-	18.20	36.60	41.70	-	59.3	30.7	-	-	-	-
Brominde	-	-	mg/l	-	-	<5.0	<5.0	-	<5.0	-	-	-	-	-
Nitrate	50	50	mg/l	-	25.70	-	-	-	50.8	30.5	-	-	-	-
Sulphate	200	250	mg/l	-	12.90	14.90	31.80	-	84.7	47.5	-	-	-	-
Sodium	-	200	mg/l	-	-	21.70	20.90	-	25.8	15.4	-	-	-	-
Magnesium	-	-	mg/l	-	-	15.10	10.30	-	15	8.75	-	-	-	-
Potassium	-	-	mg/l	-	-	0.92	1.43	-	1.06	0.36	-	-	-	-
Calcium		200	mg/l	-	-	145.00	142.00	-	131	76.5	-	-	-	-
Total Organic Carbon	-	-	mg/l	3	4.04	-	-	16.20	11.4	4.75	3	5	5.90	<0.4
Total Alkalinity ($CaCO_3$)	-	-	mg/l	-	191.00	310.00	328.00	-	232.00	250.00	-	-	-	-
Total Hardness	-	-	mg/l	-	-	424.00	397.00	-	390.00	227.00	-	-	-	-
K:NA Ratio	-	-	N/A	-	-	0.04	0.07	-	0.04	0.02	-	-	-	-
Ammoniacal Nitrogen	-	0.3	mg/l N	<0.2	-	-	-	-	-	-	<0.2	<0.2	<0.10	-

Table 7.9 (b) Results of Groundwater Monitoring Analysis: GW2

Parameter	SI 294/1989	SI 439/2000	Unit	2003	12/10/2004	02/03/2005	13/09/2005	14/03/2006	20/09/2006	16/01/2007	18/06/2007	19/11/2007	25/06/2008	20/11/2008
Sampled By				RPS	EPA	EPA	EPA	EPA	EPA	EPA	TOBIN	TOBIN	TOBIN	TOBIN
PH			PH units	6.96	7.42	7.65	7.28	-	7.14	7.46	7.84	7.29	6.99	6.99
Electrical Conductivity	1,000	2,500	µS/cm @ 20C	764	80	702	728	756	828	765	796	843	738	768
Ammonia	0.16	0.30	mg/l	-	<0.2	<0.03	0.156	-	<0.02	3.29*	-	-	-	<0.12
Total Phosphorus	-	-	mg/l	3.08	0.26	0.50	1.02	<0.2	<0.2	<0.2	0.12	0.15	0.13	0.11
Fluoride	1	1	mg/l	-	<0.1	<5.0	<0.10	-	<0.1	0.13	-	-	-	-
Total Nitrogen	-	-	mg/l	6	4.38	2.46	15.30	2.05	9.2	20.3	3	2	6.5	2.4
Chloride	250	250	mg/l	-	40.90	42.60	28.00	-	45.9	41.0	-	-	-	-
Brominde	-	-	mg/l	-	-	<5.0	<5.0	-	<5.0	-	-	-	-	-
Nitrate	50	50	mg/l	-	19.10	-	-	-	9.2	7.79	-	-	-	-
Sulphate	200	250	mg/l	-	31.10	15.80	14.50	-	38.1	33.0	-	-	-	-
Sodium	-	200	mg/l	-	-	19.00	18.70	-	24.9	19.5	-	-	-	-
Magnesium	-	-	mg/l	-	-	9.81	11.90	-	10.9	9.28	-	-	-	-
Potassium	-	-	mg/l	-	-	1.21	0.97	-	1.34	1.11	-	-	-	-
Calcium		200	mg/l	-	-	124.00	156.80	-	123.2	107	-	-	-	-
Total Organic Carbon	-	-	mg/l	<2	2.10	-	-	2.18	4.38	3.53	<2	2	2.90	<0.4
Total Alkalinity ($CaCO_3$)	-	-	mg/l	-	308.00	285.00	260.00	-	327.00	291.00	-	-	-	-
Total Hardness	-	-	mg/l	-	-	352.00	441.00	-	353.00	305.00	-	-	-	-
K:NA Ratio	-	-	N/A	-	-	0.06	0.05	-	0.05	0.05	-	-	-	-
Ammoniacal Nitrogen	-	0.3	mg/l N	<0.2							<0.2	<0.2	<0.10	-

*Invalid result from EPA. This was recognised and acknowledged by the EPA in a letter to Mr. Binman Ltd. dated the 10th June 2007.

7.4.5 Groundwater Uses

There are a number of known water abstractions in the area surrounding the site including two boreholes belonging to the Ballybricken Group Water Supply Scheme (GWSS). As part of RPS McHugh's assessment both boreholes were surveyed and the GWSS caretaker questioned about the state of the boreholes and GWSS.

Both boreholes both have "good" well yields of between 163m^3/day and 273m^3/day, with specific capacities of between 27m^3/day/m and 43m^3/day/m. Estimates of transmissivity for the bores are in the order of 33m^2/day to 53m^2/day. Estimation of permeability from transmissivity for fracture and fissured aquifers can be problematic. However using an approximate calculation taking the aquifer saturated thickness as the depth of the bore, the permeability for the aquifer is in the order of 2m/day (2.3 x 10^5 m/s). The Zones of Contribution (ZOC) for these boreholes are in the order of 2.2 ha to 5.2 ha, with the majority of this flow most probably coming from the north. .

7.5 Likely and Significant Impacts and Associated Mitigation Measures

7.5.1 Likely and Significant Impacts on Hydrology

7.5.1.1 Construction Phase

As this is an environmental impact assessment of the proposed increase in tonnage from 105,000 to 200,000 tonnes per annum, no construction phase is anticipated.

7.5.1.2 Operational Phase

No Impact

Due to the lack of watercourses on or near the site and the proposed usage of existing water and wastewater services, it is not considered that the proposed development will have a significant negative impact on the surface hydrology of the surrounding area. The closest watercourse is approximately 0.13 kilometres to the southwest of the site and eventually drains to the Camoge River, some four kilometres from the site.

All surface water within the facility drains to a Class 1 Klargester hydrocarbon interceptor with an inbuilt silt trap, which discharges to a dedicated percolation area in the southeast of the site (Grid ref: E164635 N147221). All clean roof run-off is diverted from the interceptor and discharges to four soakaways located around the site in order to minimise the hydraulic loading of the hydrocarbon interceptor. Full details concerning the hydrocarbon interceptor are included as Appendix III to this report. All water used during on-site waste processing operations will continue to be directed to the on-site Wastewater Treatment Plant (WWTP). The effluent from the WWTP is currently being removed off-site for further treatment at Castletroy WWTP, run by Limerick Co. Council. This practice will continue until the efficient operation of the WWTP can be demonstrated and the emission limit values achieved on a consistent basis.

As a result, it is not anticipated that there will be any impact on local surface waters as a result of the increase in tonnage of waste being accepted and processed at the Luddenmore facility.

7.5.2 Likely and Significant Impacts on Hydrogeology

7.5.2.1 Construction Phase

As this is an environmental impact assessment of the proposed increase in tonnage from 105,000 to 200,000 tonnes per annum, no construction phase is anticipated.

7.5.2.2 Operational Phase

No Impact

The following control measures are in place or are proposed at the waste transfer station in order to give effect to Articles 3, 4, 5, 6 and 7 of Council Directive 80/68/EEC on the protection of groundwater against the risk of pollution by certain dangerous substances and Article 6 of Directive 2006/118/EC on the protection of groundwater against pollution and deterioration:

- Only non-hazardous waste is accepted on site. All sources of waste are assessed in advance to prevent hazardous materials being accepted on-site. In addition a waste acceptance procedure is in place to assess all waste loads and ensure no hazardous waste materials are processed on-site. Any potentially hazardous waste materials identified are rejected or isolated in a contained quarantine area for further treatment off-site.
- There are no direct discharges to groundwater from the facility.
- There is no disposal of waste on-site.
- All areas where waste is handled are covered by a hardstanding with sealed joints.
- Wastewater is discharged via dedicated drainage system to a wastewater treatment plant and is further treated off-site.
- Stormwater from hardstanding areas is discharged via a dedicated drainage system to a two stage solids separation system followed by a Klargester Class 1 Hydrocarbon Interceptor prior to discharge to a certified soakaway.
- Uncontaminated water from roofs is diverted from the dedicated abatement systems to ensure the abatements systems are optimised.
- Regular cleaning of all surface areas with a dedicated roadsweeper is in place.
- Regular cleaning and housekeeping of all areas is in place.
- All fuel storage is bunded to 110% or to 25% of the total volume, whichever is greater.
- Fuel loading areas are enclosed by dedicated drainage to the hydrocarbon interceptor.
- Fuel nozzles are kept within a bunded area when not in use.
- Bunds and wastewater drainage systems are integrity tested every three years.
- Residual waste acceptance and processing areas are enclosed to minimise rainwater ingress and leachate generation.
- A standard operating procedure for the operation and maintenance of the wastewater treatment plant on a daily basis is in place.
- A standard operating procedure for the operation and maintenance of the solids settlement systems and hydrocarbon interceptor is in place.
- An on-site laboratory is in place to allow regular monitoring of the operation of the waste water treatment plant and oil interceptor.
- The waste water treatment plant and associated percolation area is limited to its design capacity of treating a hydraulic load of 18.9 m^3 per day.
- Standard laboratory procedures are in place for the laboratory test procedures including calibration protocols.

- In addition to the existing environmental team on-site, an environmental analyst was employed with responsibility for the wastewater treatment plant, hydrocarbon interceptor, laboratory, environmental monitoring and checks, SOP development and Emergency Response Plan (EMP) management on-site.
- Currently there are no discharges of wastewater effluent from emission point FE1.
- As referenced in Sections 7.2.3.2 and 7.2.3.3, improvements in the wastewater treatment plant monitoring, operation and maintenance have resulted in a significant improvement in the quality of the effluent and further improvements are in progress.
- Subject to the success of the above improvements, polish filtration systems, constructed wetlands or diversion of the emissions from FE1 are being considered.
- The percolation/soakway associated with FE1 will be reconstructed and certified in line with relevant standards in the event that emissions via FE1 occur.
- Regular groundwater monitoring upstream and downstream of the facility is in place which demonstrates the facility is not having an impact of environmental significance on the quality of the groundwater.

Potential Significant Negative Impact

Uncontrolled release of liquid contaminants from the processes on-site cold result in the contamination of groundwater in the area. Infiltration of contaminated water to groundwater may cause pollution of the aquifer. Potential contaminants could originate from lorry washings, leachate from waste, leakages from fuel storage areas or from contaminated surface run-off.

Mitigation:

As the drainage network and stormwater drainage system is already *in situ*, surface runoff will continue to be directed to the on-site hydrocarbon interceptor, which is also fitted with a silt trap. All separated water from the hydrocarbon interceptor will continue to be discharged to the dedicated soakaway in the southeastern corner of the existing site boundary (Grid ref: E164635 N147221). However, water discharged from the bund of the fuel store is not discharged to the hydrocarbon interceptor but is removed off-site for further treatment, as necessary. The loading/unloading area, beside the bund, drains to the hydrocarbon interceptor in the event of any minor spills when filling vehicles with fuel.

In order to prevent hydraulic overloading of the hydrocarbon interceptor/silt trap, all clean roof water is diverted to a four separate soakaways.

As described in Section 7.5.1.2 above, all water used during on-site waste processing operations will continue to be directed to the on-site WWTP. The effluent from the WWTP is currently being removed off-site for further treatment. It is proposed to continue this practice until the efficient operation of the WWTP can be demonstrated and the emission limit values achieved on a consistent basis. As a result, there will be no discharges from the WWTP emission point until such time as it can be demonstrated that the WWTP is operating in compliance with the required emission limit values.

A laboratory was set up in early 2008 with an environmental analyst employed by Mr. Binman to implement a rigorous monitoring regime to ensure all compliance parameters are actively monitored. This will permit sufficient data to be compiled to enable the optimisation of the operation of the WWTP and to determine what additional measures need to be implemented in order to ensure compliance.

Separation of the drainage from the various yard areas ensures that discharges with the potential to contaminate both surface and groundwater do not enter the wider environment.

Diversion of uncontaminated rainwater from roofed surfaces on-site has minimized the hydraulic loading to the WWTP and ensured that it is not overloaded hydraulically.

It is proposed to seal all joints on paved surfaces where waste is handled in order to ensure groundwater protection.

A new grease trap for the foul sewer/canteen discharge has been provided to ensure that this material does not enter the WWTP system.

The installation of the best available hydrocarbon interceptor on the market, a Klargester NS2000 Class1 Oil Interceptor, designed in accordance with EN 858 (Part1), will ensure that no hydrocarbon contamination from on-site discharges to the underlying aquifer. The Klargester NS2000 is a full retention separator with a built-in silt trap, which works on the basis of the hydrocarbons being less dense than water. Separated water is then discharged. Details of this interceptor, including the producer's data sheet, a detailed drawing and installation and operating guidelines are provided in Appendix III.

The Emergency Response Procedure (ERP) includes information on procedures to be employed in the event of emissions or spillages both on-site and off-site. This full ERP document is included as Appendix II of this EIS. Precautionary measures in place on-site include the following: bunding of all tanks, secondary containment of all over-ground pipelines including all effluent pipelines, storage of material data sheets near chemicals for easy access, segregation of incompatible chemicals, storage of all chemicals indoors if possible on concrete bases, provision of emergency spill kit and prevention on rain ingress and wind dispersion of stored substances. In the event of a spillage, flow is directed onto a common catchment area and into the WWTP.

Emergency procedures in the event of a spillage or emission include the following: immediate raising of alarm, switching off of dispensers, prevention of vehicle entry to site, prohibition on engines starting in the vicinity of the spillage, consultation of relevant Material Data sheets, local containment using absorbent material provided in emergency spill kit, monitoring of level of WWTP, immediate informing of EPA or local council by a Director or member of senior management, disposal of absorbent material as directed by EPA, investigation of reasons for emergency and initiation of corrective action and maintenance of written records of any spillages and emissions. Minor off-site spillages are dealt with using the vehicle's designated spill kit. In the event of a major spillage, the crew must contact the transport manager and an Emergency Spillage Team (ETS), comprising the transport manager, trained operators and a road maintenance vehicle, is dispatched to deal with the incident. Where the spillage cannot be dealt with by the EST, the relevant services are contacted.

Potential Moderate Negative Impact
The increased use of vehicles (associated with the increase in tonnage) at the waste transfer facility increases the potential for the spillage of hydrocarbons on the site in the form of leaks from vehicles or fuel tanks or spillages. These substances may

leach down into the soil, subsoil and groundwater and eventually contaminate surface waters. Risks associated with the operation of machinery on-site include leaks during refuelling procedures and leaks from fuel tanks or of lubricant fluids.

Mitigation:
All operations on-site occur on an area of hardstanding, from where all run-off is directed to the oil interceptor for hydrocarbon removal prior to discharge to ground. A designated refuelling area is provided on the site within an area of hardstanding. Water discharged from the bund of the fuel store is removed off-site for further treatment, as necessary. The loading/unloading area, beside the bund, drains to the hydrocarbon interceptor in the event of any minor spills when filling vehicles with fuel. Fuel is stored in a bunded fuel tank that is located in a bunded concrete area. Access to the fuel tank can only be achieved through the use of a key and a code. The bunded tank comprises of a separate internal rectangular storage tank, suitably braced and raised above the bund floor by mild steel sections. The outer bund tank is manufactured in a rectangular configuration, suitably strengthened and large enough to incorporate 110% of the inner tank capacity. All bunds are manufactured with pressed sidewalls to prevent formation of water traps, and are supported from ground level using heavy-duty steel sections welded to the underside.

A convex removable roof achieves total enclosure and the enclosed pipework and valves are accessible through a lockable hatch in the roof. Rainwater currently gathers in the concrete bund section and is released through a valve. This valve is locked closed when not in use and only the yard manager and the Managing Director have keys to the lock. Prior to discharging water from the bund it is checked thoroughly for any signs of leakage. Any water that is discharged from the bund is treated off-site. There is a roof over the bunded area to prevent the ingress of rainwater.

In the event of a serious leak or spillage, the measures contained in the Emergency Response Procedure will be followed to ensure that the spill or leak is contained immediately. In addition, all vehicles used for transport and collection of waste will be checked and maintained to avoid leaks of fuel, lubricants etc. Best practice for machinery management and maintenance will be adopted.

Potential Significant Negative Impact
All storm wastewater that arises on the site will continue to be directed to the Klargester hydrocarbon interceptor for removal of hydrocarbons and silt prior to discharge via a percolation area. However, in the unlikely event that the interceptor fails to operate as specified, the leaking of hydrocarbons to groundwater sources could have a significant negative impact on groundwater quality. The severity of the impact would increase with volume and duration of the leak. However, as there is a substantial overburden, this should provide sufficient protection for the aquifer in the post-construction phase.

Mitigation:
The hydrocarbon interceptor is subject to a strict maintenance schedule, detailed in a Standard Operating Procedure, which includes a weekly check. Its location is also designed to facilitate access for such maintenance works. An alarm is fitted in order to ensure that the interceptor does not exceed its capacity for retention of silt and hydrocarbons.

Slight Long-term Negative Impact

The provision of areas of hardstanding for the current operation at Luddenmore and for roadways and car parks reduces direct recharge to the underlying aquifer. However, the hardstand areas are insignificant in terms of the entire recharge area for the aquifer as a whole.

Mitigation:

No mitigation is prescribed as the impact is not considered to be significant.

11. MATERIAL ASSETS

The sections of Chapter 11 of the EIS that have been updated are Section 11.2.2: Surface Water Drainage and 11.2.3: Foul Water Drainage. These sections are set out in Section 11.2: Utility Services. Figure 11.8 has also been updated, and is presented in this document.

11.2 Utility Services

11.2.2 Surface Water Drainage

There are four stormwater percolation areas located around the site, through which rainwater from roofed surfaces is discharged to ground via a soak pit. The locations of the percolation areas are shown in Figure 11.8. All other surface water from the yard is discharged via a new hydrocarbon interceptor/settlement tank. The sources of all waters that are treated via the interceptor prior to discharge to the emission point, referred to as FE2, comprise:

1. Vehicle throughfares and open hardstanding areas away from waste processing building delivery/dispatch areas.
2. Yard areas in front of maintenance buildings.
3. Fuel filling area.

The surface of the yard and truck parking area is concreted. All surface water is drained from this concreted area to the percolation area via the hydrocarbon interceptor/settlement tank. This new hydrocarbon interceptor is a Klargester NS 200 Class 1 full retention separator and built-in silt trap, and is the best available unit on the market (manufacturer's details are included in Appendix III of the EIS). The recent installation of the oil interceptor at the site ensures that discharges of environmental significance do not occur. The Klargester hydrocarbon interceptor is located close to the eastern boundary of the site. The main entrance to the yard is concreted and surface water from this area is drained to soak pits at the side of the entrance.

Although groundwater monitoring results for the facility to date confirm that there has been no impact to groundwater, all joints on hardstanding areas have been sealed to further ensure there will be no impact on groundwater. This measure has been implemented as part of the EPA waste licence review application.

A vehicle washing area is located near the onsite wastewater treatment plant. All vehicle washing is carried out at this location. The vehicle washing area consists of a concreted area that slopes to a central slatted area where the washings drain. The slats are removable and can be removed when necessary to take out any build up of silt. Water from the truck wash station is discharged to the onsite wastewater treatment plant. At present, there are no discharges to ground from this treatment plant, as described in Section 11.2.3.

Fuel is stored in a bunded fuel tank, which is located in a bunded concrete area. Access to the fuel tank can only be achieved through the use of a key and a code. The bunded tank comprises a separate internal rectangular storage tank, suitably braced and raised above the bund floor by mild steel sections. The outer bund tank is manufactured in a rectangular configuration, suitably strengthened and large enough to incorporate 110% of the inner tank capacity. All bunds are manufactured with

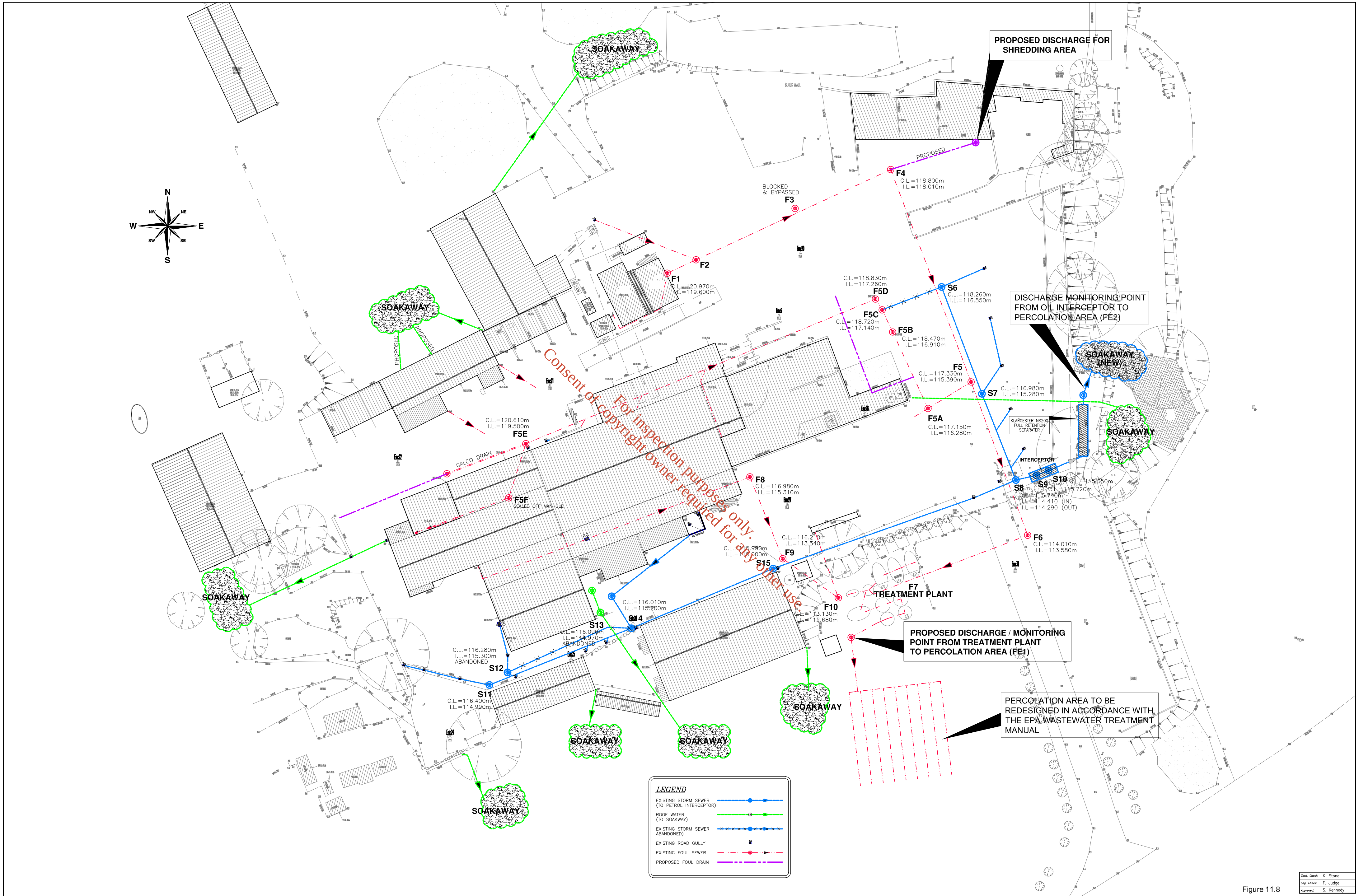

Figure 11.8

Tech. Check:	K. Stone
Eng. Check:	F. Judge
Approved:	S. Kennedy

REV.	AMENDMENT	BY	DATE
P1	EXISTING DRAINAGE REVISED	KS	16/10/2008
P2	REVISED AS PER CLIENTS COMMENTS	P.J.M.	04/01/2010
P3	REVISED AS PER CLIENTS COMMENTS	P.J.M.	11/01/2010
P4	REVISED AS PER CLIENTS COMMENTS	P.J.M.	14/01/2010
P5	REVISED AS PER CLIENTS COMMENTS	P.J.M.	15/01/2010

Job: MR BINMAN DRAINAGE STUDY, LUDDENMORE,GRANGE CO LIMERICK

Title: EXISTING STORM & FOUL DRAINAGE LAYOUT

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Stage:	PLANNING
Scale @A0:	1:250
Drawn:	P.F.
Date:	21-06-2007
Drawing No:	071-258-003
Rev:	P5

Figured dimension only to be taken from this drawing. All dimensions to be checked on site. Consultants to be informed immediately of any discrepancies before work proceeds.

pressed sidewalls to prevent formation of water traps, and are supported from ground level using heavy-duty steel sections welded to the underside. A convex removable roof achieves total enclosure and the enclosed pipework and valves are accessible through a lockable hatch in the roof. Rainwater currently gathers in the concrete bund section and is released through a valve. This valve is locked closed when not in use and only the Yard Manager and the Managing Director have keys to the lock. Prior to discharging water from the bund it is checked thoroughly for any signs of leakage. Water discharged from the bund of the fuel store is removed off-site for further treatment, as necessary. There is a roof over the bunded area to prevent the ingress of rainwater. The loading/unloading area, beside the bund, drains to the hydrocarbon interceptor in the event of a small spill when filling a truck with fuel. Drainage from the site is discussed further in Chapter 7 (Hydrology & Hydrogeology) of the EIS.

11.2.3 Foul Water Drainage

Foul water from the transfer station is drained to the onsite wastewater treatment plant. The sources of wastewater and foul water treated at the onsite WWTP comprise:

1. Foul water from canteen and toilets.
2. Wastewater from process buildings.
3. Wastewater from process yard areas in front of waste delivery areas of process buildings.
4. Vehicle/container wash bay and surrounding yard area.

The water is firstly screened to remove papers, plastics and any other gross solids before it enters the wastewater treatment plant. The treatment processes include a grease trap, aerated influent storage, level control pumping chamber, primary settlement (2), two aerated moving bed biofilm reactors (MBBR), clarifier, pumping chamber trial polishing filter and an effluent storage tank.

The diversion of uncontaminated rainwater from roofed surfaces has minimised the hydraulic loading to the wastewater treatment plant and reduced fluctuations in flow due to adverse weather conditions. The tonnage figure for wastewater effluent transported offsite in 2008 is estimated to be approximately 6,200 tonnes. The total volume of wastewater, including that from building washdowns, generated and sent off-site for treatment in 2009 was 5,468 m^3, and it is anticipated by Mr. Binman Ltd. that similar volumes will continue to be generated.

At present, there are no discharges to ground from the treatment plant. The wastewater is collected from the onsite plant and brought to Castletroy Wastewater Treatment Plant for further treatment. There will be no discharges from the onsite wastewater treatment plant emission point until such time as it can be demonstrated that it is operating in compliance with the emission limit values. Foul water will be treated in the wastewater treatment plant to a standard of 20 mg/l BOD and 30 mg/l suspended solids.

Since July 2008, several improvements have been made to the operation of the onsite WWTP at the Mr. Binman Ltd. waste transfer station. A full-time Environmental Analyst was employed to set up an environmental laboratory and to monitor and operate the WWTP. An intensive in-house assessment of the WWTP was undertaken, including measurement of key parameters at every stage of the WWTP. This assessment included analysis of the influent in terms of volume and composition and the impact of each stage of the wastewater treatment system on key parameters.

This assessment provided valuable information on control issues associated with the WWTP, which was used to develop and implement an improvement programme for control of the wastewater treatment plant. This improvement programme included:

- Development and implementation of standard operating procedures (SOPs) for operation and maintenance of the WWTP and associated equipment on a daily basis and training of relevant personnel.
- Development and implementation of standard laboratory procedures for conducting regular in-house monitoring of key control parameters to provide information on the efficiency of the WWTP.
- Managing hydraulic throughput in the WWTP to ensure that the plant is not overloaded or underloaded hydraulically. The WWTP is limited to the design throughput of 18.9 m^3 per day.
- Managing Chemical Oxygen Demand/Biological Oxygen Demand (COD/BOD) throughput to ensure the WWTP is not overloaded or underloaded. Reduced loadings to the WWTP are achieved through ramp, dicersion of roof drains and Level 3 ramp run-off, replaced use of power-washing units with dedicated road-sweeper/washer and limiting the use and type of detergents.
- Purchase of a dedicated vacuum tanker for the transfer of wastewater off-site. The tanker also allows for more regular maintenance of the silt trap, grease trap and primary settlement tank.
- Installation of a polymer dosing system to reduce solids, BOD, etc. in the final effluent. The polymer dosing system was installed to flocculate suspended solids in the discharge to the clarifier in order to reduce the residual suspended solids and thereby further improve emission discharges.

In addition to the existing WWTP improvement measures that are detailed above, Mr. Binman Ltd. is currently investigating further optimisation measures in order to ensure that consistent compliance with emission limit values for WWTP effluent can be achieved. These measures, which will be implemented if successful, include optimisation of the polymer dosing system and an assessment to compare WWTP effluent from the clarifier with that from the storage tank to which the effluent is discharged prior to removal offsite.