Environmental Impact Assessments

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Non-Technical Summary of Environmental Impact Statement for proposed Abbott Ireland Pharmaceutical Manufacturing Plant Sligo, Ireland

prepared for

Abbott Ireland

by

EIS Ltd.
6 Merrion Square
Dublin 2

May 2001

1. INTRODUCTION

This summary is provided to allow a non-technical reader to understand how the proposal will fit into the local environment. It provides a summary of the main findings. The summary is laid out in the same way as the main report.

2. EXISTING ENVIRONMENT

The site of the project is on lands that are owned by Abbot Ireland near the Manorhamilton Road, where the red circle is shown on the map above. The fields lie to the north of the old District Mental Hospital and are west of the existing Abbot Ireland Ballitivnan operation. In the main EIS the existing environment is described under a number of headings that are required by the Regulations.

The following is a summary of principal findings about the existing environment:

Human Beings

Yeats' Height is the nearest housing and there are a small number of roadside houses on the Manorhamilton road to the east and also across a low hill on the smaller local road to the north. The majority of the other landuses in the area is grass-based agriculture.

Flora and Fauna

The mammals, birds, fish, insects and plants of the site and the surroundings were thoroughly examined. A badger sett and freshwater spring, with a small area of surrounding wetland plants, were the principal features noted on the land. Attention was also drawn to the stream that flows through the site which, while unimportant in its' own right, does connect into the nearby Doonally River which is an important ecological and fisheries feature.

Water and Geology

The groundwater below the site and the stream that flows through the site were examined and found to have good water quality.

Air Quality

Air quality was found to be relatively good with any detectable traces being from local home heating and passing road traffic.

Noise

A survey of noise found that maximum recorded levels were due to passing traffic and local activity. The existing plant at Ballytivnan was also audible.

Landscape

The nearby Manorhamilton road is a recognised local tourist route offering fine views across towards Ben Bulben.

Roads and traffic

The N16 Sligo to Enniskillen road passes the site and has sufficient spare capacity.

Cultural Heritage
The site is the location of where Marlbrook House once stood. There are no archaeological remains on the development site.

3. PROJECT DESCRIPTION

General

Abbot Laboratories is one of the world's leading healthcare companies. Abbott Ireland will be carrying out the project. The Company has been established in Ireland since 1975 with over 1600 employees working at plants in Sligo, Cavan and Donegal.

The project will be used for making active pharmaceuticals, in small batches, that are used for treating illnesses such as cancer. There will be three main buildings that will be used as follows:

- Administration and Laboratory Building
- Drug Product Building
- Bulk Manufacturing Building
- Utilities Building Tanks and Storage

The project will be in operation by early summer 2003. It will cost approximately IR£45 million to build and construction employment is expected to peak at about 150. Initially up to 50 people will be employed and this will increase to about 150 people over the following six years.

Operations and Processes

The project will operate independently of the existing Abbott Ireland, Sligo facilities. It will have its own workforce, management and all necessary support services.

The project is a pharmaceutical manufacturing plant. Its' processes and operations will be examined by the Environmental Protection Agency (EPA) and they will need to issue an Integrated Pollution Control License before production can begin. The project is intended to make a range of products that will vary over the coming years, each new product or change of production process will also need to be licensed by the EPA.

In general the processes will be similar throughout. Raw materials are placed into sealed vessels where they are mixed, and sometimes heated, until the required reactions have taken place. After this step the material follows several purification stages before being finally isolated as a pharmaceutical ingredient. These stages take place in a number of sealed and separated spaces. The isolation is very important to maintain the purity of the product. All of these processes take place within the Bulk Manufacturing Building. After purification some products will be sent off-site to be further processed but most will be mixed and filled into capsules or pressed into tablets and packaged. These latter processes will take place in the Secondary Manufacturing Building. Air and water emissions from these processes will be captured and treated to the standards set and monitored by the EPA.

4. IMPACTS AND MITIGATIONS

The project has been carefully examined since the beginning of the design to ensure that adverse impacts were anticipated and avoided or minimised. Nonetheless it is a requirement of the EIA Regulations that a description must be provided of the effect on every one of the following topics.

Human Beings

The creation of up to 150 new jobs and the spending of up to IR£45 million on construction will be positive impacts on the local economy. No adverse impacts are anticipated.

Flora and Fauna

There will be a loss of some hedgerows and established trees though most will be retained. A small spring and associated wetland vegetation will be a local loss and care will have to be taken to minimise disturbance of a large local badger sett which will be near the building works. The North-Western Regional Fisheries Board will be consulted to avoid any threat to spawning fish. The EPA licence limits will ensure that there will be no effects from operations.

Soil

The soils and geology that lie under the site are vulnerable to water pollution. All pipes and outdoor areas where spills or leaks could occur will be built and monitored to prevent or quickly capture any spill. No adverse impacts are anticipated.

Water

There will be no discharges of effluent to local streams or rivers. The wastewaters from the development will be treated as part of the process, the remaining waters together with wastes from toilets and canteens will go to the new local authority wastewater treatment plant. Discharges to water form part of the EPA licence. No adverse impacts are anticipated.

Air

Emissions to air will be treated prior to release to air using a thermal oxidiser and a scrubber. Discharges to air form part of the EPA licence. No adverse impacts are anticipated.

Landscape

The project will be visible from the Manorhamilton Road. It will not interrupt the view towards the mountains and will only be visible for a very short length of the road. The effects will be localised. As time passes the extensive new planting will further reduce the visibility and the effect.

Material Assets

There will be no adverse effects on the traffic or roads.

Cultural Heritage

The archaeology of the site and the surroundings have been carefully examined. While there is known to be nearby remains – none have been recorded or noticed on the site. No adverse effects are anticipated.

The Interaction of Topics

The interaction of topics have been evaluated and no adverse interactions are anticipated.

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GLOSSARY OF IMPACTS

Cumulative Impact – The addition of many small impacts to create one larger, more significant, impact.

'Do Nothing Impact' – The environment as it would be in the future should no development of any kind be carried out.

Impact Avoidance – When no change is caused.

Impact Reduction – Where the significance of adverse impacts is lessened.

Impact Remedy – When an adverse effect is eliminated.

Imperceptible Impact – An impact of measurement but without noticeable consequences.

Irreversible Impact – When the character, diversity or reproductive capacity of an environment is permanently lost.

Indeterminable Impact – When the full consequences of a change in the environment cannot be described.

Long-term Impact – Impact lasting twenty to fifty years.

Medium-term Impact – Impact lasting seven to twenty years.

Negative Impact – A change which reduces the quality of the environment (for example, lessening species diversity and the reproductive capacity of the ecosystem, by damaging health, property or by causing nuisance).

Neutral Impact – A change which does not affect the quality of the environment.

Permanent Impact – Impact lasting over fifty years.

Positive Impact – A change which improves the quality of the environment (for example, by increasing species diversity and the reproductive capacity of the ecosystem, by removing nuisances or improving amenities).

Profound Impact – An impact which obliterates all previous characteristics.

Short-term Impact –Impact lasting one to seven years.

Significant Impact – An impact which, by its magnitude, duration or intensity alters an important aspect of the environment.

Slight Impact – An impact which causes changes in the character if the environment which are not significant or profound.

Synergistic Impact – Where the resultant impact is of greater significance than the sum of its constituents.

Temporary Impact – Impact lasting for one year or less.

`Worst case' Impact – The impacts arising from a development in the case where mitigation measures substantially fail.

GLOSSARY OF TERMS

Amelioration – Measures to diminish a negative impact.

Aquifer – A body of permeable rock that is capable of storing significant quantities of water.

Aquiclude – A rock with very low permeability, impermeable to groundwater flow, which may act as a boundary to an aquifer.

Baseline Survey – A description of the existing environment against which future changes can be measured.

BATNEEC – Best Available Technology Not Entailing Excessive Costs – Use of BATNEEC means that a greater degree of control over emissions to land, air and water may be exercised, utilising the best currently available technologies. In the identification of BATNEEC, emphasis is placed in pollution prevention techniques and waste minimisation. Required by the EPA as part of Integration Pollution Control.

BPEO – Best Practicable Environmental Option – Takes account of the total pollution from a process (Including the risk of transfer of pollutants from one medium to another) and the technical possibilities for dealing with it.

Competent Authority – Any agency charged with examining an Environmental Impact Statement with a view to issuing a consent to develop.

Commissioning – The rendering fully operational of a project or process.

Decommissioning – The final closing down, and putting into a state of safety of a development, project or process when it has come to the end of its useful life.

“Do nothing” Scenario – The situation or environment which would exist at some point in the future if no intervention or development were carried out.

Ecology – The study of the relationships between living organisms and between organisms and their environment (especially animal and plant communities), their energy flows and their interactions with their surroundings.

Effluent – Any fluid discharged from a source into the environment.

Environmental Impact Assessment (EIA) – The process of considering the environmental effects of development from consideration of environment aspect at design stage, through preparation of an EIS, evaluation of same by a competent authority and the decision as to whether a development should be permitted to proceed, and the public’s response to that decision.

Environmental Impact Statement (EIS) – A statement of the effects, if any, which the proposed development, if carried out, would have on the environment.

Emission – The amount of pollutant discharged per unit time, or the amount of pollutant per unit volume of gas or liquid emitted.

EPA – Environmental Protection Agency.

Ground Water – The water which flows underground through naturally porous parts of the soil or rock.

Hydrology – The science concerned with the occurrence and circulation of water in all its phases and modes, and the relationship of these to man.

Impact – The degree of change in an environment resulting from a development.

Infrastructure - The basic structure, framework or system which supports the operation of a development project for example, installations such as roads and sewers which are necessary to support development projects.

IPC - Integrated Pollution Control - Aims to prevent or solve pollution problems rather than transferring them from one medium to another. All major emissions to land, air and water are considered simultaneously and not in isolation. BATNEEC is required as part of IPC to minimise pollution of the environment as a whole.

Landuse – The activities which take place within a given area of space.

LHS – Is the rivers left side i.e. face downstream

Life Cycle (project) – Refers to the stages in the life of a process of development, including construction, operation, existence, extraction, manufacture, storage, transport, handling, use, disposal and decommissioning.

Methodology – The specific approach or techniques used to analyse impacts or describe environments.

Mitigation – Measures designed to avoid, reduce or remedy adverse impacts.

Monitoring – The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time, to assess the efficiency of control measures.

NGO – Non Governmental Organisations.

Particulates – Fine solids or liquid droplets suspended in the air.

Pollution – Any release to the environment which has a subsequent adverse effect on the environment or man.

Processes – The activities which take place within a development.

Project Promoter – A term used to describe persons or organisations carrying out a development.

Receptor – Any element in the environment which is subject to impacts.

Regulations – Planning Regulations 1963-1991 including SI 349, 1989 and SI 25 of Environmental Impact Assessment Regulations.

RHS is the rivers right side i.e. face downstream

Risk Assessment – An analytical study of the probabilities and magnitude of harm to human health or the environment associated with a physical or chemical agent, activity or occurrence.

Scoping – The process of identifying the significant issues which should be addressed by a particular Environmental Impact Assessment.

Screening – The process of assessing the requirement of a project, for Environmental Impact assessment based on the significance and/or environmental sensitivity of the receiving environment.

Scrubber – Device for flue gas cleaning.

Services – The conduits, pipes and lines that carry water, phones, electricity, sewage etc.

Sensitivity – Vulnerability of a sensitive receptor or environment to an adverse impact.

Significance – The degree of social or scientific concern attached to a likely impact.

Statutory EIS – A term sometimes used to describe an EIS prepared in accordance with the regulations.

Statutory Consultees – Organisations and authorities stipulated by legislation to be notified by a competent authority if an application is made which might give that organisation a cause for concern.

Surface Water – Natural water bodies such as streams, lakes and rivers.

Threshold – The magnitude of a project which, if exceeded, will trigger the requirement for an Environmental Impact Assessment to be carried out.

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CHAPTER 1 – INTRODUCTION

1.1 INTRODUCTION AND TERMS OF REFERENCE

Environmental Impact Services Limited (EIS Ltd.) has been commissioned by Abbott Ireland to prepare an Environmental Impact Statement (EIS) for a proposed expansion of their Irish operations in Sligo.

This EIS is being submitted to the Planning Authority as part of the planning application documentation prior to commencement of operations. The objective of this EIS is to determine any significant impacts of the proposed development on the environment and where measures proposed to avoid, reduce or remedy them.

The project will require an Integrated Pollution Control Licence (IPCL) from the Environmental Protection Agency (EPA). This will examine the specific environmental effects of the proposed production processes and products.

1.2 LEGISLATION

Environmental Impact Statements (EIS's) are carried out in response to the requirements of the European Community Council Directives of 1985 and 1997, on the assessment of the effects of certain public and private projects on the environment[1]. The enabling statutory instruments (S.I.s) which transpose these Directives into law in Ireland are the European Communities (Environmental Impact Assessment) Regulations, 1989 to 2000 (the EIA Regulations), with the main legislation being S.I.s 349/89 and 93/99. These Regulations generally set out the types of projects which shall be subject to Environmental Impact Assessment (EIA) and the statutory format and content for EISs.

Article 24 of the Local Government (Planning and Development) Regulations, 1994 (as amended) requires the submission of an EIS for any development of a class specified under Article 24 of S.I. 93/99.[2] The proposed development falls within the class of development types under category 6 (e) of this Article: … for the production of basic pharmaceutical products using a chemical or biological process.

The information to be contained in an EIS is set out in the Second Schedule of Article 25 of S.I. 93/99. The content of this EIS conforms with the relevant requirements as specified in this Article. This EIS has also been undertaken having regard to the Environmental Protection Agency's Draft Guidelines on the information to be contained in Environmental Impact Statements (EPA 1995) and Advice notes on Current practice in the preparation of Environmental Impact Statements (EPA 1995).

[1] 85/337/EC and 97/11/EC

[2] The Local Government (Planning and Development Act 2000) sets out the new legislative framework for the preparation of Environmental Impact Statements. Whilst this act has been passed by the Oireachtas the parts of the act relevant to EIS's have not yet become operational.

As the boundary between the administrative areas of Sligo Corporation and Sligo County Council passes through the development site, the planning application will be submitted to both Planning Authorities.

1.3 SCOPING

Scoping is the process of identifying potential concerns that need to be examined in detail in an EIS. The determination of potential concerns to be addressed in this EIS arose from:

- Consultation with statutory bodies (see also Sections 1.4 & 2)
- A review of the previous planning application on the site and the accompanying Environmental Impact Statement
- Experience of previous EISs and the requirements of the EIA Regulations

Based on the above, a scoping document was produced which identified the key concerns to be addressed in the EIS. This is detailed in Chapter 2 of this report.

1.4 CONSULTATION

1.4.1 Consultation with Agencies

The following bodies were consulted in the preparation of this report:

- The Planning, Roads and Environmental Services Departments of Sligo County Council and Corporation
- The Sites and Monuments Section of Dúchas
- The Environmental Protection Agency
- The North West Regional Fishery Board

All of the comments, suggestions and information provided by the above mentioned bodies have been taken into account in the preparation of this EIS.

1.4.2 Public Consultation

It was not considered necessary to initiate public consultation for this EIS as a previous planning application on this site highlighted any public concerns

1.5 EIS FORMAT

This EIS follows a grouped format structure. Using this structure the EIS is prepared in a format which examines each environmental topic (as prescribed by the Regulations) as a separate chapter. Each of these separate chapters refers to: -

- The proposed development
- The receiving environment
- Likely significant impacts
- Mitigation measures

- Residual impacts (where applicable)

Within the individual chapters the EIS addresses each of the topics specified by the EIA Regulations as follows:-

EIA REGULATION TOPICS	EIS CHAPTER TOPICS
Project Description	Project Description
Human Beings	Human Beings
Flora	Flora, Fauna and Landuse
Fauna	Flora, Fauna and Landuse
Soils	Water and Geology
Water	Water and Geology
Air	Air Quality Noise
Climate	Air Quality
Landscape	Landscape
Material Assets	Waste Management Roads and Traffic
Cultural Heritage	Cultural Heritage
Interaction of the foregoing	Where it arises this is addressed within the above chapters

1.6 STUDY TEAM

The study team used to prepare this EIS was selected to ensure that as many of the study team who worked on the previous EIS for the site as possible would work on this EIS, due to their familiarity with the site and the issues involved.

The study team that prepared this EIS was as follows:-

Role	Personnel	Organisation
Study Director	D Conor Skehan	Environmental Impact Services Ltd.
Study Manager	Brendan Allen	Environmental Impact Services Ltd.
Specialist Topics		
Human Beings	Brendan Allen	Environmental Impact Services Ltd.
Flora, Fauna and Landuse	Brian Madden	Biosphere Environmental Services
Water and Geology	Richard Foley	Enterprise Ireland
Air Quality	Fred Mc Darby	Enterprise Ireland
Noise	Larry Kenny	Enterprise Ireland
Landscape	D Conor Skehan	Environmental Impact Services Ltd.
Waste Management	Richard Foley	Enterprise Ireland
Material Assets	Brendan Allen	Environmental Impact services Ltd.
Cultural Heritage	Lisa Courtney	Margaret Gowen & Co. Ltd.

1.7 A NOTE ON QUOTATIONS

Environmental Impact Statements by their nature contain statements about the proposed development, some of which are positive, and some less than positive. Selective quotation or quotations out of context can give a very misleading impression of the findings of the study. The study team urge that quotations should, where reasonably possible, be taken from the conclusions of specialists' sections or from the non-technical summary and not selectively.

1.8 STATEMENT OF DIFFICULTIES ENCOUNTERED

The EIA Regulations require that difficulties such as technical deficiencies, lack of information or knowledge encountered in compiling any specified information for the Environmental Impact Statement be described. No such difficulties were encountered in the preparation of this EIS.

CHAPTER 2 – SCOPING

2.1 INTRODUCTION

Scoping is the process of determining the likely concerns that need to be examined in an environmental impact statement. The determination of concerns to be examined in this EIS arose from: -

- Site visits and local investigation
- Consultation with:
  - The Planning, Roads and Environmental Services Departments of Sligo County Council and Corporation
  - The Sites and Monuments Section of Dúchas-The Heritage Service
  - The Environmental Protection Agency
  - The North Western Regional Fisheries Board
- A review of the previous planning application on the site and the accompanying Environmental Impact Statement
- Experience with previous EISs and the requirements of the EIA Regulations

2.2 SCOPING DOCUMENT

On the basis of the typical concerns expressed by the public about project of this type and also on account of a previous application by Abbott Laboratories on the same site there is a high level of certainty about questions of likely concern which are as follows (Headings follow EIA Topics and do not indicate order of priority):

2.2.1 Scope of Proposed Pharmaceutical Manufacturing Plant, Sligo

- **Proposed Development**

It is proposed to construct a new facility for the manufacture of pharmaceutical compounds at a site on the northern outskirts of Sligo.

The project will produce active pharmaceutical compounds by using standard synthesis processes. It will also have facilities for formulation, tabletting and encapsulation of these important pharmaceutical products.

It is anticipated that the company will manufacture a variety of pharmaceutical products in small quantities (approximately 2500kgs of active ingredient per annum).

It is important to note that this project is proposed in the same location as a previous initial application .

- **The Existing Environment and Likely Impacts**

Each of the headings below (eg. '*Human Beings*' corresponds to the topics prescribed by the EIA reulations)

Human Beings

The principal concerns centre on the likely effects on the amenities, health and safety of the nearby Yeats' Heights and other individual residences, to the northwest in particular.

Flora

No significant concerns on the impact of this proposed operation on the flora of the area have been identified.

Fauna

Fish life in the receiving waters (i.e. downstream of the Local Authority waste water treatment works) has been identified as a particular concern of the North West Regional Fisheries Board. The Regional Fisheries Board comments have been solicited and incorporated in this EIS.

Soil and Geology

Parts of the site are underlain by sensitive groundwater-bearing geology, which is highly porous. Assurance was sought that no spillage of compounds used in the manufacturing of the pharmaceutical products could enter the groundwater without proper detection and containment.

Water

Assurances were sought that waste water loadings would be minimised and that the processes employed would conform with all relevant regulatory requirements.

Air

Having regards to the the low-lying location assurances were sought that there will be adequate dispersion of air emissions (principally from the boiler exhaust stack).

Noise

Assurances were sought that the plant would be designed to conform with EPA Guidelines for noise, after an initial start up and commissioning phase.

Climate

No significant concerns have been raised on the effects of development on the local climate.

Landscape

The site lies to the east of an existing manufacturing site and is set in highly enclosed low lying fields that lie to the north and west of the Manorhamilton Road.

The Manorhamilton road is an important local tourism amenity which overlooks the site from the South and East. The Planning Authority were concerned that the design should minimise the contrast of proposed development with the surrounding countryside.

Material Assets

The principal significant concern was the potential impact of the proposed development on the local road network, principally in terms of the junction with the public road but also in terms of road capacity.

Cultural Heritage

Although there are known archaeological features in the immediate vicinity, the proposed site is devoid of any known features. Nonetheless assurance was sought that provisions should be made to detect any hitherto unknown remains during the construction phase.

Alternatives

The EIS will describe the process of evaluating alternative site layouts and the decision supporting the proposed design.

CHAPTER 3 – ALTERNATIVES CONSIDERED

3.1 INTRODUCTION

EIA Regulations state that when environmental effects[3] are taking into account, the developer must consider alternatives as well as the basis for the selection of the preferred means to address potential environmental effects. This chapter describes the alternatives that were considered in this project. Each principal option is described in terms of the main elements and the opportunities and constraints posed by each option.

3.2 SITE SELECTION FACTORS

Abbott Laboratories has determined a strategic need for a new facility capable of manufacturing pharmaceutical products to provide quality healthcare and combat diseases in oncology (cancer), neurology (diseases and disorders of the nervous system) and urology (diseases and disorders of the kidneys and urinary tract).

Abbott's history in Ireland has been one of success. With manufacturing operations in Sligo, Donegal and Cootehill, employment has steadily increased. A profile of the employment skills shows that substantial numbers of jobs have been suited to people with second level qualifications and where specific third level qualifications are needed, individuals with these skills have been available. The proximity of the Institute of Technology in Sligo has been as asset utilised by Abbott Ireland in recruiting technical positions.

To provide the necessary staff resources for the proposed development it is necessary to locate a pharmaceutical manufacturing operation in reasonable proximity to a town with a significant population such as Sligo. In addition to staffing needs, Sligo Town and County Sligo also offers many amenities as well as having good communication and transportation links.

In consideration of this application for development, the site offers a number of advantages:

1. The availability of a large tract of land adjacent to the existing plant
2. No significant difficulties with construction are expected
3. Access to primary rail and transportation routes thus facilitating the transport of raw materials and finished products.
4. Availability of an educated workforce and
5. Recreational and cultural needs that attracts and retains an educational workforce.

[3] EIA Regulations 1999 (S.I. 93/99), Article 25 Second Schedule 1(d)

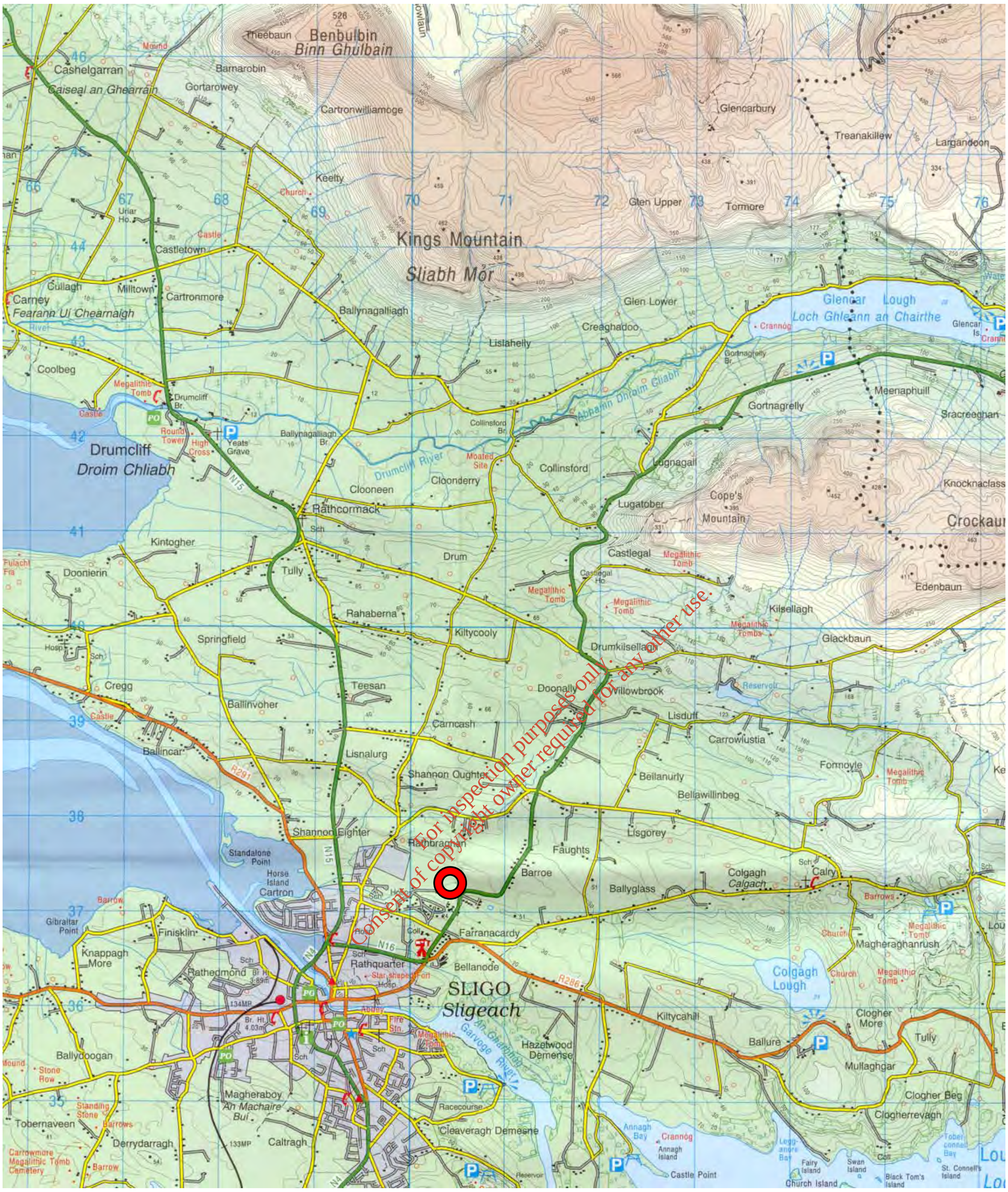


Figure 1: Site Location Map

3.3 PROPOSED SITE

The site for the proposed development is on property which adjoins the existing Abbott Ireland site at Ballytivnan, Sligo. The property spans the two townlands of Ballytivnan and Rathbraghan and comprises a number of fields with a total area of 47 ha (116 acres) roughly in an L shape (see Figure 1). The boundaries include the existing Abbott Ballytivnan site, private housing and the Doonally River to the west, the former Sligo-Leitrim District Mental Hospital (SLDMH) immediately to the south, agricultural lands to the east and a public road and the Doonally River to the north. Part of the SLDMH complex is currently in use as a day care centre.

The proposed development will take place on an area of about 12.5 ha at the eastern end of the site. Virtually all of the development will be in the Rathbraghan townland with a portion of the internal access road in the Ballytivnan townland. Access will be from the N16, the Sligo - Manorhamilton road, at the point to the entrance of the Marlbrook House (in ruins). A small stream runs through the southern part of the site. The Institute of Technology, Sligo at Ballinode is about 0.75 km to the south-east and there is a school about 0.7 km to the south. Apart from the SLDMH, Saint Johns is about 1.3 km to the south-west and the Sligo General hospital is about 1 km to the south of the site. Sligo Town centre is 2 km distant to the south.

The site topography is defined by two valleys oriented east-west separated by a central spine. The elevations range from a low of 8 m OD (ordnance datum) in the south-western end to a high of 40 m OD at the north-eastern end. For many years parts of the property have been leased for livestock grazing.

3.4 "DO NOTHING"

If the project was not to proceed globally there would be negative impact on the ready availability of sufficient supplies of quality pharmaceuticals to meet projected demands to combat a variety of diseases and disorders such as cancer:

If the project does not proceed on this site it will proceed on another site abroad.

3.5 ALTERNATIVE LAYOUTS

In the preparation of the Master Plan for this pharmaceutical plant, the orientation and juxtaposition of each of the buildings has been carefully explored and it is hoped the proposal addresses the key elements that would successfully respect the contextual nature of the surrounds and siting.

The key elements explored were;

- Siting topographically – contours and heights relative to adjacent lands and neighbours.
- Siting geologically – where to sub-structurally locate the building where engineering and underground conditions are complementary.
- Orientation – identifying the "face" of the development to its neighbours.
- Situation – the contextual relationship of the buildings with the landscape and horizons.

- Aesthetics and materials – adopting complementary and modern but proportioned language with materials that reflect or blend into the environment.
- Access and circulation – to define the siting and infrastructure being mindful of both the municipal developments outside of the sites with regards to roads and future developments, and internally to recommend an efficient circulation within the site.

In addition, each individual building's form was explored to ensure the least possible imposition in terms of massing and a horizontal aesthetic chosen which has resulted in heights being been kept to a minimum wherever possible.

3.6 THE ALTERNATIVES

In order to reflect on the alternatives the following for options were explored. Each of these options identifies, with bullet points, the pros and cons with a preceding summary conclusion for each of the options.

In the diagram corresponding to each option there are four blocks, which represent the four primary buildings

No. 10 is the Administration and Laboratory block, which in the proposed scheme is the frontispiece building with the more elaborate façade and architectural language. Each building thereafter is more simplified in architectural articulation and more industrial in appearance.

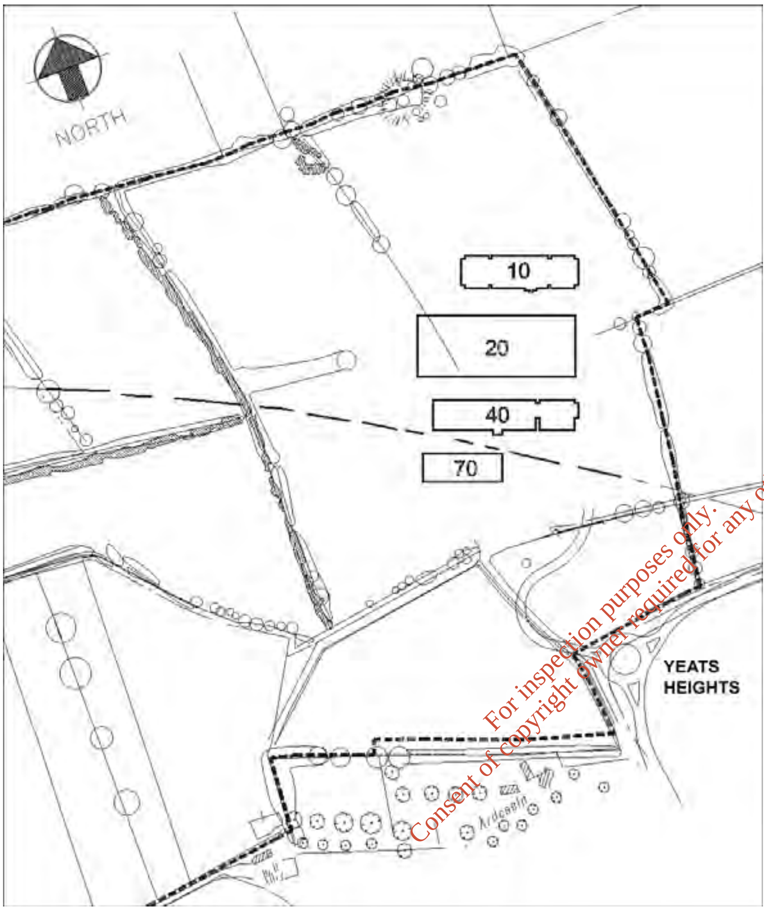
No. 20 is the Secondary Manufacturing building where finished pharmaceutical products are made for the marketplace.

No. 40 is the Bulk manufacturing building where the active ingredients are made for the finished pharmaceutical products.

No. 70 is the Utility building where all the primary services are located which support the buildings; i.e. boilers etc.

3.7 OPTION 1 REVERSE SITING OPTION

Here each of the buildings have been sited in reverse but the orientation of each of the facades kept as they have been proposed. This option results in a sub-optimal building layout.



Pros

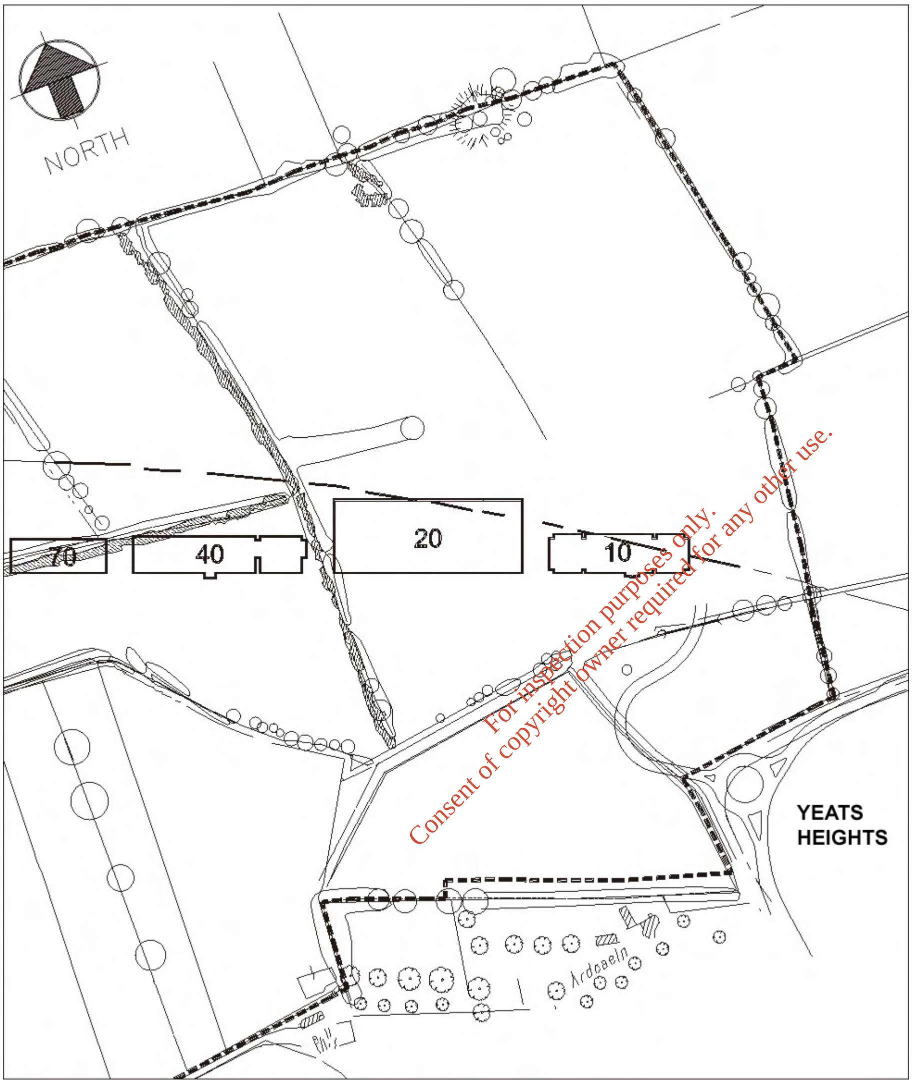
- None

Cons

- The development would be compromised contextually or otherwise.
- Industrial structures too close to residential developments and the town.
- Closer nuisance and noise to residents.
- Screening of the more agreeable "public faced" building which would be sited at the "rear of the site"

3.8 OPTION 2 WITH THE CONTOURS SITING OPTION

Here each of the buildings is sited side by side with the orientation of each façade as proposed. This option results in a more “elongated” solution and conveys a larger development with a non-complementary continuos façade; i.e. each façade with a different language as a consequence of the corresponding building function.

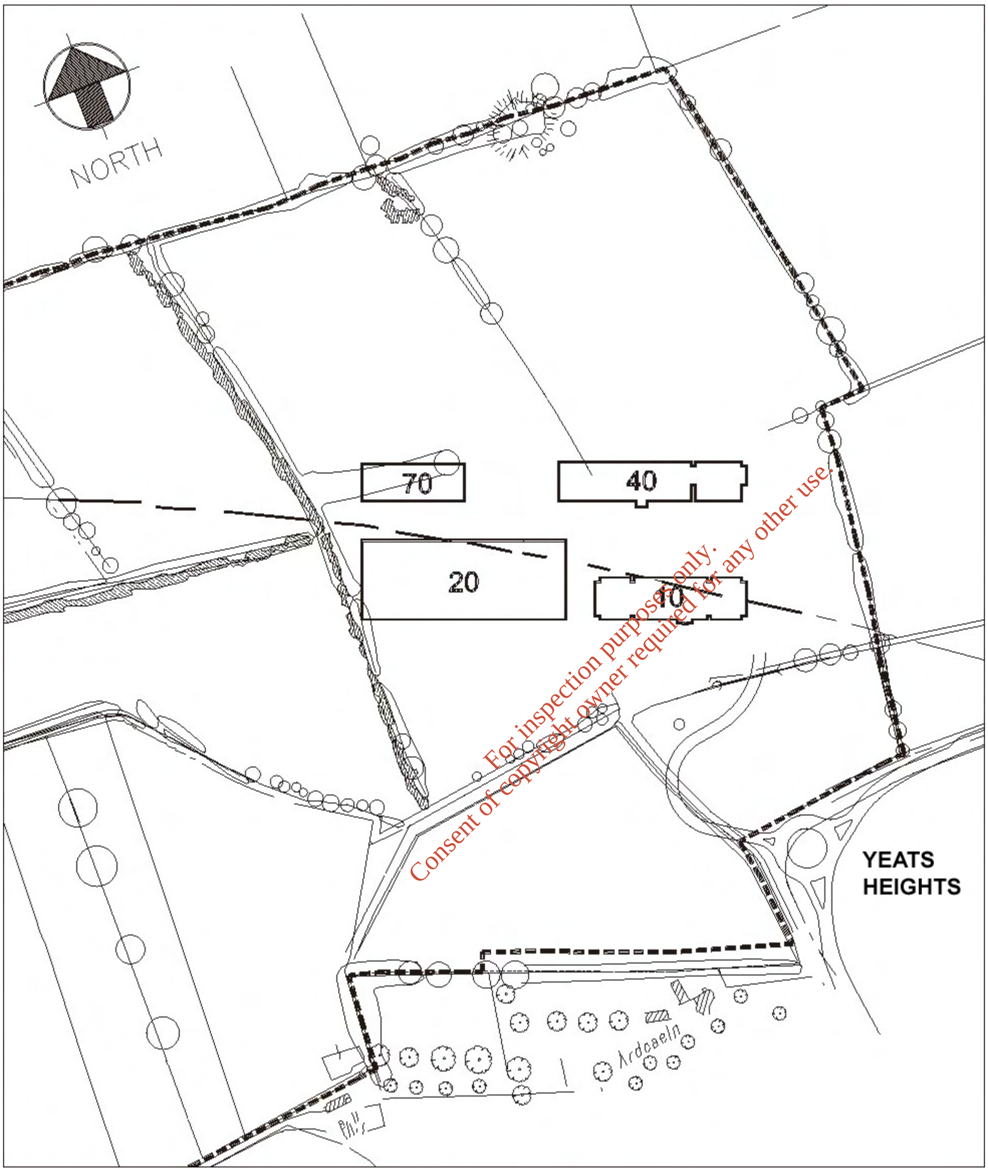


Pros
- None except modular expansion northwards

Cons
- A more apparent and imposing façade of all four structures
- No contextual or natural screening by corresponding buildings
- Geotechnical difficulties in some of the ground conditions

3.9 OPTION 3 PAIRED SITING OPTION

Here each of the buildings have been paired with orientation of each façade as has been proposed. Circulation and servicing of these buildings would become difficult and the language of the more public faced building lost against that of its more industrial neighbours.



Pros

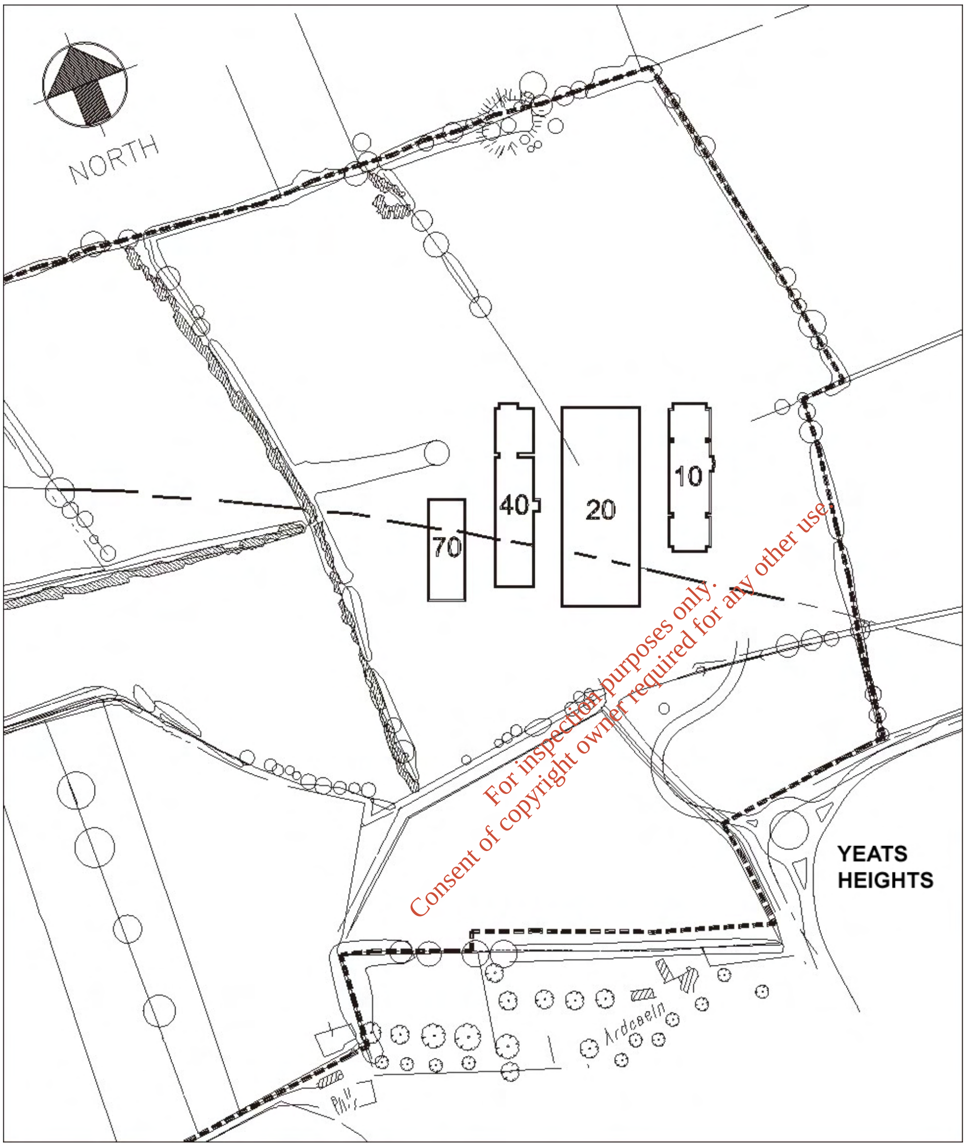
- None

Cons

- A confused industrial face represented by the different facades
- The "public face" is compromised
- Technical and circulation difficulties for each of the structures
- No contextual or natural screening of the buildings

3.10 OPTION 4 EAST TO WEST ORIENTATION OPTION

Here each of the buildings are sited on the same axis but at 90^{O} to that proposed. This has a “backs to the town” affect if the principal faces were to face east and a more visibly exposed aspect of the more industrial elements and structure which would end up in east.



Pros

- None

Cons

- An ends on aspect with no façade or face to the public.
- No complementary façades visible from the primary sight lines
- No contextual or natural screening of the buildings
- Servicing of each building would become complicated
- Geotechnical difficulties in some of the ground conditions

3.11 ALTERNATIVE PROCESSES

The company have investigated the use of alternative solvents and raw materials during the synthetic process but as yet have been unable to determine alternatives that produce the same active ingredients to the required standards. These matters are under continious review and such reviews will form a normal part of IPC Licence renewal with the EPA.

CHAPTER 4 – PROJECT DESCRIPTION

4.1 INTRODUCTION

This chapter provides a comprehensive project description of the proposed site layout and the manufacturing processes and products to be used. The approximate quantities of materials and natural resources used as well as the quantities of waste materials generated, are also described. Finally, an indication of the likely duration and effects of construction activities is provided.

In addition to this general project description, each subsequent chapter provides a description of relevant project characteristics for the particular environmental topic under consideration.

4.2 THE DEVELOPER

4.2.1 Abbott Company History

Abbott Laboratories is one of the world's leading health care companies with a worldwide manufacturing and distribution network for its products. It was founded more than a century ago, in 1888, when Dr Wallace Abbott, MD began making a new form of medicine in Chicago. Using the active part of medicinal plants, he formed tiny pills, called "dosimetric granules", which provided a precisely measured amount of drug. He thus became a pioneer in the new science of pharmaceutical medicine. Within two years, the demand exceeded the needs of his own medical practice, and a manufacturing business was established. In 1915, the company changed its name to Abbott Laboratories and since then, the company has grown steadily through development of new products, joint ventures and acquisitions. Today Abbott has operations in more than 50 countries and sells its products in more than 130 countries. It mission is to provide quality healthcare, worldwide, Abbott Laboratories is involved in the following five broad business areas:

Nutritional Products:
The company makes adult, infant and medical products to provide balanced nutrition for healthy development as well as the restoration of physical health after medical treatment. It is the world leader in scientifically formulated nutrition.

Pharmaceutical Products:
Wall Street and stakeholders considers pharmaceuticals as the core strength of Abbott Laboratories. This proposed development is a compatible with Abbott's manufacturing strategy. Abbott's pharmaceutical products include anti-infective, cardiovascular, neuroscience, hormonal and anti-ulcer drugs. The range includes one of the world's best-selling antibiotics, a treatment for AIDS and products to treat migraine, epilepsy and manic depression.

Diagnostic Products:
Abbott is the world leader in the business of in-vitro diagnostics – the laboratory testing of body fluids. They developed the first AIDS test in 1985, and are a leader in testing for HIV infection, hepatitis and in blood glucose self-testing for people with diabetes.

Hospital Products:
The company offers a full range of anaesthetics, injectable drugs, infection-control products, diagnostic imaging agents, IV Solutions, drug-delivery systems and other medical speciality products for hospital, clinical labs and alternate health care sites around the world.

Speciality Products:
The company also manufactures a range of speciality products, which are used as key raw materials for their pharmaceutical products, or in final active pharmaceutical ingredients.

The company now has approximately 70,000 employees world-wide and has annual sales of over US $17 billion.

The company has a strong commitment to environmental protection and the Corporate Environmental policy, signed by the chief Executive Officer is applicable to all Abbott operations world-wide. This environmental policy, which charts the environmental course for manufacturing operations, is reproduced at the end of this chapter.

4.2.2 Abbott in Ireland

Abbott Ireland is a major overseas subsidiary of the company, with its headquarters in Sligo. It has three manufacturing locations in Sligo, one in Donegal and one in Cootehill, County Cavan. Employment has grown from an initial 20 in 1975 to the present level of over 1600.

All of the products manufactured in Ireland are exported and distributed throughout the world. Indeed the current expenditure in the Irish economy on wages, raw materials and services is more than IR£75 million per annum.

The Abbott Ireland plant's and their products are as follows: -

Sligo(Ballitivnan): Established in 1974 for the manufacturing of hospital products. It now employs approximately 700 people in the manufacturing of catheters, infusion sets, and other devices made from extruded and moulded plastics for the administration and delivery of nutrition and anaesthetics to patients. The headquarters for Abbott Ireland is also located on this site and employs an additional 25 people.

Sligo (Finisklin): The Abbott Ireland Pumps Plant has been in existence since 1993 and now employs approximately forty people. This plant is engaged in the servicing, repair and re-manufacturing of computer aided pumps that electronically control delivery of nutritional, hospital-related and pharmaceutical products.

Sligo (Finisklin) The Abbott Ireland Diagnostics Division was established in 1994 to provide an international manufacturing site for production of bulk reagents used in Abbott's diagnostic analysers. This plant manufactures solution formulations for the diagnostic analysers and employs approximately 250 people.

Cavan (Cootehill): This plant was established in 1974 and manufacturers a range of nutritional infant formulae under the brand names “Similac” and “Gain”. The products are made from locally sourced skim milk, and direct employment in the plant is 150 people.

Donegal: (Donegal Town) : The plant commenced operations in 1980 and since then has grown steadily. It now employs 550 people in the production of a variety of suction disposal sets and intravenous administration devices.

4.3 GENERAL PROPOSAL

4.3.1 Reason for Development

Abbott Laboratories has a very strong research team currently focusing on the critical therapeutic areas of oncology, neurology and urology, indeed 75% of the products in the Abbott pipeline fall into one of the above categories. Currently the company does not have a manufacturing facility dedicated to the production of these compounds and as such it has decided to construct a new facility in Ireland to support the manufacture of these new products.

The proposal is to construct this new facility for the manufacture of a wide range of active pharmaceutical compounds by using standard synthesis routes together with formulation, tabletting and encapsulation supporting facilities.

The Plant will be used to manufacture a wide range of pharmaceutical products in small quantities.

The maximum capacity of the proposed bulk plant in terms of isolated compounds, is approximately 2500 kgs per year. The secondary facility will be able to process 2500 kgs per year.

4.3.2 Product Range

The types of active pharmaceutical compounds which the company plans to manufacture include the following,

▪ Rubitecan	Oral cancer therapy
▪ CisAtracurium	Neuromuscular blocking agent
▪ Atrasentan.	Oral cancer therapy
▪ Uprima	Male erectile dysfunction

Atrasentan will be formulated into soft elastic capsules, Rubitecan into hard gelatin capsules and Uprima into a tablet. Cis-Atracurium will be placed into specific containers and shipped off-site to another Abbott manufacturing facility for formulation into vials.
(See Section 4.8 for more detailed typical product description)

The processes are operated in batch production mode and the equipment used to manufacture these pharmaceutical products and intermediates are standard designs for the industry and consist of reaction, extraction, purification, crystallisation, isolation and drying equipment.

The flexible nature of the manufacturing plant will permit the company to manufacture new products apart from those specified above. Process development and scale-up will be performed in an Abbott development centre outside of Ireland before transfer of any new process to the Sligo plant. Before a new product or process is introduced, hazard and risk assessment studies will be carried out to ensure safe operation.

However, Production will be limited to the manufacture of drug compounds using the general processes and in the equipment outlined in this report. Each proposal to manufacture new categories of products or significantly change the manufacturing processes or the nature and quantity of the raw materials would be the subject of an application to the Environmental Protection Agency for an amendment to the IPC Licence.

4.3.3 Abbott Environment Corporate Policy

INTRODUCTION

It is the purpose of this policy to:

A. Establish the company's environmental values and ideals;

B. Guide all employees in addressing environmental issues and assessing the environmental impacts of their operations; and

C. Demonstrate environmental commitment to the company's stakeholders and other interested parties.

POLICY STATEMENT

I. Scope
This policy applies to all operations and employees of the company worldwide.

II. Commitments

Each of the company's operating areas shall:

A. Conduct its operations in compliance with all applicable environmental laws, regulations, permits, licenses, approvals and orders;

B. Promote and implement environmental management practices and programs which help to protect human health and the environment;

C. Make continuing efforts to reduce or eliminate waste and the release of pollutants into the environment, to conserve resources, to reuse and recycle materials where feasible at every stage of the product life cycle, and to reduce, eliminate or change the use of materials or practices as appropriate which may affect human health and the environment;

D. Promote appropriate environmental training and education of employees to ensure execution of this policy;

E. Seek opportunities to participate in the development of environmental legislation, regulation or policy that may significantly affect the company's operations, and work with appropriate governmental authorities to develop technically sound and financial responsible solutions to environmental issues;

F. Continually assess operations and significant transactions to limit potential liability, to ensure continued compliance, and to develop and maintain good relationships between the company and the communities in which it operates.

III. <u>Responsibilities</u>

Managers have the primary responsibility for compliance of their operations with this policy within their respective functional areas and authority limits. Managers are expected to communicate this policy to all their respective employees and to establish programs as necessary to ensure its implementation.

Employees who are unsure of the regulatory implications of their actions or decisions are expected to seek guidance from their managers or environmental professionals within the company. Employees who become aware of an event or condition which has environmental implications are responsible for advising company management.

All employees are responsible for compliance with all environmental policies, procedures, practices and rules of the company applicable to their assigned duties and responsibilities.

Fig 2 General Aerial View of the proposed facility from the south east. The Administration and Laboratory building, with associated employee and visitor parking, is in the foreground. The next building is the Secondary Manufacturing building with the Bulk Manufacturing Building beyond. At the rere can be seen the Utility building with associated tanks and storage areas.

4.4 SITE LAYOUT

4.4.1 Building Functions

The development will consist of three main buildings and a number of ancillary structures The first building (Building A) will have a plan area of 1610m^2 and a uniform height of 11.2m above ground level. This will hold the office accommodation, canteen and laboratories. The second building (Building B), with a plan area of 4134m^2 and a uniform height of 11.2m above ground level, will be mostly single storey and will accommodate the tablet and hard gel manufacturing suites, the soft elastic manufacturing suite and the finished product warehouse.

The third building (Building C) with a plan area of 1870m^2 and a uniform height of 16.2m above ground level, will be a two storey construction and will contain the active pharmaceutical ingredient production equipment and the bulk materials warehouse.

The active pharmaceutical plant will be split into a number of cells, or suites, with each suite operating independently and provided with separate gown in and gown out rooms and technical service areas. The product contact equipment will thus be separated from the service equipment. In general the operating environment will be a standard Class VII or “shirt sleeves” designation.

Like most modern pharmaceutical production plants there will be a general downwards flow of materials to make maximum use of gravity flow thus minimising the need for pumping. Many of the reaction and distillation vessels will be mounted so that the top part is accessed from the floor above and the bottom part from below.

To the north of building C will be the bulk storage tanks which will be linked to the production area of buildings B and C by a pipe-bridge. These tanks will be used for storing common liquids such as dichloromethane, methanol, oil for the boilers, liquid nitrogen for purging pipes or vessels and water. The area will also house the waste aqueous and organic bulk storage tanks.

In the area between the building and the bulk tanks will be a combined sprinkler-process water reservoir and associated pump house, an emergency power generator, fuel oil storage tank, cooling towers and air emission abatement systems.

Access to the site will be via an entrance at about the same location as the existing entrance to Marlbrook House (in ruins). The main internal road will run parallel to the east side of the buildings with various ‘side’ roads giving access to the buildings and other structures including the car park.

4.4.2 Architectural Considerations

The plant will be completed in up to three phases commencing with bulk manufacture and Quality Assurance/Quality Control and Administrative facilities, followed by Secondary manufacture.

Materials and General Building Description

The general aesthetic principals for the design, form and colouring of the buildings are a contextual and sympathetic approach to the rural surroundings where this building is located. In addition, it is appreciated that this is an "edge of town" development an adjacent to the site, on high' is a private housing development that would look down on to the site.

Three of the four main buildings, i.e. the Administration and Laboratory, the Secondary manufacturing and the Bulk manufacturing buildings will all be constructed with metal cladding wall construction coloured silver to manufacturer's specification. The roof will also be a metal sheeting material, which will be coloured green. Glazing will be coated metal frames with double-glazing.

The fourth building, the Utility (energy centre) building will be a concrete render and block work construction finished in render and painted in a colour that would match the metal clad buildings. In addition there will be small ancillary buildings such as firewater pump house, security building and other structures, which will be rendered.

Siting

All of the buildings have been sited over the rising contours of the site and each elevation and form of the building sited on corresponding levels that would give the optimum elevation appearance. For this reason some areas have been excavated and that volume of removed earth used to suspend the buildings in elevated positions complimentary with site lines and the general horizon lines in the background.

All buildings will have vehicular access from all sides therefore facilitating the day to day activities of deliveries and despatches and the infrequent and hopefully unlike event of emergency vehicle access, i.e. fire engine etc.

The site will be landscaped to minimise the impact of the buildings on its surroundings and will complement the proposed new roundabout and associated roadside planting. The site will be accessible and linked via a new roundabout and roadway to the south of the site at the foot of the Yeats Housing Development. In the next stage of detail design there will be close consultation with the Roads Authority to complement the proposals being made for the area south of the site.

Materials

In principal three buildings, the Administration and Laboratory, the Secondary manufacturing and the Bulk manufacturing buildings will be concrete cased steel-framed structures with metal pan and concrete filled floors. The roofs to these buildings will be metal trussed, metal finished outer skin structures with integrated insulation and vapour barriers.

The Utility building will be of similar frame construction, but as stated before will be concrete block work walls and external render fish. The roof construction will be a built up and insulated finish on a permanent metal pan and concrete filled roof incorporating insulation and a vapour barrier and will be laid to a gentle fall.

4.5 CONSTRUCTION AND COMMISSIONING PROGRAMME

A geotechnical survey of the property has been carried out and the results confirm that the area selected for the proposed development is suitable for construction using conventional techniques. It is not anticipated that piling or rock blasting will be needed and there are no standing structures requiring demolition. Construction of the development is expected to commence in late 2001 and it is projected to take almost two years to complete.

Construction of the site access road will be the first task and this will involve bringing fill material to the site to build up the access road to the required level.

The next stage will involve earthworks, lasting for about three months, to prepare for the excavation and laying of building foundations. The extent of earthworks will be limited and rather than have a uniform level across the site, it will be stepped. There will be a difference of about 2.5m between ground level at building A and ground level at building B and again between building B and C. The difference in level between building C and the bulk storage tanks to it's rear will be between 3 and 4m. Stripped soil will be stored on-site for reuse in the landscaping programme to provide the site with aesthetically pleasing features and to blend in with the landscape.

On completion of the earthworks and excavations, construction of the buildings and ancillary structures will commence. The three main buildings will have steel frames to which will be fixed an insulated architectural cladding. Erection of the building frames and fixing of cladding will take about three months. The remainder of the construction period will involve concrete works (floor slabs, bases etc.), architectural fit-out, installation of electrical and mechanical services and processing equipment.

Employment numbers will vary throughout the construction phase depending on the tasks involved and will peak at about 150. General construction workers will be recruited locally if possible. Some tasks can be only undertaken by specialist contractors with the necessary staff skills and expertise. These workers will stay in local rented accommodation or in B&B establishments. There is a long history of travel-to-work in the Irish building industry and so the demand for local accommodation will not be significant. Construction site working hours will normally be 08.00 to 17.00, Monday to Friday and 09.00 to 13.00 on Saturdays. Occasionally longer hours will be worked for some speciality tasks which need to be completed in as short a time as possible.

The access roads to be used for the delivery of construction materials such as steel, timber, cement, pipes, fill, sand, hardcore etc., will depend on the successful suppliers. Based on experience at Abbott Ireland's recent extension, about 50% of materials will arrive from the Sligo Town direction and 50% from the Manorhamilton direction. The same will apply to the delivery of plant and equipment which will be installed in the buildings. There will be a small number of deliveries of equipment categorised as slow moving 'wide loads'. As far as practicable these will be scheduled to arrive at the site outside of peak traffic hours on local roads.

Access to the site will be controlled for security and health and safety reasons. Abbott Laboratories has a program on contractor safety and is enforced. The construction site will be fenced and there will be separate secure contractors compound for storage of building materials and equipment. Space will be provided on-site for construction workers cars, vans and trucks.

Any significant pipelaying associated with the project will take place within the Abbott Ireland owned property.

Control of emissions during the construction phase are discussed in chapters five to eight.

The estimated capital cost for the initial phase of the proposed development is IR£45 million.

The project is currently scheduled as follows

Commence Construction	Q4	2001
Complete Construction	Q4	2002
Commission Processes	Q2	2003

4.6 UTILITIES

4.6.1 Electrical Supply

The 38 kV ESB sub-station at the existing Abbott Ireland site will be used as the power source for the proposed development. It will be linked to the new site by cables carried on standard timber poles. Within the site power cables will be laid underground. The total demand for power is projected at 2 MW.

4.6.2 Water

Water Supply

The water supply to the site will be from the Sligo Corporation public supply main (300 mm diameter) which runs near to the development site. The estimated demand for water is 40 m^3/d and the main has the capacity to deliver this volume.

Water Storage

Abbott Ireland will provide a mains and firewater storage tank with a capacity of 1058 m^3. About 900 m^3 of this will be permanently in reserve for the fire sprinkler system and ring main. Sprinklers will be installed in the buildings as appropriate. The reservoir will be located at the north-eastern corner of the proposed development.

Cooling Water

Two cooling towers, to be located north of building C, will be provided. They will be outdoors and at ground level. The system will normally operate with both towers on 'low' duty but if one needs to be removed from service the other can satisfy the cooling load demand by operating on 'high' duty.

Water

The manufacturing of quality pharmaceuticals demands the use of purified and distilled water. The standard water used in the plant will be designated as purified and will go through a series of purification steps prior to use in the plants.

4.6.3 Steam

Two gas oil fired steam generating boilers will be located in the energy centre. These will provide steam for process use. They will normally operate on a duty-standby basis but can operate together if an exceptional demand arises.

4.6.4 Oil Storage

A single gas oil storage tank will be located to the north of building C. It will be surrounded by a concrete bund to contain any spillages. In addition, Abbott Laboratories has internal requirements that demands that the tank, valves, and piping are engineered designed to prevent leaks and if such an occurrence does occur, is engineered to alarmed and contained. In addition, company designed procedures will be in effect to ensure that off-loading of gas oil from tankers are accomplished in an environmentally sensitive manner.

4.6.5 Site Lighting

External lighting will be kept to the minimum consistent with the requirements for safety and security. The system has been designed so that over-spill of lighting in the evening beyond the site boundaries has been minimised.

4.6.6 Drainage

Foul Sewer

Process and sanitary waste water will discharge to the Sligo Corporation foul sewer a short distance (380 meters) south-west of the site. This is a 300mm diameter pipe and has ample capacity to accept the waste water. The materials of construction will ensure that leakages of wastewater from site operations will not occur.

Storm Water

Storm water will discharge to the stream which passes through the site. The capacity of the stream is determined by a culvert which passes under the Ballytivnan Road and another culvert downstream of this. It will be necessary to regulate the volume and quality of storm water discharged from the site and so a detention pond with a flow restriction will be provided. Parking area run-off of stormwater will utilize a oil-water separator to ensure that oil does not enter the receiving stream.

4.7 RAW MATERIALS AND STORAGE

The facility will utilise a limited range of raw materials, some of which will be delivered and stored in bulk, the fixed storage tanks will be bunded. Where appropriate, the development will utilise tanks, valves and piping engineered to prevent leaks of bulk raw materials and company required procedures to ensure that bulk raw materials remain in their containers or in engineered designed secondary containment.

The volumes stored are based on the production of approximately 7kgs per day of finished products, are listed in Table 4.1.

Raw Material	Description	Storage
Dichloromethane (DCM)	100% methylene chloride	30m^3

Table 4.1 Volumes of Principal Raw Materials to be Stored

There will be storage of other solvent and liquid reagent materials in smaller containers and dedicated IBCs (intermediate bulk containers). Methanol will also be stored in an IBC. These will be contained in specifically designed storage areas designed for containment until retrieved for use. Company procedures will require periodic inspection.

Solid materials such as sodium hydroxide and sodium sulphate will be delivered in bags (probably 10 to 20kgs). Similar to the solvent and liquid reagent storage areas solids will be contained in specifically designed and assigned storage areas until retrieved for use. Company procedures will require periodic inspection.

A number of smaller tanks will be located in the buildings for use as day tanks and check tanks for raw materials, in the range 0.2 to 1.0 m^3.
Any liquid spills will be contained and either pumped to a holding tank for disposal to the sewer to collected for off-site disposal by government-authorised contractors.

Dry cleaning techniques will be used for spills of solids and the collected material will be disposed of off-site by authorised contractors.

4.8 PROCESS DESCRIPTION

All the proposed production processes are relatively simple, consisting of a one or two reaction steps followed by a solvent extraction recovery step carried out in glass-lined or stainless steel pressure vessels and then several purification steps using chromatography columns. The final isolation and drying will be carried out using closed drying equipment.

The following general description illustrate the steps by which four typical products are produced. These descriptions are provided to illustrate the types of manufacturing processes that are proposed. The details of the processes for individual products will be provided to the Environmental Protection Agency (EPA) for approval and Integrated Pollution Control Licensing prior to the commencement of operations.

4.8.1 Rubitecan

Reaction Step
The raw material, a pharmaceutical organic intermediate, sulphuric acid and potassium nitrate are charged into a reactor. The mixture is then agitated until the reaction is complete.

Recovery Step
The crude product is first dissolved into DCM and then washed with water to remove unreacted materials and impurities.

Purification Step
The product is extracted using THF/DCM in chromatography columns. The quality fractions are collected in product receivers whilst the impure organic fractions are transferred to bulk storage for further treatment.

Distillation Step
The quality fractions are distilled and the THF/MDC is replaced by acetone/IMS.

Isolation/Drying Step
The Rubitecan is crystallised out of acetone/IMS, filtered , washed with IMS, dried and then packed off into 500gm containers.

Formulation
The API will be charged to a dissolution tank, mixed with a number of excipients then filled into hard gel capsules.

4.8.2 Cis-Atracurium

Reaction Step
The raw materials, pharmaceutical organic intermediate, toluene and are charged into a reactor. The mixture is heated and agitated until the reaction is complete.

Recovery Step
The crude product is then washed with toluene to remove un-reacted materials and impurities and then diluted with DCM.

Purification Step
The product is extracted using methanol/benzene sulphonic acid /water/DCM in chromatography columns. The quality fractions are collected in product receivers whilst the impure organic fractions are transferred to bulk storage for further treatment.

Distillation Step
The quality fractions are distilled and the methanol/water/DCM is replaced by diethyl ether.

Isolation/Drying Step
The CisAtracurium is crystallised, filtered, washed with diethyl ether, dried and then packed off into 500gm - 2kg containers for formulation off-site.

4.8.3 Atrasentan

Reaction Steps
The raw materials, pharmaceutical organic intermediate , THF, potassium carbonate and dibutyl bromoacetamide are charged into a reactor. The mixture is then agitated until the reaction is complete.

The crude intermediate is further reacted with, ethanol and caustic to form the Ester derivative.

Recovery Step
The crude product is first dissolved into ethyl acetate and then washed with dilute HCl to remove unreacted materials and impurities.

Distillation Step
The product is filtered to remove any impurities and the ethyl acetate distilled off under vacuum, then redissolved into ethyl acetate.

Isolation/Drying Step
The Atrasentan is crystallised, filtered , washed with ethyl acetate, dried and then packed off into 500gm -- 2 kg containers.

Formulation
The API will be charged to a dissolution tank, mixed with a number of excipients then filled into soft elastic capsules.

4.8.4 Uprima

The API is received as a raw material, blended with a number of excipients then compressed into a tablet form of varying strengths.

The processes will be monitored and controlled by a computer based system which will give continuous information to the operators and supervisors about all aspects of the process. Typically, the information provided includes tank and vessel liquid levels, temperatures, pressures, the status of valves (open or closed), mixers/agitators (on or off), pumps (running or off) and flow rates. The system is backed up by in-process sampling and analysis of reaction mixtures and the purification stages by laboratory staff.

CHAPTER 5 – HUMAN BEINGS

5.1 INTRODUCTION

This chapter considers the impact of the proposed development in the context of population and settlement, land use, employment and other impacts of a social and economic nature. In terms of human beings, the types of issues which developments such as this raise (both during construction and operation) include: impacts on amenities and services in the area; additional economic opportunities; increased traffic; and impacts on existing land uses.

5.2 PLANNING AND DEVELOPMENT CONTEXT

The boundary between the administrative areas of Sligo Corporation and Sligo County Council passes through the development site. Although most of the proposed development's structures will be within the County area, the access road and other ancillary items will be within the Corporation area. The two development plans are therefore relevant to the planning permission application.

The Corporation Development Plan map indicates that part of the lands in their area are zoned for industrial development and the other part has no zoning. The County plan indicates that no zoning applies to their area. This means that any planning application for any development in the non-zoned areas will be judged on its merits and nothing is precluded.

The other zonings in the vicinity (Corporation Plan) are 'Community Facilities' to the south of the site (FAS, Regional Technical College and former SLDMH grounds mainly) and 'Housing' to the west and south-west (including Rathbraghan Estate) and to the south-east (including Yeats' Heights). Yeats' Heights is a modern development comprising some fifty residences.

The aims and goals of the County Development Plan include (section 2.15):-

- To stem population movement from areas of population decline by improving the quality of life and the provision of increased employment opportunities

- To encourage and foster the development of the economy of the County i.e. agriculture, industry, commerce, tourism, fishing and amenity etc. by ensuring the availability of the infrastructural facilities to meet increased demands

Section 3 of the Plan notes (at 3.2.5 Land Use):-

While the Council recognises that the economic potential of the County depends heavily on the success of state agencies and on private developers, it nevertheless acknowledges the fact that the responsibility for the foundations of economic growth must be laid by the public sector in the provision of infrastructure.

It is an objective of the Council to facilitate the development of centres of employment by endeavouring to provide sites and services for industrial use as they are required and housing sites planned in relation to industrial locations.

In all industrial developments proposed in the county or contiguous to the county, it is policy of the Council as custodians of the public interest to ensure that specialist advice is obtained so as to ensure that the impact of industrial development on the environment can be combined with such other considerations as urbanisation, agriculture, education, leisure and tourism.

Section 4 of the Plan notes (at 4.7 Industrial and Commercial Development):-

Industrial developments will be required to satisfy minimum conditions with regard to layout, access, design and landscape. Sufficient car parking for employees and visitors, loading and unloading facilities and adequate circulation areas within the curtilage of the site should be provided. Effective screening from the public road, residential areas or open space will be required where it is considered necessary by the Planning Authority and the developers will be required to keep at least one third of their site free from development and must be compatible with the conforming use in the area and must not materially detract from the existing amenities.

The Plan contains numerous references to the importance of tourism and the need therefore to protect the County's natural amenities and its cultural heritage.

5.3 EXISTING ENVIRONMENT

5.3.1 Population

Although unemployment rates have fallen in recent years, Sligo County still has significant numbers of male and female unemployed. The population is growing slowly as can be seen from the recent census results. In 1991 it was 54,756 and this had increased to 55,821 by 1996 - a net increase of 1.9% compared with an increase of 2.8% for the state.

Between 1991 and 1996, Sligo Rural District (RD) and the Municipal Borough showed an increase in population of +4 and +2.8% respectively. Tubbercurry, Dromore West and Boyle No. 2 RD's showed population decreases of -0.7, -0.1, and -3.5% respectively. The population of the Borough now stands at 17,786.

5.3.2 Employment

The 1996 census indicated that 20,204 persons were employed and that 2,790 were unemployed in County Sligo. The corresponding data for 1991 were 17,992 and 3,127 persons respectively. In the case of the Municipal Borough, the relative proportion of employed to unemployed differs significantly from the County as a whole. In 1996, 6,805 were employed but 1,207 were unemployed, giving a higher rate of unemployment in Sligo MB. A similar situation was found in 1991 (5,815 employed and 1,191 unemployed) however the rate of unemployment has decreased.

5.3.3 Landuse and Amenities

Land use is described according to the predominant activity in various sectors, moving in a clockwise direction starting at the north shore of Sligo Harbour.

The sector from the north shore of Sligo Harbour (west of property) to just south of the R286 (south-east of property) is a low-lying undulating landscape, with hills rising to between 40 m and 60 m. Looking to the north the slopes of Benbulbin are readily visible, while to the east and north-east the ground starts to rise towards Keelogyboy Mountain, Crockauns and Cope's Mountain, the lower slopes of which are afforested. Colgagh Lough, a medium sized lake, occurs to the south-east of the property just at the edge of the survey area. The area is traversed by a network of roads - two national primary roads, the N15 and N16, two regional roads, the R286 and R291, and a network of third class roads. All the national and regional roads converge on Sligo town.

By far the predominant land use in this sector is grass based agriculture. The grassland is mostly improved and utilised for both dry stock (sheep and cattle) and dairy farming.

Some damp to wet pasture fields with rushes occur throughout, an example being at Bellanurly in the north-east. The majority of the fields are bounded by hedgerows. Dispersed housing occurs regularly along the roads throughout the agricultural areas, with occasional concentrations of houses such as along the west and south arms of the Carncash Crossroads.

The Garavogue River, a short river channel which leads from Lough Gill to the sea, occurs in the south-eastern sector of the survey area. This channel is surrounded on both sides by mostly semi-natural woodland of the Hazelwood Demesne and Cleaveragh Demesne. The channel and woodland is of high conservation importance being within the Lough Gill proposed Candidate Special Area of Conservation. The area also has amenity value.

Sligo Town occupies the entire south-west sector of the survey area, extending from west of the Cleaveragh Demesne to the Finisklin area on the south side of Sligo Harbour, and then north of the river as far as the present Abbott Ireland complex and St. Columba's Hospital.

The western sector of the survey area comprises the extreme inner part of Sligo Harbour. There is a permanent deep channel leading to Sligo quays - this channel continues through the centre of Sligo town and merges with the Garavogue River. This estuarine area has commercial use by way of shipping activities but also high nature conservation value (designated as a Special Protection Area (SPA) and as a Candidate Special Area of Conservation (CSAC)).

Specific landuse features include; an organic farm situated at Tonaphubble, just south of Cleaveragh, artificial insemination bull station at Doonally - situated approximately 2 km north-east of property, Cleaveragh Racecourse - situated in the south-eastern sector of Sligo town (which is also used for point-to-pointing and athletics) and a pitch and putt course - Lisnalurg, about 1 km north-west of the property.

5.4 IMPACTS FROM PROPOSED DEVELOPMENT

5.4.1 Population and Housing Demand

It is not possible to accurately predict where employees of the proposed development will reside but based on employment patterns in the existing Abbott Ireland plant it is likely that employees will reside within a 20km radius. Initially 50 people will be employed and this will rise to about 150 over 6 years. Given that the increase in employment will be gradual and employees are likely to be dispersed over a wide area throughout Sligo it is not expected that there will be any noticeable increase in population and housing demand which is directly attributable to the proposed development.

5.4.2 Employment and Economic Activities

Initially up to 50 will be employed and this will increase to about 150 over the following six years. About twenty will be employed in production activities and the remainder in management, supervision, quality assurance, technical services, administration and support activities. The production staff will work on a shift basis seven days per week while the other staff will work standard office hours, Monday to Friday. It is envisaged that all staff will require a minimum of second level education standard and there will be a requirement for a significant number of staff with third level educational standard. Services such as security, catering and ground maintenance will be provided by specialist local contractors.

The proposed development will operate independently of the existing Abbott Ireland, Sligo facilities It will have its own workforce and management and all necessary support services (water, power, energy, telecoms, drainage warehousing, transportation and access) will be provided at the site.

5.4.3 Services and Amenities

Apart from the site itself which is currently used for grazing there will be no significant adverse impacts on local amenities as a result of the proposed development.

The development will connect directly to the N16 Sligo - Manorhamilton Road and will increase the overall traffic loading. Sections of this road are presently being upgraded and further sections will be upgraded in the near future. Whilst additional traffic will be generated by the proposed development (especially during the construction phase) it is not anticipated that there will be significant impacts on human beings. The section on traffic gives full details of traffic impacts.

5.5 MITIGATION MEASURES

As no significant impacts on human beings are anticipated, no mitigation measures are proposed or required. Specific mitigation measures set out in other sections of this EIS will all ensure that indirect effects on human beings are mitigated.

CHAPTER 6 - FLORA AND FAUNA

6.1 INTRODUCTION

This chapter of the Environmental Impact Statement (EIS) examines the impacts of the proposed development on flora and fauna of the site and the surrounding area. It is based on a review of the ecology report prepared for the previous EIS by the same ecologist, which has been updated to take account of any recent legislative changes and other changes. It has not been considered necessary to undertake a new site visit as the landuse is still the same as previously and no part of the property is covered by a conservation designation or proposed designation nor is it directly adjacent to any area with such a designation.

The ecological survey was concentrated on the property that is proposed to be developed but some examination of the immediate surrounding areas was made in order to put the ecological interests of the property in context and to determine whether the development would have any impact on surrounding areas.

The habitats and vegetation types as well as terrestrial vertebrate fauna (i.e. mammals, fish, amphibians, reptiles and birds) occurring within the study area are described. A habitat map for the property is contained in Appendix A. The likely impacts of the development on the local flora and fauna are discussed and, where necessary, recommendations are made for amelioration of the impacts. Although only 21%, approximately, of the total Abbott Ireland property will be developed the entire property was examined to establish the baseline conditions.

6.2 OVERVIEW OF PROPERTY CHARACTERISTICS AND LOCATION

6.2.1 General

The Abbott Ireland property is located at the northern edge of Sligo town and approximately 1 km from the coastline at Sligo Harbour. It occurs at the divide between the developed urban land to the south and south-west and agricultural land, predominantly pasture, to the east, north and north-west. The existing Abbott Ireland facility adjoins the survey area immediately to the west and the former Sligo-Leitrim District Mental Hospital (St. Columba's) adjoins it immediately to the south. The northern boundary is skirted by a third class road and the Doonally River, a watercourse of substantial ecological interest. The N16 passes the south-east corner of the development site. While located within a largely urbanised and agricultural landscape, there are areas of high scientific interest and with conservation designations in close proximity to the property.

Within the property, the ground rises from less than 20 m in the south to approximately 40 m at the north-east. The property consists principally of improved pasture fields divided by mostly well developed hedgerows. Several wet fields occur in the south-west sector. A small stream, with good bankside vegetation, traverses the southern part of the property. A feature of some note is a calcareous spring at the former Marlbrook House.

6.2.2 Areas of Conservation Importance in Vicinity

Information on areas of conservation interest in the vicinity was supplied by the National Parks & Wildlife Service, Dublin.

No part of the property is covered by a conservation designation or proposed designation nor is it directly adjacent to any area with such a designation.

The property is, however, situated in the vicinity of areas with high scientific interests and which have conservation designations or proposed designations. Such designated sites within a radius of 3 km from the survey area are listed below under the various designations.

A. Candidate Special Areas of Conservation (CSAC) under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (commonly known as the Habitats Directive and implemented in Ireland by Statutory Instrument number 94 of 1997).

Cummeen Strand/Drumcliff Bay (Sligo Bay) (site no. 0627)
Situated approximately 1 km west of the property. A large coastal complex with five Annex I habitats - fixed dunes (grey dunes); marram dunes; estuaries; tidal mudflats; large shallow inlets and bays. Of these the fixed dunes are of particular note as they are a priority Annex I habitat. Also has two animals listed on Annex II of Directive - grey seal (Phoca vitulina) and the (Vertigo angustior).

Lough Gill (site no. 01976)
A large lake site with a well wooded shoreline situated to the south-east of the property (nearest point is about 1 km). Has three Annex I habitats - old oak woodlands; residual alluvial forests; natural eutrophic lakes. Of these the alluvial forest is of particular note as it is a priority Annex I habitat. Also has four animals listed on Annex II of Directive - three (Lampetra planeri), (Lampetra fluviatilis) the sea lamprey (Petromyzon marinus), and the freshwater crayfish (Austropotamobius pallipes).

B. Special Protection Area (SPA) under Council Directive 79/409/EEC on the conservation of wild birds (commonly known as the Birds Directive and implemented in Ireland by Statutory Instrument number 291 of 1985).

Cummeen Strand (designated on February 7, 1995; Statutory Instrument number 31 of 1995).
Situated approximately 1 km west of the property and encompassing much of Sligo Harbour. An estuarine site of sand and mud flats and fringe saltmarsh vegetation. Important arrival point for brent geese (Branta bernicla) in autumn and has an internationally important population of ringed plover (Pluvialis apricaria). Almost completely included in Cumeen Strand/Drumcliff Bay CSAC.

C. Proposed Natural Heritage Areas as nominated by National Parks & Wildlife, Dúchas-The Heritage Service.

Cummeen Strand/Drumcliff Bay (site no. 0627)
Proposed designated area is the same as that of the Candidate Special Area of Conservation (see A above).

Lough Gill (site no. 01976)
Proposed designated area is the same as that of the Candidate Special Area of Conservation (see A above).

Colgagh Lough (site no. 01658)
A medium sized lake set in limestone hills and situated approximately 3 km east-south-east of the property. Has interesting hydrological, sedimentological and zoological features.

Glencar Cliffs (site no. 0628)
A cliff site with notable rock outcrops and an interesting flora. Situated just over 3 km north-east of the property.

D. Ramsar Site under the RAMSAR Convention[4]

Cummeen Strand
Designated area is the same as that of the Special Protection Area (see B above).

6.3 SURVEY METHODOLOGY

The survey was carried out on December 11 and 12, 1997 in moderate weather conditions.

6.3.1 Ecological Survey

Principal habitat types present were identified and mapped by systematically traversing the entire Abbott Ireland property. Particular attention was given for the possible presence of habitats which are listed as of high conservation interest on the Habitats Directive. Similarly, searches were made for plants which are legally protected under the Flora (Protection) Order 1987, which has now been superseded by the Flora (Protection) 1999. A limitation to the botanical survey was the time of year, as a lower diversity of plants would be present than would be found in the summer period.

The property was searched for signs of vertebrate presence; emphasis was placed on vertebrates listed as protected species under the Wildlife Act, 1976 or species of high conservation interest as listed under the Habitats Directive. As many vertebrates tend to be far ranging or with large territories, some areas adjoining the property were also examined. For small or common species, the habitats present indicate species that are likely to be present (for example, field mice). Growth of dense vegetation in some hedgerows prevented full examination; care was taken to search for tracks and signs of larger mammals in these areas.

[4] *This convention is concerned with wetlands protection.*

Bird species utilising the property were noted. An assessment was made of the suitability of the habitat for supporting bird species which were not present at the time of the survey owing to their migratory habit (for example, summering warblers). Particular attention was paid to the possible presence of bird species which are listed as of importance under the Birds Directive.

The standard scientific literature was searched for past references to the property or locality. A local expert naturalist, Dr. Don Cotton, was consulted on the known wildlife interests of the general area.

6.3.2 Land Use Survey

Land use within a 3 km radius of the property centre was classified by a combination of:- (i) interpretation of map detail from Ordnance Survey 1:10,560 maps and 1:50,000 Discovery map series; and (ii) ground truthing by driving within the survey area and stopping at intervals.

Land was classified into the following main categories:-

Urban/suburban:	commercial, industrial or residential
Agricultural:	pasture or other types
Forestry:	commercial (conifers), or amenity/semi-natural
Water:	estuary, river or lake

In addition, information was sought on specialist agricultural activities in the area from the following bodies or sources:-

Mr Martin Henry, Chief Agricultural Officer, Sligo (general comments on agricultural activities in area)
Irish Organic Farmers & Growers Association, Dublin (location of registered organic farms)
Organic Trust Ltd., Dublin (location of registered organic farms)
National Stud Kildare & Irish Field Directory (location of registered studs, riding centres)

6.4 EXISTING ENVIRONMENT

6.4.1 Habitats, Vegetation and Flora

The habitats and vegetation types occurring within the property are described in the following section. Characteristic plant species are listed and a full list of plants recorded is given in Appendix attached. Scientific names of plants are used throughout except for tree and shrub species. For these, common names are used with scientific names in parentheses following their first mention. Common names of other species of flowering plants can be found in Scannell and Synnott (1987) and Webb et al. (1996)(see references at end of chapter).

The principal habitat types within the property are improved pasture grassland, damp to wet grassland, hedgerows, stream and drains and a calcareous spring. In addition, the Doonally River skirts the northern property boundary. The various habitats are indicated in Appendix A

6.4.2 Descriptions of Habitats and Vegetation Types Present

(a) Improved Grassland

The majority of the property consists of fields of improved pasture, either reseeded in the past and/or fertilized. Lolium perenne is frequent to common in these fields with Agrostis capillaris, Holcus lanatus, Cynosurus cristatus, Poa annua, Poa pratensis and Festuca rubra as companion species. Trifolium repens is generally distributed throughout but locally abundant in some places. Ranunculus repens is very common in the poorer swards and typical agricultural weeds such as Senecio jacobaea and Cirsium vulgare are scattered. The slope is on heavy soils with poor drainage and the rush Juncus effusus occurs sparsely.

(b) Damp to Wet Grassland

Damp to wet pasture occurs where the water table is high in the fields immediately east of the present Abbott Ireland complex. A typical damp pasture vegetation is found, with many of the species of the improved pasture and in addition Agrostis stolonifera, Festuca pratensis, Juncus inflexus and Elymus repens. Large patches of Iris pseudacorus occur in the wetter areas. A species of Nasturtium is abundant in the drains which were full of water at the time of survey.

The wettest community, which occurs in the field immediately north of St. Columba's, consists of the abundant sedge Juncus effusus, with the poached ground between clumps (inundated at the time of visit) containing very abundant Ranunculus repens, occasional Veronica beccabunga, Glyceria fluitans and Agrostis stolonifera. The source of the inundation in this very wet area appeared to be a discharge of shallow groundwater (?) (marked N1 on Appendix A) as well as the general poor drainage of the area. Water was draining from this area into a 'sink' (marked N2 in Appendix A) at the time of the survey.

(c) Hedgerows and Treelines

Hedgerows form the boundaries between fields and are an important feature of the area. All boundaries shown on the Ordnance Survey map are intact apart from those between the southern fields which have been removed almost entirely. There are approximately 6.4 km of hedgerows within the property.

The hedgerows have not been machine cut in recent times and are characterised by having a high proportion of tall trees. In some cases, the boundary is more aptly described as a treeline. On Appendix A the approximate locations of tall trees is indicated by circles (o). The hedgerows usually comprise an earthen embankment on which the trees grow and in some cases an accompanying ditch (mostly shallow and dry). Wire fences have recently been erected along or through many of the hedges.

The average height of the sections of hedgerows without trees is 5 - 6 m. Some of the trees are fairly mature, with heights of up to 15 or even 20 m. Most of the hedgerows are about 5 m in width at ground level but some are wider than this owing to encroaching brambles and low scrub.

Ash (Fraxinus excelsior) is by far the principal tree species present within the hedgerows. The main small tree or shrub species is hawthorn (Crataegus monogyna), followed by blackthorn (Prunus spinosa), holly (Ilex aquifolium) and occasional elder (Sambucus nigra). Holly is noticeably common in some of the hedges and is the dominant species along one stretch. A planted line of beech (Fagus sylvatica) occurs along the western end of the stream (on north bank). The remainder of the trees and shrubs along the stream are described as riparian vegetation (see section on stream).

The ground layers of the hedgerows are dominated by brambles (Rubus spp.). Ivy (Hedera helix) is common and some wild rose (Rosa sp.) and honeysuckle (Lonicera periclymenum) occur. Owing to the time of year there was a low diversity of herbaceous species within the hedges - those recorded include Heracleum sphondylium, Primula vulgaris, Stellaria holostea, Vicia spp., Galium aparine, Urtica dioica. The ferns Phyllitis scolopendrium and Dryopteris filix-mas occurred in the shaded areas.

Some of the hedges are rather gappy owing to cattle damage (cattle passing through and widening gaps and congregating at hedges) - these occur mainly in the lower fields just north of the stream. Those hedgerows dominated by trees often have sparse growth in the lower layers owing to shading by the tall trees.

(d) Stream

A stream runs east to west across the southern part of the property. This stream rises in a pasture field immediately east of the property and continues westwards to enter the sea at Cartron. Parts of the section between the property and the sea has been culverted.

The channel has probably been artificially straightened and deepened in the past. Flow is generally fast and the water clear. The stream is cut into a calcareous substrate and the water flows over a hard bed of 'tufa' like material. In places small banks of silt, coarse sand and stones occur derived from this tufa and from limestone. The width of the channel is mostly between 2 and 4 m. Water depth varied from about 20 - 50 cm.

The stream bed was very poor in plant species, possibly due to the fast flow and nutrient poor hard calcareous substrate, though also possibly due to the time of year. Occasional Apium nodiflorum was the only submerged species on the hard substrate and this was joined by locally abundant Ranunculus repens and Nasturtium sp. where silt or sand had accumulated

The banks of the stream are almost vertical, up to two metres high in places. Chrysosplenium oppositifolium and the common liverwort Conocephalum conicum often form a complete green cover down to the water's edge. Other bryophyte species also occur. Small plants of Anthriscus sylvestris and Carex sylvatica occur commonly within this community. Hedera helix covers much of the surface elsewhere and tall plants of Equisetum sp. (probably E. telmateia) occur in places

Trees and shrubs occur along much of the watercourse, often forming good cover. Species present include hawthorn, elderberry, sycamore (Acer pseudoplatanus), alder (Alnus glutinosa) and privet (Ligustrum vulgare). Willow (Salix spp.) features along the stream and is the dominant species at the extreme eastern end of the property - here the willow extends away from the stream on wet ground and develops into a small patch of wet woodland. Brambles and wild roses are also common. The well developed riparian vegetation along the stream forms a useful corridor for wildlife.

(e) Calcareous Spring

In the far east of the property and within the development site, adjacent to the ruins of Marlbrook House, a spring emerges and forms a distinctive plant community over several square metres. A species of chara (Stonewort) grows densely within the water. Around the edges there is frequent Juncus articulatus, Juncus acutiflorus, Rumex crispus, Epilobium sp. and Equisetum palustre. Nasturtium sp. is abundant around the margins and along the drain leading to the main stream.

6.4.3 Habitats in Area Immediately Surrounding Property

Most of the southern and eastern part of the property adjoins developed land, namely St. Columba's Hospital, the present Abbott Ireland facility and recent housing developments. East of St. Columba's, a small woodland associated with a house adjoins the property. This woodland is of planted species and includes an orchard - it has negligible scientific interest as a woodland but some of the trees have heavy lichen infestations. All of the land immediately east of the property is pasture of similar type to that within the property, though grazed by both cattle and sheep.

The northern boundary of the property skirts a county class road and for a section the Doonally River. The Doonally River rises on the lower slopes of Keelogyboy Mountain and enters the sea at Cartron. It is a physically diverse river and includes some small waterfalls near the present survey area. Information supplied by Dr Don Cotton indicates that it is a river usually with good water quality and with substantial ecological interest. It has a rich invertebrate fauna including pollution sensitive mayflies like Ecdyonurus venosus and Rhithrogena semicolorata, and it also has trout (Salmo trutta) and flounder (Platichthys flesus). Higher animals associated with the river include otter (Lutra lutra), kingfisher (Alcedo atthis), dipper (Cinclus cinclus) and grey heron (Ardea cinerea). The section of river which skirts the boundary of the property has mature trees along its bank, including alder, ash and hawthorn.

6.4.4 Lichens

The ash and hawthorn trees of the hedgerows have moderate to good lichen growths, with foliose (leafy) and fruticose (shrubby) species well represented. While a comprehensive lichen study was not carried out, samples collected at two locations resulted in eighteen species being identified. These were all typical of uncut rural hedgerows in regions with grass based farming. The species diversity indicates a moderate air quality and a thick growth of epiphytic algae on the branches indicates the presence of ammonia possibly originating from agriculatural activities such as spreading of animal slurries on lands in the area. Species recorded include Arthonia radiata, Evernia prunastri, Lecanora chlarotera, Parmelia sulcata, Parmelia glabratula, Ramalina farinacea, Ramalina fastigiata and Usnea subfloridana. Three of the species are considered characteristically local in townlands of rural Ireland; these are Physcia aipolia, Physcia semipinnata and Ramalina fraxinea.

6.4.5 Likelihood of Rare Plant Species Occurring at Site or Environs

No rare, threatened or legally protected plant species, as listed in the Irish Red Data Book (Curtis & McGough 1988), were found at the development site nor have been known to occur in the immediate area in the past. However, the survey was carried out in winter when conditions for specimen identification are not at their optimum. It is prudent, therefore, to consider what species might occur taking into account the nature of the locality.

The only Red Data Book species which might possibly occur (within the hedgerows) is Prunus padus (bird cherry), as it is known to occur in the general area[5]. While not considered rare or threatened in Ireland, this species is listed in the Red Data Book as it was formerly protected in the Republic of Ireland.

Other locally scarce tree species which occur in the general area and which could also occur within the hedgerows of the property are Acer campestre (field maple), Prunus cerasus (dwarf cherry) and Prunus domestica (wild plum). While of some local interest, all of these are considered introduced species (Webb et al. 1996) and therefore of lower conservation importance.

6.5 VERTEBRATE FAUNA

6.5.1 Mammals, Amphibians and Reptiles

The property possesses a relatively poor representation of fauna. This is mainly a reflection of the low diversity of habitats present and the general intensive nature of the surrounding lands. A list of vertebrate species present or likely to be present in the vicinity of property is given in attached Appendix.

The presence of brown rat (Rattus norvegicus), field mouse (Apodemus sylvaticus), rabbit (Oryctolagus cuniculus) and fox (Vulpes vulpes) was confirmed by sightings or signs (burrows). The agricultural landscape, with frequent hedgerows, is one in which other common mammal species would be present - such as the pygmy shrew (Sorex minutus), hedgehog (Erinaceous europaeus) and probably Irish stoat (Mustela erminea hibernica) and Irish hare (Lepus timidus hibernicus).

A very large badger (Meles meles) sett was located within one of the hedgerows near the stream (see map). This was a well established main sett with about 15 entrances extending along a distance of over 40 m. At least three of the entrances were active and fresh prints were visible on the marly soil. An outlier sett with two holes, one active, was found in an adjacent hedgerow. It is possible that other outlier setts may exist in some of the many hedgerows. Scrapings by badgers were noted in several of the pasture fields. These findings indicate that a badger social group is active within the property.

The small stream is unlikely to have any substantial fish populations and would not sustain otters. The Doonally River which flows north of the property is, however, a substantial waterbody of apparent good quality and is known to have otter (Lutra lutra)[6]. It is likely therefore, that animals may wander onto the property on occasions.

Bats are likely to occur within the general vicinity. Within the property, the main potential roosting location is a disused cottage and adjacent sheds near to the existing Abbott Ireland facility. While some of the older trees may have suitable cavities for roosting bats, generally the trees are not at an age where cavities and holes are frequent.

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[5] *Source: Dr D Cotton*
[6] *Source: Dr D Cotton.*

The common frog (Rana temporaria) probably occurs in the low lying areas of the property. Wet ditches and areas which are waterlogged into spring or early summer would provide breeding sites. The absence of ponds would prevent the occurrence of newts (Triturus vulgaris). The habitat within the property is not considered suitable for the common lizard (Lacerta vivipara).

6.5.2 Birds

Two main groups of birds were distinguished based on habitat preference. These were species associated with agricultural lands and hedgerows, and species associated with rivers and wet areas. A full list of bird species recorded is given in Appendix.

(a) Species Associated with Pasture Grassland and Hedgerows
Ubiquitous species of agricultural lands, namely rook (Corvus frugilegus), jackdaw (Corvus monedula), starling (Sturnus vulgaris) and wood pigeon (Columba palumbas), were present though not abundant in the general area. The other widespread crow species, magpie (Pica pica) and hooded crow (Corvus corone cornix), were also observed. A pair of ravens (Corvus corax) was within the property for a short period but then passed on.

The hedgerows provide good cover and feeding for small bird species, with common species such as blackbird (Turdus merula), song thrush (Turdus philomelos), chaffinch (Fringilla coelebs), robin (Erithacus rubecula), dunnock (Prunella modularis) and great tit (Parus major). Several bullfinches (Pyrrhula pyrrhula) were observed at one location and a party of long-tailed tits (Aegithalos caudatus) was active in the area. Mistle thrushes (Turdus viscivorus) were recorded in the taller trees. A roosting woodcock (Scolopax rusticola), a wader species which occurs in woodland and feeds on pasture, was flushed from within a hedgerow. A hunting sparrowhawk (Accipiter nisus) was observed in the area.

(b) Species Asociated with Watercourses and Wet Areas
The small stream is unlikely to sustain any riparian bird species other than perhaps moorhen (Gallinula chloropus) and mallard (Anas platyrhynchos).

Limited investigation of the Doonally River showed that it provided good habitat for riparian birds - two dippers (Cinclus cinclus) were present on the river just at Fort Louis, as well as grey wagtails (Motacilla cinerea). This river is also known to sustain kingfisher (Alcedo atthis) and grey heron (Ardea cinerea)[7].

Within the property, six snipe (Gallinago gallinago) were flushed for the damp fields at the south western part of the property and one was flushed from near the spring at Marlbrook House. It is considered that snipe would be regular winter visitors in small numbers to the area. Curlew (Numenius arquata) and gulls (mostly black-headed gulls Larus ridibundus) may also visit the property at times.

(c) Suitability of Habitats for other Birds
The hedgerows would attract common summer migrants such as chiffchaff (Phylloscopus collybita) and probably willow warbler (Phylloscopus trochilus). Swallows (Hirundo rustica) nest in the old buildings and species such as swift (Apus apus) and house martin (Delichon

[7] *Source: Dr D Cotton*

urbica) would feed over the property. More localised species such as whitethroat (Sylvia communis) or sedge warbler (Acrocephalus schoenobaenus) would not occur owing to absence of suitable habitat. The wintering thrushes, fieldfares (Turdus pilaris) and redwings (Turdus iliacus), would almost certainly occur within the property during winter (though not seen during the survey).

Barn owl (Tyto alba) may utilise the property for feeding purposes as it is known to occur in the general vicinity. However, it is considered unlikely to breed within the property.

6.5.3 Likelihood of Other Rare or Protected Animals in or Around the Site

The survey was carried out in winter a time when some animal species are least active. It is prudent, therefore, to consider what species might occur taking into account the nature of the locality. Owing to the calcareous nature of the area, consideration must be given to the possibility of the occurrence of the freshwater crayfish (Austropotamobius pallipes) in the small stream within the property or in the Doonally River. This species is protected under the Wildlife Act, 1976 and is also listed on Annex II of the Habitats Directive. Crayfish have been recorded from the Garvoge River in Sligo Town[8] and at another site in the vicinity of Lough Gill[9]. While the water quality and habitat of the small stream appear suitable, the fact that it is relatively short in length and not connected to a larger river system may lower the likelihood of its occurrence. There may be a higher chance of finding crayfish in the Doonally River. The optimum time for sampling crayfish is late-summer and autumn when breeding activity is taking place. During winter they are relatively inactive and difficult to find as they burrow into banks.

Lampreys, important fish species which are listed on Annex II of the Habitats Directive, might occur in the Doonally River as the habitat appears suitable. River lamprey (Lampetra fluviatilis) and brook lamprey (Lampetra planeri) have both been recorded in the Bonet River and there is also a reporting of sea lamprey (Petromyzon marinus) in the Garavogue River (Cotton 1993). As the river lamprey and sea lamprey are migratory species, living part of their lives in the sea, it is very unlikely that they would be found in the small stream within the property owing to the culverted lower section. There is a chance, though probably low, that the brook lamprey could occur in the small stream as it is non-migratory and occurs "in small streams, particularly in the limestone regions of Ireland"[10].

No discharge of waste water to either the stream or the Doonally River is proposed.

6.6 ASSESSMENT OF SCIENTIFIC INTEREST OF SURVEY AREA

6.6.1 Habitats, Vegetation and Flora

No habitat of high scientific or conservation interest (that is, regional to national importance) occurs within the property.

Most of the property consists of improved pasture fields of negligible scientific interest.

[8] *Source: Dr D Cotton, 1993*
[9] *Source: F Marnell, NPWS*
[10] *Source: Whilde, 1993*

Damp to wet grassland is a widespread habitat is western Ireland and is of no especial ecological importance at the property.

The hedgerows are mostly well developed with a high proportion of fairly mature trees - these provide useful habitat for native flora and fauna and are considered as of moderate ecological interest in a local context. Similar hedgerows, however, are quite common elsewhere in the vicinity and the county.

The habitats of most note within the property are the small stream and the spring. The stream has clear water flowing over a limestone substrate and has well developed bankside vegetation. The spring, which appears to feed the stream, has deep clear water and an aquatic and wetland flora. Both of these habitats are likely to have an interesting flora in spring and summer. While probably not uncommon on a regional scale, these two habitats add diversity to the property and are considered to be of some local scientific interest.

The Doonally River, which occurs outside of the property but which skirts its northern boundary, is a watercourse of good quality and with considerable scientific importance. Of particular note is its rich invertebrate fauna and the presence of trout, otter and kingfisher.

No rare, threatened or protected species of flora were recorded during the survey or are known to have been recorded in the immediate area in the past. There is a possibility that Prunus padus, a Red Data Book species, may occur within the many hedgerows of the area

6.6.2 Fauna

Within the property, the main animal interest lies in the presence of a large active badger sett. While a widespread species, badger is legally protected under the Wildlife Act 1976.

Of particular importance is the presence of otter and kingfisher on the Doonally River. Both species are of high conservation importance - otter is listed as an Annex II species on the Habitats Directive while kingfisher is listed as an Annex I species on the Birds Directive. While the small stream within the property would not support populations of these animals, it is likely that otter would at times wander within the property.

There is a possibility that freshwater crayfish, an Annex II Habitats Directive species, may occur in the Doonally River or even in the small stream within the property. Also, one or more of the three lamprey species, all listed on Annex II of the Habitats Directive, may occur in the Doonally River. The small stream might have potential for only the brook lamprey.

6.7 LAND USE

6.7.1 General Land Use Description

Land use is described according to the predominant activity in various sectors, moving in a clockwise direction starting at the north shore of Sligo Harbour.

The sector from the north shore of Sligo Harbour (west of property) to just south of the R286 (south-east of property) is a low-lying undulating landscape, with hills rising to between 40 m and 60 m. Looking to the north the spectacular slopes of Benbulbin (526 m) are readily visible, while to the east and north-east the ground starts to rise towards Keelogyboy Mountain (438 m), Crockauns (463 m) and Cope's Mountain (395 m), the lower slopes of which are afforested. Surface rivers and streams are few, with the Doonally River, which rises near Fermoyle, being the main river of the area. Colgagh Lough, a medium sized lake, occurs to the south-east of the property just at the edge of the survey area. The area is traversed by a network of roads - two national primary roads, the N15 and N16, two regional roads, the R286 and R291, and a network of third class roads. All the national and regional roads converge on Sligo town.

By far the predominant land use in this sector is grass based agriculture. The grassland is mostly improved and utilised for both dry stock (sheep and cattle) and dairy farming. There are a number of pedigree herds in the area and a significant proportion of the milk supply for Sligo town and region comes from the area. Of particular note is the location of the North-West Cattle Breeding Society's artificial insemination bull station at Doonally (approximately 2 km north-east of the property).

Some damp to wet pasture fields with rushes (Juncus sp.) occur throughout, an example being at Bellanurly in the north-east. The majority of the fields are bounded by hedgerows. Dispersed housing occurs regularly along the roads throughout the agricultural areas, with occasional concentrations of houses such as along the west and south arms of the Carncash Crossroads.

The Garavogue River, a short river channel which leads from Lough Gill to the sea, occurs in the south-eastern sector of the survey area. This channel is surrounded on both sides by mostly semi-natural woodland of the Hazelwood Demesne and Cleaveragh Demesne. The channel and woodland is of high conservation importance being within the Lough Gill Candidate Special Area of Conservation. The area also has amenity value.

Sligo town occupies the entire south-west sector of the survey area, extending from west of the Cleaveragh Demesne to the Finisklin area on the south side of Sligo Harbour, and then north of the river as far as the present Abbott Ireland complex and St. Columba's Hospital.

The western sector of the survey area comprises the extreme inner part of Sligo Harbour. This is typically estuarine in character with expanses of sand and mud exposed at low tide. There is a permanent deep channel leading to Sligo quays - this channel continues through the centre of Sligo town and merges with the Garavogue River. This estuarine area has commercial use by way of shipping activities but also high nature conservation value (designated as a Special Protection Area (SPA) and as a Candidate Special Area of Conservation (CSAC)).

6.7.2 Specific Land Use Features

Organic farm (grassland, beef, cows for breeding and production, calves) - situated at Tonaphubble, just south of Cleaveragh. Operated by G. & E. McSharry.

Artificial insemination bull station at Doonally - situated approximately 2 km north-east of property and operated by the North-West Cattle Breeding Society.

Garden Centre - situated immediately south of the present Abbott Ireland facility.

Cleaveragh Racecourse - situated in the south-eastern sector of Sligo town. Also used for point-to-pointing and athletics.

Pitch and Putt course - Lisnalurg, about 1 km north-west of the property.

6.8 IMPACTS FROM PROPOSED DEVELOPMENT

There will be loss of some hedgerows and established trees in the vicinity of Marlbrook House where the proposed development will be sited. All other hedgerows and trees will be retained. The impact of this will be minor because the proportion to be lost is small relative to what will be retained and the landscaping proposals will partly compensate for the loss. A high proportion of the new trees will be native species.

Loss of improved pasture grassland due to the proposed development is not of significance. There will be loss of some wet grassland, which is considered an impact of negligible significance. Loss of the calcareous spring and its associated flora will be of some significance in a local context. A small section of stream habitat will be lost due to culverting for the access road

It is intended to avoid physical damage to the outlier badger sett but in the event of unforeseen circumstances arising, advice will be sought from National Parks and Wildlife, Dúchas the Heritage Service.

Operation of the proposed development will have negligible impact on the flora and fauna of the locality due to the anticipated stringent emission limit values to be imposed by the EPA in the IPC licence.

6.9 MITIGATION MEASURES

6.9.1 Construction Phase

While the proposed development site will not extend to the location of the main or outlier badger setts, there is a risk that the outlier sett could be damaged during the construction phase. Efforts will be made to prevent damage to the area of the outlier sett by fencing and by informing building contractors of the importance of this area. However, if it is considered that there is a high risk of damage due to some unforeseen circumstance, then contact will be made with the National Parks and Wildlife Service and advice sought as to the best means of dealing with the situation.

It is planned to retain as much as possible of the existing trees and hedgerows and to incorporate them into the development site landscaping programme. This aspect is further discussed in the landscape and visual impact aspects of the proposed development.

To protect water quality in the stream it will be necessary to temporarily divert it while the culvert which will carry the access road is constructed. Furthermore to protect the hydrological condition of the stream -which could otherwise be altered due to the loss of *the spring - an underground culvert shall be provided from where the groundwater spring rises to the surface to join the stream as close as possible to its existing confluence.*

6.9.2 Operational Phase

The principal measures to mitigate the impact of the emissions from the proposed development were described in chapters five, six and seven. These may be summarised as follows:- Waste water (treated) will be discharged to the Sligo Corporation foul sewer; storm water (uncontaminated) will discharge to the stream and all waste will be removed from the facility for disposal at authorised locations elsewhere. Emissions to the atmosphere will be treated so that the requirements of the BATNEEC Guidance Note will be met. The results of dispersion modelling studies show that ground level concentrations of the various process emissions will be negligible. These measures will serve also to protect the Candidate Special Areas of Conservation and Special Protection Area identified previously.

All of the emissions from the proposed development will be subject to licence with emission limit values imposed by the EPA. The limit values are designed to protect all facets of the environment including flora, fauna and soils.

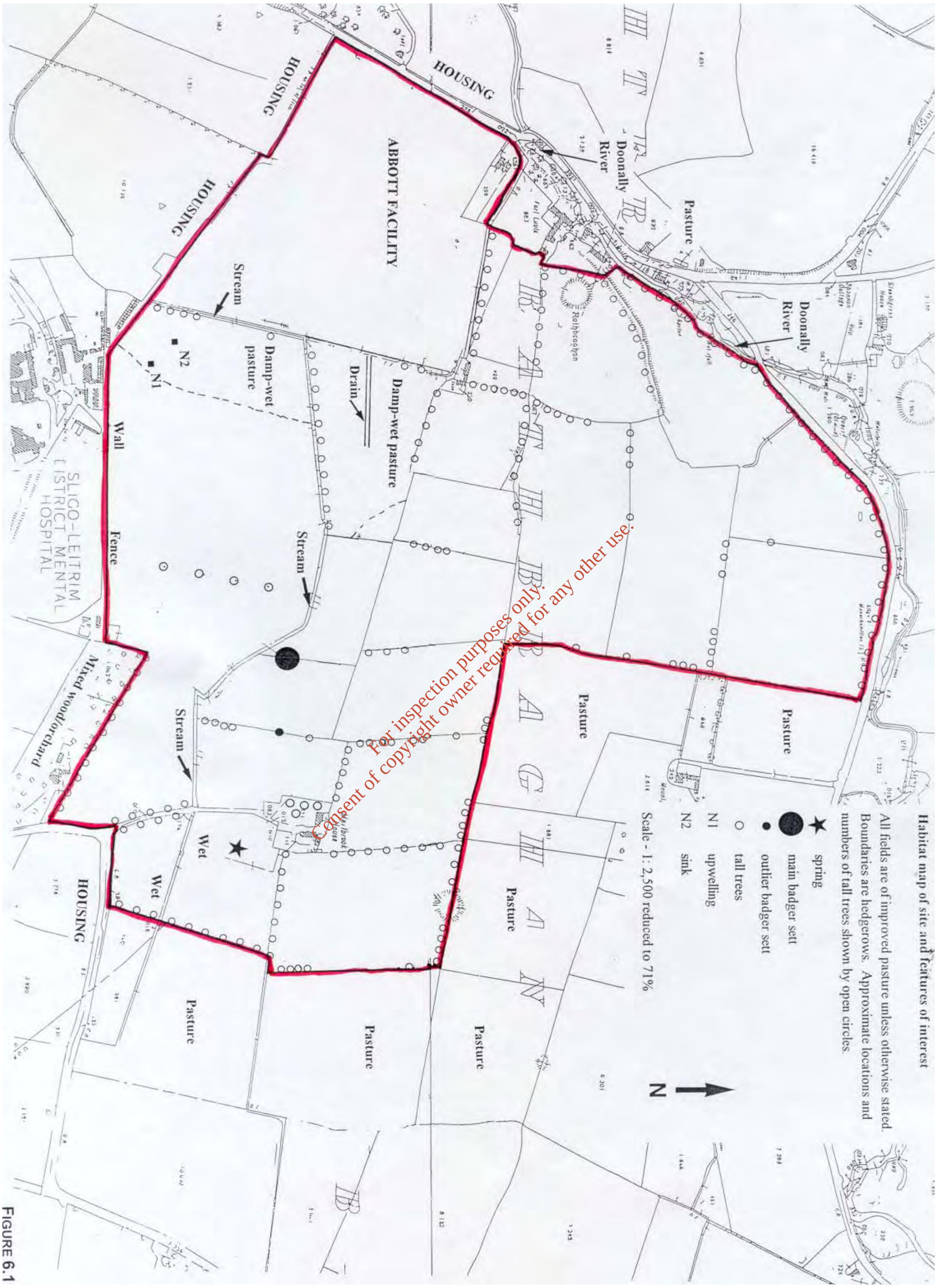

Figure 6.1: Ecology Map

APPENDICES ON FLORA & FAUNA

Appendix I

List of plant species recorded in survey area

Acer pseudoplatanus
Agrostis capillaris
Agrostis stolonifera
Anthriscus sylvestris
Apium nodiflorum
Bellis perennis
Carex sylvatica
Cerastium fontanum
Chara sp.
Chrysosplenium oppositifolium
Cirsium vulgare
Cratageus monogyna
Cynosurus cristatus
Dryopteris filix-mas
Elymus repens
Epilobium sp.
Equisetum palustre
Equisetum sp. (*telmateia* ?)
Fagus sylvatica
Festuca rubra
Festuca pratensis
Fraxinus excelsior
Galium aparine
Glyceria fluitans
Hedera helix
Heracleum sphondylium
Holcus lanatus
Ilex aquifolium
Iris pseudocorus
Juncus acutiflorus
Juncus articulatus
Juncus effusus
Juncus inflexus
Lolium perenne
Lonicera periclymenum
Nasturtium sp.
Phyllitis scolopendrium.
Plantago lanceolata
Plantago major
Poa annua
Poa pratensis
Primula vulgaris
Prunella vulgaris
Prunus spinosa
Ranunculus acris
Ranunculus repens
Phyllitis scolopendrium
Rosa sp.
Rubus fruticosus
Rumex crispus
Salix sp.
Sambucus nigra
Senecio jacobaea
Senecio vulgaris
Stellaria media
Taraxacum officinale
Trifolium repens.
Urtica dioica
Vicia sp.
Viola odorata

Appendix II

List of Irish mammal and amphibian species in survey area

		Status in Study area
Mammals		
Insectivora		
Hedgehog	*Erinaceous europaeus*	Probable
Pygmy shrew	*Sorex minutus*	Present
Chiroptera		
Pipistrelle	*Pipistrellus pipistrellus*	Possible
Brown long-eared bat	*Plecotus auritus*	Possible
Leisler's bat	*Nyctalus leisleri*	Possible
Daubenton's bat	*Myotis daubentoni*	Possible
Lagomorpha		
Rabbit	*Oryctolagus cuniculus*	Present
Irish hare	*Lepus timidus hibernicus*	Probable
Rodentia		
Wood Mouse	*Apodemus sylvaticus*	Present
House Mouse	*Mus musculus*	Probable
Brown Rat	*Rattus norvegicus*	Present
Carnivora		
Fox	*Vulpes vulpes*	Present
Badger	*Meles meles*	Present
Irish Stoat	*Mustela erminea hibernica*	Probable
Otter	*Lutra lutra*	Present
American Mink	*Mustela vison*	Possible
Amphibians		
Frog	*Rana temporaria*	Probable

Appendix III

List of bird species recorded or likely to occur in survey area

Species	Status in Survey Area
Grey Heron *Ardea cinerea*	Doonally River
Mallard *Anas platyrhynchus*	Doonally River, possibly within site
Sparrowhawk *Accipiter nisus*	Hunts within site, may breed in area
Kestrel *Falco tinnunculus*	Likely within site
Pheasant *Phasianus colchicus*	Heard within site
Moorhen *Gallinula chloropus*	Doonally River, possibly within site
Snipe *Gallinago gallinago*	Winter visitor to wet fields
Woodcock *Scolopax rusticola*	Winter visitor to site
Curlew *Numenius arquata*	Occasional winter visitor
Black-headed Gull *Larus ridibundus*	Occasional winter visitor
Wood Pigeon *Columba palumbas*	Resident
Barn Owl *Tyto alba*	Possible within site
Swift *Apus apus*	Likely summer visitor
Kingfisher *Alcedo atthis*	Doonally River
Swallow *Hirundo rustica*	Likely summer visitor
House Martin *Delichon urbica*	Likely summer visitor
Meadow Pipit *Anthus pratensis*	Winter visitor
Grey Wagtail *Motacilla cinerea*	Doonally River
Pied Wagtail *Motacilla alba*	Resident
Dunnock *Prunella modularis*	Resident
Dipper *Cinclus cinclus*	Doonally River
Wren *Troglodytes troglodytes*	Resident
Robin *Erithacus rubecula*	Resident
Blackbird *Turdus merula*	Resident
Fieldfare *Turdus pilaris*	Likely winter visitor
Redwing *Turdus iliacus*	Likely winter visitor
Song Thrush *Turdus philomelos*	Resident
Mistle Thursh *Turdus viscivorus*	Resident
Chiffchaff *Phylloscopus collybita*	Likely summer visitor
Willow Warbler *Phylloscopus trochilus*	Likely summer visitor
Spotted Flycatcher *Muscicapa striata*	Doonally River, summer visitor
Long-tailed Tit *Aegithalos caudatus*	Winter visitor, may breed
Coal Tit *Parus ater*	Resident
Blue Tit *Parus caeruleus*	Resident
Great Tit *Parus major*	Resident
Magpie *Pica pica*	Resident
Jackdaw *Corvus monedula*	Resident
Rook *Corvus frugilegus*	Frequents site but breeds elsewhere
Hooded Crow *Corvus corone cornix*	Resident
Raven *Corax corax*	Occasional visitor
Starling *Sturnus vulgaris*	Resident
Chaffinch *Fringilla coelebs*	Resident
Greenfinch *Carduelis chloris*	Winter visitor, may breed
Goldfinch *Carduelis carduelis*	Winter visitor, may breed
Linnet *Carduelis cannabina*	Winter visitor, may breed
Bullfinch *Pyrrhula pyrrhula*	Winter visitor, may breed

CHAPTER 7 – WATER AND GEOLOGY

7.1 WASTEWATER

7.1.1 Waste Water Sources and Characteristics

The proposed development will result in generation of various wastewater streams. These will be:-

- process waste water
  - direct from production
  - indirect from production, for example, scrubber systems
- utility waste water
- sanitary waste water

In addition there will be also storm water discharges from the roofs of the buildings, hard paved areas (car and truck parks) and internal circulation roads.

Each production cell and its aqueous waste can be separately monitored and intercepted to ensure that waste streams are compatible with emission criteria.

Design Philosophy

The project has been developed to allow a number of self contained and independent production cells to operate separately. Each will produce small quantities of products in small (250 to 1000 litre capacity) reactors.

(a) Process Wastewater

Aqueous waste

Aqueous waste (streams containing a high proportion of water) will originate from the batch processes including vessel rinses and drains from the drum booths. This waste will be directed to the building aqueous waste tank, a dedicated 2000 litre tank which services all the process cells.

This tank can be sampled, if required, before directing the contents to the main aqueous storage tank located in the tank farm. Any pH adjustment which is required can be carried out in this tank before sending the contents to a purpose designed unit which will reduce the concentration of volatile organic compounds. This is described in more detail in section 7.5 (Mitigation).

Organic Waste

The organic phase waste stream will also be accumulated in a dedicated 2000 litre bulk storage tank. When a pre-determined volume has been reached in the tank the material will be pumped through a stripping column to remove trace aqueous compounds and reduce the overall volume of the waste material. This concentrated stream will be discharged to a road tanker and transferred off-site for further recycling (see chapter 11 Waste Management).

Indirect process waste water

Scrubbers will be employed to reduce the concentrations of components in the gaseous emissions from the process. A number of scrubbers will be employed and these are described in chapter six which deals with emissions to the atmosphere. A scrubber functions by transferring the component from the gas to the liquid phase (water in this case) if it is soluble. The scrubbers will recirculate the water sprays with a proportion continuously discharged and fresh water added to make up the loss. In this way the scrubber will operate at maximum efficiency as the saturation point of the various components is never reached. The scrubber will discharge to the aqueous waste receiver at the tank farm.

The main components of the combined direct and indirect raw process waste water will be as follows (Table 7.1):-

Table 7.1 Typical daily volumes (litres) of aqueous process related wastewater for three named products.

	Rubitecan	CisAtracurium	Atrasentan	Total
Aqueous waste per batch	1786	168	696	2650
Cycle time (days)	7.0	3.4	1.4	
Aqueous waste per day	255	49	483	
Total aqueous waste per day				788
Equipment cleaning water				914
Scrubber waste				851
Total aqueous waste per day				2552

The characteristics of the raw process wastewater will vary from day to day depending on which products are being made and the stage of the individual process. Generally each product will go through several processing stages and many of these will not result in wastewater generation. Depending on the individual product the time from the initial reaction to final isolation of purified product could be up to 7 days. The typical characteristics of the raw process wastewater from a small scale batch type operation manufacturing Rubitecan, CisArtacurium and Atrasentan are presented in table 7.2. It will be seen that the volume of process wastewater generated is very small (2.5 m^3/d) reflecting the fact that the scale of production is small[11] and water is typically only used in one stage of some of the processes and for equipment rinsing. The process wastewater will contain traces of products, unreacted starting raw materials and organic solvents. It will contain also some inorganic compounds such as sodium nitrate and sodium carbonate and sodium sulphate.

[11] For example, the scheduled total output of one of the products will be about 29 kg per annum

Table 7.2: Estimated raw process wastewater general characteristics for current proposed products (Rubitecan, CisAtracurium and Atrasentan).

Parameter	Concentration
pH	7-9
Biochemical oxygen demand, kg/d	6
uspended solids, mg/l	400
Nitrate, mg/l NO_3	35
Hydraulic load	2.5m^3/d
Population Equivalent of 6 kg BOD	90 persons

Process waste water will not arise from the tabletting or encapsulation operations.

(b) Utility waste water

The utilities will include:-

- cooling water
- hot water and steam generation
- purified water treatment systems

Cooling water

The cooling water will be of the non-contact type, that is, there will be no direct contact with any process substance. Cooling water will be employed to remove heat from various processes and equipment. The cooling water return stream will pass through cooling towers to remove heat prior to recirculation. To control the build up of inorganic dissolved solids (mainly calcium, magnesium and bicarbonate) naturally present in the water, it will be necessary to remove some water and replace it with fresh water. This is called blowdown and it is normally discharged to the site's main wastewater drain. Its volume will depend on the cooling load which in turn is determined by the ambient temperature. Cooling water is usually treated with various proprietary formulations designed to control corrosion, microbiological growths and scale build-up. Simple inorganic compounds, such as sodium carbonate and sodium hydroxide, are used to control corrosion. Broad spectrum, low toxicity biodegradable biocides are typically used to control the microbiological growths. Scale build-up is controlled by use of pH adjustment and addition of polyphosphates and polyphosphonates often used in conjunction with organic polymers or dispersants.

Hot water and steam

Hot water will be required for space heating while steam will be needed for process use (heating vessels). Details of this process are given in section 4.6. For the same reasons that scale build-up must be controlled in the cooling water system, a similar programme of blowdown and treatment will be employed in the steam generation plant but there will be no need for microbiological growth control. The blowdown will discharge to the site's main wastewater drain with the volume depending on the heating load required.

The estimated hydraulic load associated with the utilities is about 10 m^3/d. The BOD and suspended solids content will be very small, approximately 4 kg/d for each, and the only other constituent will be the dissolved solids which will range from 500 to 1000 mg/l.

(c) Sanitary waste water

Waste water from the washrooms and toilets will be collected in the foul drainage system and will discharge for treatment to the sewer. It will have the same characteristics as normal domestic sewage, that is, a BOD concentration of about 300 mg/l and a suspended solids concentration of about 350 mg/l. The hydraulic load will be about 10 m^3/d (100 l/head/d and at maximum employment of 100 staff). The sanitary flow will contribute some nitrogen and it will contain a minor amount of phosphorus. The canteen will generate about 3 m^3/d of wastewater containing about 3 kg BOD and some fats/grease. Fat-grease traps will be installed on the drains from the canteen. The concentrations of nitrogen, phosphorus and fats/grease in the combined flow from the canteen, toilets and washrooms will be typical of those found in municipal sewage.

The general characteristics of the combined wastewater streams at the discharge point to the municipal foul sewer at Ballytivnan are presented in table 7.3.

Table 7.3: General load characteristics of combined wastewater as discharged from site for current proposed products (Rubitecan, CisAtracurium and Atrasentan).

Source	Hydraulic load, m^3/d	BOD load, kg
Process (direct & indirect)	2.5	6
Utilities	10	4
Sanitary (incl. canteen)	13	6
Totals	28.5	16

It is expected that from time to time new products will be proposed for manufacture at Sligo. These will be made on a similar scale to the current proposed products (Rubitecan, CisAtracurium and Atrasentan) and will result in similar small volume emissions of process wastewater with general characteristics similar to those given in table 7.2. The utilities to be provided in the current proposal will have sufficient capacity to service the requirement for several future new products and so additional wastewater flow from utilities will be small.

Each new proposed product will be evaluated for its environmental significance and following consultation with the EPA revisions, if required, will be made to the IPC licence. The EPA will be required to consult with Sligo Corporation and obtain their consent to any licence modification affecting the wastewater discharge.

(d) Drainage Provisions (General)

Production Building Drainage

Floor drains from the building will be routed via underground piping (double contained polypropylene) to free drain to a sump tank just outside the main production building. This sump tank can be sampled and the contents routed to aqueous waste storage, waste solvent storage or directly discharged to foul sewer. The tank is sized to contain normal anticipated drain down from the production areas. If there is a major spillage or fire water deluge the sump tank will overflow into the sump where it can be monitored and pumped away to foul sewer if levels of contaminants are acceptable. If the spillage contains solvents the sump contents can be transferred to drums or road tanker.

Secondary Production Building Drainage

Liquid spillage in the secondary production facility will be contained in the room/cell and cleaned locally. Door sumps will be provided to contain spillage in the room/cell. This liquid effluent can then be pumped out, drummed and disposed of off-site.

Administration Building Drainage

Liquid spillage in the administration building including the laboratory facility will be contained in the area and cleaned locally. Door sumps will be provided to contain spillage in the area. This liquid effluent can then be drummed and disposed of off-site.

Utility Building Drainage

Floor drains from the utilities building will be routed via underground piping. Any areas handling fuel oil (boiler, oil storage, oil tanker bay) will drain to the utilities area sump via an isolation valve. These drain lines will be run in double contained pipe. In the oil handling areas spillage can be removed locally by drumming or discharging to road tanker. If the effluent contains water only this can be drained to the utilities sump by opening the isolation valve. This sump provides another containment area which can be sampled/inspected before discharge. The normal discharge route is to foul sewer via an isolation valve, but if there is any oil found in this sump it can be disposed of to road tanker/drums.

All other areas in the utility building will free drain to the utilities sump. The sump is sized to contain normal anticipated drain down from the utility building. If the deluge system operates the utilities sump will overflow to the storm water retention pond. The contents of storm water retention pond can also be sampled before release to foul sewer.

Tank Farm, Drum Store and Environmental Area Drainage

Tank Farm, Environmental and Drum Store Area

Each of the bunded areas containing tank farm, environmental and drum store will be provided with an individual sump. The contents of these sumps can be inspected *in situ* and if the content is rainwater the isolation valve will be opened to release the contents to a common sump for all the areas. This sump will retain the contents until it is cleared (by sampling/inspection) for discharge to foul sewer. Any abnormal scenario such as the presence of some solvent in this water, can be handled by retaining it in either the sump or the bund and pumping out to drums or the waste storage tanks.

Tanker Bay
The tanker bay will contain any rainwater or spillage during a loading operation, as a small depression in the tanker area will provide a bunded area. The area will be isolated via a manual valve so that any solvent spillage can be cleared locally.

Generally the tanker bay contents will be rainwater which will be released from the tanker bay to the common sump via the isolation valve. Although the intention is to treat all spillage in the tanker area the sump will provide a secondary containment area where solvent spillage can be removed for disposal. If the sump contents are acceptable they can then be released to foul sewer by opening the isolation valve. If the deluge system is activated during tanker loading/off-loading this would potentially overflow the sump, to the firewater retention pond. The contents of the retention pond can be tested before release to foul sewer.

(e) Storm water
A dedicated storm water drainage system will be provided to collect and discharge uncontaminated storm water from the roofs of the buildings, paved areas, car and truck parks and internal circulation roads. Storm water is rainfall. An interceptor will be provided on the drain from the car park to remove oil which may drip from the engines of employee cars. Drainage from the area in the vicinity of the unloading bay will drain to the on-site waste water treatment systems.

The storm water discharge will be to the stream that presently forms part of the eastern and southern boundaries of the existing Abbott Ireland premises. Prior to discharge the water will pass through a detention pond which will allow the quality of the discharge to be monitored and if contamination is found to interrupt the discharge. The peak volume of storm water is estimated at 620 l/s based on a developed area of 23,000 m^2 and a storm return period of ten years.

Uncontaminated storm water run-off typically has a BOD of 5 - 10 mg/l and a suspended solids concentration of 10 - 15 mg/l. These concentrations increase to about 20 mg/l and 30 mg/l respectively at times during the year and particularly in early autumn when the heavier rains flush decaying vegetation such as grass clippings and leaves from the land. Uncontaminated storm water is normally discharged directly to the nearest surface water drainage system as it does not cause contamination. It is standard modern good practice to exclude storm water from municipal foul drainage systems.

7.2 RECEIVING ENVIRONMENT - SURFACE WATER

7.2.1 Sligo Harbour

Sligo Harbour is part of Sligo Bay and is effectively the estuary of the Garavogue River. It approximates to an east-west rectangle with a length of about 6 km and a width of about 2 km. Almost 90% of the estuary dries out at low water on spring tides leaving a well defined river channel along the northern side. The navigation channel was dredged in 1985 to give a depth of 2.7 m (chart datum) at low water spring tide. The amplitudes of the tides are about 3.3 m for mean spring and 1.5 m for mean neap. The main entrance to the estuary is between Deadman's Point and Coney Island.

The bay and estuary form an important amenity being used for angling, bathing at a number of beaches (Strandhill and Rosses Point are designated), boating, shell-fisheries and navigation. Cummeen Strand is internationally important because of its significant brent goose population. Although at low tide there are extensive dry flats, nevertheless, there are several points of scenic views across the bay. It is important that the amenity value be maintained.

As part of the Environmental Impact Statement for the proposed municipal waste water treatment plant for Sligo Town, an extensive water sampling and analysis programme was carried out in recent years by Jennings O'Donovan and Partners, Consulting Engineers to Sligo Corporation. A comprehensive study on flow patterns, flow velocities and bathymetry (depths) within the estuary was carried out to help establish the optimum location for the discharge of treated waste water from the new plant and to predict the impact on water quality.

At present the municipal waste water discharges untreated to the harbour area from an outfall at Deep Water Quay. The studies referred to above have shown that water quality, using the traditional assessment parameters of biochemical oxygen demand, suspended solids, ammonia and phosphorus, is good. For example, the BOD concentration at neap tides, 50 m from the existing outfall was 9.5 mg/l and this decreased to 1.6 mg/l 250 m from the outfall. Dissolved oxygen concentrations were rarely less than 95% of saturation. Because the present discharge is untreated, there is localised pollution in the immediate vicinity of the outfall and there is also an aesthetic problem. The reason why water quality is good despite the untreated nature of the existing discharge is because of the massive dilution afforded to the relatively tiny volume of waste water. Dilution is given by the tide and by the Garavogue River which is the main surface water discharging to the bay in the harbour area.

The hydrographic study established that the degree of exchange of the water in the bay with the open sea is dependent on a number of factors including the height of the tide, the direction and strength of the prevailing wind and the flow in the Garavogue River. Water movements within the estuary are dominated by the tidal oscillation and the moderate range, along with the shallow bathymetry, leads to appreciable currents. These have been defined and clearly indicate that the tidal rise and fall and its associated currents are the principal mechanism by which mixing is induced in the estuary.

The open topography of the estuary and its alignment close to the prevailing wind directions make it well disposed to wind induced circulation. Winds from the south-west, west and north-west can be expected 50% of the time, with mean hourly wind speed exceeding Force 3 for over 60% of the time.

The shape and depth of the estuary are such that large volumes of water leave the estuary on the ebb tide. In the outer estuary, off Bomore Beach, the plume of estuarine water which develops on the ebbing tide extends out between the Bell Buoy and the Blackrock light. The indications are that under calm conditions, this plume does not mix well with the surrounding open sea water and that it is returned substantially undiluted to the estuary on the incoming flood tide. Thus the overall flushing time is quite long and the background concentrations of conservative parameters, if present, could be relatively high.

Three predictive models were employed to study the flushing time. The simplest, the prism model, which assumes thorough mixing with the open sea, predicted a flushing time of about one day. Predictions based on box and tidal flushing models gave results of ten to 17 days depending on the flow in the Garavogue River. In other words, the flushing time is controlled by the river flow being shortest at high river flows and longest at low flows. The ten day result was obtained for a mean river flow of 12 m^3/s.

7.2.2 Doonally River

The Doonally River flows along the northern and north-western part of the Abbott Ireland property (see figure 1) and a short distance later discharges to the estuary at Cartron.

Table 7.4: Water Quality River Doonally, 1997*

Parameter	Concentration
pH	7.4
Biochemical oxygen demand, mg/l O_2	2.3
Suspended solids, mg/l	< 5
Ammonia, mg/l NH_4	0.05
Nitrate, mg/l NO_3	2.6
Nitrite, mg/l NO_2	< 0.01
Phosphorus, total mg/l P	0.05

*Sampled and analysed by Forbairt

It is an important river with a substantial ecological interest (see also chapter 6). The river is in good condition as judged from a sample collected and analysed in December 1997 (see Table 7.4).

7.2.3 Stream

A small stream passes through the property entering at the eastern boundary and generally flowing from east to west until it reaches the eastern boundary of Abbott Ireland's existing premises where it turns south along the boundary. It then flows westwards and shortly afterwards discharges to the estuary at Cartron. It flows through culverts under the Ballytivnan Road and also at a nearby wholesalers premises. There is some evidence to suggest that it's source is a spring in a nearby field east of the proposed development but the flow is added to by drainage ditches in the locality.

Water samples collected and analysed in December 1997 showed the following results (Table 7.5):-

Table 7.5: Water quality local stream, 1997*

Sampling location Parameter	SW2	SW1
pH	7.5	7.4
Biochemical oxygen demand, mg/l O_2	1.8	1.7
Suspended solids, mg/l	< 5	< 5
Ammonia, mg/l NH_4	< 0.05	< 0.05
Nitrate, mg/l NO_3	1.6	1.5
Phosphorus, total mg/l P	0.05	0.06

*Sampled and analysed by Forbairt

These results indicate good water quality in the vicinity of the Abbott Ireland property. Visual inspection showed no obvious signs of pollution such as excessive growth of aquatic weeds, sewage fungus or discoloured sediments.

It will not be necessary to alter the course of the stream in the vicinity of Marlbrook House to allow the proposed development to proceed. Precautions will be taken to minimise contamination of the stream, during earth-works and construction, from site storm water drainage. The internal site road will be carried over the stream by a short culvert. It may be necessary to temporarily divert the stream while the culvert is put in place.

During the construction phase sanitary waste water generated by the construction workers will be collected and removed off-site by the contractor for disposal at a location to be agreed with Sligo Corporation.

7.3 Receiving Environment – GroundWater

7.3.1 Geology

The geological setting of the property is underlain by Carboniferous limestones of the Glencar Formation. This formation consists of alternating layers of calcerous shales and limestones containing abundant fossil debris.

Six monitoring wells were drilled at the. The depth to bedrock ranged from 0.75 (MW-4) to 6 m (MW-3). Typically, the top 0.5 m of bedrock was fractured or weathered. In MW-2, broken/fissured rock was again encountered approximately 2m below the bedrock surface. There was little evidence of cavities or major fissures in the boreholes drilled.
The overburden on the property varies according to elevation; the low-lying south-western side of the property comprises deep strata of soft, low permeability silts and clays of an estuarine or alluvial origin. Glacial tills cover the bedrock on the higher parts of the property. A creamy, clayey silt was encountered in MW-1, the location closest to the low-lying valley of the site. This layer extended to 2 m depth, where it met the weathered limestone bedrock. In all other boreholes, the overburden encountered was more typical of glacial deposits. Typically a silty gravelly clay stratum overlies a firm to stiff layer of

consolidated gravelly clay and boulders (logged as boulder clay), which in turn interfaced with the bedrock. MW-1 and MW-3 are located within the development area part of the property.

7.3.2 Hydrogeology

The hydrogeology of the property has been inferred from data obtained during the drilling and surveying of water levels in the boreholes installed as part of this investigation. Groundwater inflows were recorded in the shallow limestone bedrock, and the monitoring wells were completed at this level. The groundwater levels measured in the boreholes are presented in Table 7. The ground-water flow conforms to site topography and local drainage pattern.

The monitoring wells were surveyed for elevation with respect to an arbitrary site datum. In the case of the first group of wells the arbitrary datum was MW-2, top of PVC riser, (taken as 100 m) and for the second group, the arbitrary datum was MW-6, top of PVC riser (taken as 200 m). The well elevations were used in conjunction with the static water level measurements at each well to determine the local hydraulic gradient of the water table and the resultant groundwater flow directions. The results of the elevation survey are shown in Table 7.4.

Table 7.6: Groundwater levels in boreholes*

				Static water level	
	Elevation (Top of Riser)	Depth drilled	Water Strike (approx. depth)	17-Dec-97 (depth)	17-Dec-97 (m arb. datum)**
MW-1	100.85	6.22	3.5	2.23	98.62
MW-2	100	8.96	6.5	2.05	97.95
MW-3	108.54	21	19	4.57	103.97
MW-4	195.14	6.48	6	5.03	190.11
MW-5	200.45	6.6	4	2.79	197.66
MW-6	200	7.63	6.5	4.72	195.28

*All measurements in metres
**Arbitrary datum points: MW-2 TOR taken as 100 m; MW-6 taken as 200 m

The depth of the overburden varied between 0.75 m (MW-4) and 6 m (MW-6). Wells drilled higher up on the hill slopes had a greater depth of overburden cover. Groundwater entered the wells primarily when a fissure was encountered in the bedrock, with the water level recovering up to a static level higher than the depth where the fissure was encountered, reflecting the impermeable and confining nature of the overburden. The water yield varied from very good in MW-1, MW-6 to very poor in MW-3 and MW-5, reflecting differences in local permeability depending on the borehole location. The limestone at the property can be described as a minor aquifer.

A spring was noted just south of Marlbrook house in the area investigated by MW-1 to MW-3 . The spring is at an elevation of approximately 16-17 m OD, and drains as surface water to the stream south of this point. The spring is probably due to a series of fissures connected to the aquifer beneath the hill (elevation approximately 35 m OD) north of Marlbrook house. The monitoring well MW-1 was drilled at a similar elevation as the spring. Water level in this well was approximately 2 m below ground level.

7.3.3 Water Quality

(a) Inorganic compounds

The results of the analyses for inorganic compounds are presented in Table 7.7. Although this groundwater is not used as a drinking water, the results are compared with the National Drinking Water Standards[12]. The level of iron in MW-5 is slightly higher than the potable water MAC (maximum admissible concentration) but this is likely to be naturally occurring iron. Other than this element, all other parameters in each of the six wells were within the drinking water criteria. The groundwater quality appears generally consistent in each of the six wells.

[12] *Statutory Instrument Number 81 of 1988*

Table 7.7: Groundwater analytical data - inorganic compounds

Parameter	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
pH	7.4	7.5	7.8	7.2	7.8	7.2
Colour, Hazen Units	<5	<5	<5	<5	<5	<5
Conductivity, µS/cm	665	655	600	700	575	700
Total Hardness $CaCO_3$, mg/l	395	386	324	386	303	390
Total Alkalinity $CaCO_3$, mg/l	382	358	292	374	290	383
Non-carbonate Hardness, $CaCO_3$, mg/l	13	28	32	12	13	7
Calcium Ca, mg/l	135	130	105	130	100	130
Magnesium Mg, mg/l	14	15	15	15	13	16
Sodium Na, mg/l	16	15	16	14	16	13
Potassium K, mg/l	1.7	<1	4.3	3	4.5	2.7
Iron Fe, mg/l	0.15	0.18	0.08	0.1	0.22	0.14
Manganese Mn, mg/l	0.01	0.01	0.03	<0.01	0.02	<0.01
Copper Cu,mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium Al, mg/l	0.09	<0.05	0.07	0.12	0.17	0.13
Nitrate NO_3, mg/l	6.4	9.6	6	7.2	4.4	7.2
Nitrite NO_2, mg/l	<0.01	<0.01	0.02	<0.01	0.02	<0.01
Chloride Cl, mg/l	24	23	22	21	26	21
Sulphate SO_4, mg/l	11	10	49	8.4	27	8
Total Ammonia NH_4, mg/l	<0.05	<0.05	<0.05	0.08	<0.05	<0.05
Non-purgeable Organic Carbon C, mg/l	2.4	4.6	2.1	3.5	3.1	2.6

Table 7.8: Groundwater analytical data - volatile organic compounds

	Monitoring Well Ref. No.							
Parameter	Units	MW-1	MW-2	MW-3		MW-4	MW-5	MW-6
Dichlorofluoromethane	µg/l	<1	<1	<1		<1	<1	<1
Chloromethane	µg/l	<1	<1	<1		<1	<1	<1
Vinylchloride	µg/l	<1	<1	<1		<1	<1	<1
Bromomethane	µg/l	<1	<1	<1		<1	<1	<1
Chloroethane	µg/l	<1	<1	<1		<1	<1	<1
Trichlorofluoromethane	µg/l	<1	<1	<1		<1	<1	<1
trans-1,2 Dichloroethene	µg/l	<1	<1	<1		<1	<1	<1
Dichloromethane	µg/l	<1	<1	<1		<1	<1	<1
1,1-Dichloroethene	µg/l	<1	<1	<1		<1	<1	<1
1,1-Dichloroethane	µg/l	<1	<1	<1		<1	<1	<1
cis-1,2-Dichloroethene	µg/l	<1	<1	<1		<1	<1	<1
Bromochloromethane	µg/l	<1	<1	<1		<1	<1	<1
Chloroform	µg/l	<1	<1	<1		<1	<1	<1
1,2-Dichloroethane	µg/l	<1	<1	<1		<1	<1	<1
1,1,1-Trichloroethane	µg/l	<1	<1	<1		<1	<1	<1
1,1-Dichloropropene	µg/l	<1	<1	<1		<1	<1	<1
Benzene	µg/l	<1	<1	<1		<1	<1	<1
Carbontetrachloride	µg/l	<1	<1	<1		<1	<1	<1
Dibromomethane	µg/l	<1	<1	<1		<1	<1	<1
1,2-Dichloropropane	µg/l	<1	<1	<1		<1	<1	<1
Trichloroethene	µg/l	<1	<1	<1		<1	<1	<1
cis-1,3-Dichloropropene	µg/l	<1	<1	<1		<1	<1	<1
trans-1,3-Dichloropropene	µg/l	<1	<1	<1		<1	<1	<1
1,1,2-Trichloroethane	µg/l	<1	<1	<1		<1	<1	<1
Toluene	µg/l	<1	<1	<1		<1	<1	<1
1,3-Dichloropropane	µg/l	<1	<1	<1		<1	<1	<1
Dibromochloromethane	µg/l	<1	<1	<1		<1	<1	<1
1,2-Dibromoethane	µg/l	<1	<1	<1		<1	<1	<1
Tetrachloroethene	µg/l	<1	<1	<1		<1	<1	<1
Chlorobenzene	µg/l	<1	<1	<1		<1	<1	<1
Ethylbenzene	µg/l	<1	<1	<1		<1	<1	<1
Xylenes (p/m)	µg/l	<1	<1	<1		<1	<1	<1
Styrene	µg/l	<1	<1	<1		<1	<1	<1
1,1,2,2-Tetrachloroethane	µg/l	<1	<1	<1		<1	<1	<1
o-Xylene	µg/l	<1	<1	<1		<1	<1	<1
1,2,3-Trichloropropane	µg/l	<1	<1	<1		<1	<1	<1
Isopropylbenzene	µg/l	<1	<1	<1		<1	<1	<1
Bromobenzene	µg/l	<1	<1	<1		<1	<1	<1
2-Chlorotoluene	µg/l	<1	<1	<1		<1	<1	<1
Propylbenzene	µg/l	<1	<1	<1		<1	<1	<1
1,2,4-Trimethylbenzene	µg/l	<1	<1	<1		<1	<1	<1
4-Isopropyltoluene	µg/l	<1	<1	<1		<1	<1	<1
1,3,5-Trimethylbenzene	µg/l	<1	<1	<1		<1	<1	<1
1,2-Dichlorobenzene	µg/l	<1	<1	<1		<1	<1	<1
1,4-Dichlorobenzene	µg/l	<1	<1	<1		<1	<1	<1
sec-Butylbenzene	µg/l	<1	<1	<1		<1	<1	<1
tert-Butylbenzene	µg/l	<1	<1	<1		<1	<1	<1
1,3-Dichlorobenzene	µg/l	<1	<1	<1		<1	<1	<1
n-Butylbenzene	µg/l	<1	<1	<1		<1	<1	<1
1,2-Dibromo-3-Chloropropane	µg/l	<1	<1	<1		<1	<1	<1
1,2,4-Trichlorobenzene	µg/l	<1	<1	<1		<1	<1	<1
Naphthalene	µg/l	<1	<1	<1		<1	<1	<1
1,2,3-Trichlorobenzene	µg/l	<1	<1	<1		<1	<1	<1

Hexachlorobutadiene	µg/l	<1	<1	<1		<1	<1	<1

(b) Volatile organic compounds (VOCs)
The results of the analysis for the suite of 54 VOCs in the water samples is presented in table 7.8. The results show that none of the parameters analysed for were detected. The limit of detection is one microgram per litre (µg/l). This implies that the groundwater from each of the six monitoring wells is free of contamination from organic compounds of an industrial or any other source.

7.4 PREDICTED IMPACTS

Assessment of the effects of the proposed discharge from Abbott Ireland requires consideration of two separate but inter-related impacts. These are the impacts on (a) the proposed municipal waste water treatment plant and (b) the waters of Sligo Bay to which the treatment plant will eventually discharge. The typical characteristics of the wastewater discharge from the proposed development site were presented in table 7.3

7.4.1 Sligo Municipal Treatment Plant

In setting emission limit values for the proposed waste water discharge, the EPA is obliged to consult with and to take into account the requirements of the sanitary authority, Sligo Corporation. The Corporation will wish to ensure that the waste water is not hazardous to its sewer maintenance staff, does not damage the fabric of the foul sewerage system and pumping stations and will not have an adverse impact on the biological processes in the new treatment plant.

The EPA's BATNEEC Guidance Note does not give limit values for discharges of waste water to municipal sewers because such discharges must have the consent of the sewerage undertaker (sanitary authority in this case) in the first instance and because local circumstances vary from authority to authority and from plant to plant.

To mitigate the impact of the proposed discharge various measures, which are described in section 7.5, will be taken by the company. To determine the impact on the municipal wastewater treatment plant it is necessary to ensure (i) that the treatment plant has the capacity to accept the discharge and treat it so that the final discharge to the Bay is within the design limits and (ii) that the components of the Abbott Ireland discharge do not inhibit or reduce the efficiency of the municipal treatment plant

Hydraulic load
The combined (process, utility and sanitary) hydraulic load at 28.5 m^3/d represents less than 0.4% of the design dry weather flow (8500 m^3/d) of the proposed municipal plant. It has been confirmed that the municipal sewer at Ballytivnan has the capacity to accept an additional 28.5 m^3/d.

pH
By controlling the pH, the sewer maintenance staff, the sewers and the treatment plant will not be at risk from very acidic or very alkaline discharges.

BOD, COD and organic compounds
The estimated BOD load to be discharged is 16 kg/d which is less than 1% of the design load of 2100 kg BOD/d. The estimated COD load is 80 kg/d[13]. Capacity will exist in the treatment plant for these loads.

The organic components of the waste water will include solvents (dichloromethane, methanol, toluene, ethanol, diethyl ether, ethyl acetate, acetone, tetrahydrofuran) and traces of unreacted raw materials and products. The BOD and COD concentrations of the process waste water will be due mainly to the presence of small concentrations of the water soluble organic solvents such as ethanol, methanol and ethyl acetate. These compounds are all readily biodegradable even at high concentrations. In the context of a discharge to a municipal sewer, solvents such as ethanol, methanol and ethyl acetate are not of significant environmental importance and the main reason for limiting them is to ensure that sewer maintenance staff are not exposed to high concentration vapours and that the risk of an explosion in the sewer is minimised.

Dichloromethane and toluene
Under regulations made earlier this year[14], the Minister has prescribed a water quality standard of 10 μg/l each for dichloromethane and toluene. The definition of waters includes tidal waters. The steam stripper will ensure that the discharge from the proposed development will not cause these standards to be exceeded.

The discharge will contain also traces of unreacted raw materials and traces of products. It is highly unlikely that these will have any adverse impact on the municipal treatment plant as biologically based treatment systems are the most commonly used worldwide to treat pharmaceutical manufacturing wastewaters. It is possible to estimate a worst case scenario for the concentration of products in the discharge. The average output per day from the proposed development of will be about 2 kg. Taking a nominal loss rate to drain of 1%, the concentration entering the municipal treatment plant would be about 0.0025 mg/l or 2.5 parts per billion. At this level it is extremely unlikely that any adverse impact will occur. In practice the concentrations of products at the inlet to the treatment plant will be much lower as a loss rate to drain of 1% would be regarded as unacceptably high by the company.

Suspended solids
The estimated suspended solids load is 20 kg or 1% of the design load of 2040 kg/d.

Phosphorus
There will be no contribution of phosphorus from the manufacturing process. The only sources will be from the sanitary and utilities waste streams. The concentration in the discharge will be at the same level as found in normal municipal wastewater.

7.4.2 Sligo Bay

The new Sligo municipal wastewater treatment will have capacity to accept and treat the proposed discharge from the Abbott Ireland development. The discharge will not adversely

[13] *BOD is traditionally used in waste water treatment design in Ireland. COD is usually used in continental Europe.*
[14] Statutory Instrument Number 12 of 2001, Water Quality (Dangerous Substances) Regulations, 2001.

impact on the municipal treatment plant and consequently will not cause the design final effluent parameters to be exceeded. These design parameters were selected by the Corporation so that water quality in the Bay would not deteriorate. In particular the discharge from Abbott Ireland will not contain any substance in such as concentration that would interfere with the amenities of the Bay or fisheries, for example, tainting of fish flesh or shell fish.

7.4.3 Local Watercourses

Water quality in the local water course will not be affected by the proposed development. A comprehensive set of design measures will ensure that the risk of contamination due to a process or drainage leak is minimal. In the unlikely event of a spill or leak the contaminant will be retained within the development site in the pond.

7.4.4 Groundwater

Waste materials will not be deposited within the development site. As there will be no direct discharge of any wastewater stream to ground any adverse impact would have to be because of accidental circumstances. There are two possible scenarios to consider. The first is a process spillage from a ruptured tank or from a burst pipe. The second is leakage from waste water drains.

The risk of a spillage causing extensive contamination is negligible because of (i) the above ground location of the bulk tanks (all bunded), (ii) the pipework (all above ground) and (iii) the facility design philosophy.

The second scenario (leaking drain) is difficult to detect within a short time of a leak developing. The shallow depth to the rock over much of the site means that leakage could result in groundwater contamination and also surface water contamination since the water table is relatively near to the surface for much of the year. However, as the process waste water drains will be double contained, any leakage would have to come from drains carrying treated waste water to the Sligo Corporation foul sewer. It follows that the contaminant load released would be very small.

The public water supply is available to all dwellings down gradient of the development site in the area and so in the most unlikely event of a contamination incident there would be no result in loss of drinking water. As an added safeguard, installation of monitoring wells (six have already been drilled) and regular monitoring will ensure that the possibility of contamination would be detected before the contaminants migrate off-site.

7.5 MITIGATION

A number of measures will combine to mitigate the impact of the waste water discharge from the proposed development. These measures include the comprehensive legislative based controls, company policy on environmental protection and the provision of waste water treatment facilities so that water quality in the receiving environment, including ground water, is protected.

7.5.1 Legislative Controls

Before commencing discharge of waste water the company will be obliged to hold an integrated pollution control licence. An application for a licence will be submitted to the

EPA. The requirements of the EPA are generally known in advance as the Agency has published (1995) a BATNEEC Guidance Note for the Chemical Sector. The Note emphasises the need for waste minimisation through elimination, substitution, prevention, reduction and re-use, rather than use of 'end-of-pipe' treatment.

An example of a specific measure which the company will employ to reduce emissions to the aquatic environment is the fact that most steps in the manufacturing process will take place in dedicated equipment. This means that it will not be necessary to clean each item of plant after each use and so the volume of waste water and its contaminants (BOD, COD etc.) will be significantly reduced.

In formulating the licence the EPA is legally obliged to have regard to water quality standards and may not issue a licence that would result in pollution. Over 200 IPC licences have been issued to date and a feature of them is the comprehensive monitoring programmes and reporting regimes imposed on the licensees. This is reinforced by the EPA's own unannounced monitoring. Abbott Ireland will also carry out regular monitoring and auditing of the control systems to ensure that all are functioning at optimum efficiency and that there is compliance with all licence conditions.

7.5.2 Treatment

(a) On-Site Treatment

The wastewater from all pharmaceutical manufacturers in Ireland is treated either in on-site plants or in treatment plants owned by the local authority. When the organic load as measured by the BOD value is small it is normal practice to discharge the wastewater, after preliminary treatment, to the local authority or municipal treatment plant. Preliminary treatment typically entails pH adjustment or removal of a specific component that would be likely to inhibit or reduce the efficiency of the municipal treatment plant.

In the case of the Abbott Ireland proposed development, the total BOD load at about 16 kg/d is very low and so the required degree of on-site treatment will be limited to pH adjustment and removal of volatile organic compounds by steam stripping technology. The organic and aqueous waste streams will be pumped directly from the production buildings to separate waste receiver tanks located at the bulk storage area. The aqueous stream will be accumulated, neutralised (pH adjusted) and then passed through a steam stripper to remove trace organic compounds. The priority compounds for removal will be dichloromethane (DCM) and toluene because of their environmental characteristics[15]. With the exception of diethyl ether all of the solvents are known to be biodegradable in activated sludge based wastewater treatment plants. After treatment the stripped liquor will be sampled and tested to ensure that it is within the levels specified in the integrated pollution control licence. Once approved for release it will be discharged along with the sanitary and utilities wastewater streams to Sligo Corporation's foul sewer at Ballytivnan.

[15] . These two compounds are on the EU list of 129 substances for priority candidates for inclusion as List I substances consequent to the 'Dangerous Substances' Directive Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community and amendments.

If analysis of the stripped wastewater shows that the solvent concentrations are above the limit values, the contents of the test tank will be returned to the aqueous waste tank for another pass through the steam stripper.

The overhead organic waste from the steam stripper will be pumped directly to the waste solvent storage tank. The steam stripper is designed to operate intermittently when sufficient volume has accumulated in the main aqueous storage tank. It is expected that the stripper will be on-line for 3 to 4 hours per day.

The organic phase waste stream will also be accumulated in a dedicated bulk storage tank. Again when a pre-determined volume has been reached in the tank the material will be pumped through a stripping column to remove trace aqueous compounds and reduce the overall volume of the waste material. This concentrated stream will be discharged to a road tanker and transferred off-site for further recycling.

(b) Proposed Sligo Municipal Plant

At present the waste water discharged from Sligo Town and its environs amounts to about 8200 m^3/d containing about 1960 kg BOD/d. The discharge is not treated. The proposed municipal treatment plant is being provided in accordance with the requirements of the Environmental Protection Agency (Urban Waste Water Treatment) Regulations 1994[16]. These Regulations, made on foot of a European Union directive[17], require for municipalities with a population equivalent of more than 15, 000 persons that the standard of waste water discharged conform to the following specification:-

Biochemical oxygen demand,	25 mg/l O_2 or minimum 70-90% removal
Suspended solids,	35 mg/l or minimum 90% removal
Chemical oxygen demand	125 mg/l or 75% minimum removal

In the case of discharges to sensitive waters, the regulations further require that facilities to reduce nitrogen and phosphorus be provided so that concentrations of nitrogen and phosphorus do not exceed 15 mg/l as N and 2 mg/l as P respectively. Sligo Bay has not been designated a sensitive area. However, the Foreshore Lease from the Department of the Marine requires that the total phosphorus be not greater than 2 mg/l P.

The proposed treatment plant will incorporate screening and grit removal, primary sedimentation, biological oxidation using activated sludge (fine bubble aeration), final clarification and flow measurement. Storm water holding tanks will be provided. On the basis of studies to be carried out in the future a decision will be made regarding the provision of final discharge disinfection to reduce the total bacterial counts. The new plant will incorporate sludge treatment facilities and Sligo was recommended as a hub centre for sludge treatment in the National Strategy report published a few years ago by the Department of the Environment. The estimated capital cost of the proposed plant is about IR£3.3 million.

[16] *Statutory Instrument Number 419 of 1994*
[17] *Directive 91/271/EEC*

The proposed treatment plant will be constructed in two phases for completeion Q2 2003. Phase I has been designed to treat a dry weather flow hydraulic load of 8500 m^3/d. The design BOD load is 2100 kg/d which is equivalent to a population of 35,000 persons. The design daily loads for chemical oxygen demand (COD), suspended solids, total nitrogen (N) and ortho-phosphate (P) are 3040, 2040, 87 and 49 kg respectively. The phase II expansion envisages a design DWF hydraulic load of 12,500 m^3/d and a BOD loading of 3000 kg/d.

		Design	
Parameter	Actual at present	Phase I	Phase II
Hydraulic load, m^3/d	8200	8500	12500
Biochemical oxygen demand, kg/d	1960	2100	3000

Comparing the actual present loads and the design loads it is apparent that provision has been made for some population growth, increased industrial and tourism related activity as well as the connection of some peripheral areas around the town to its main drainage system. This spare load provision means that it is considered unlikely that phase II will need to be constructed for some years but if the proposed development by Abbott Ireland proceeds some of the spare phase I capacity will be utilised. The BOD spare capacity is 140 kg BOD/d and Abbott Ireland will discharge about 16 kg/d. The spare hydraulic capacity is 300 m^3/d and Abbott Ireland will discharge about 90 m^3/d. Phase I has been designed in such a way that construction of phase II will not disrupt the treatment plant.

7.5.3 Local Surface Waters

There will be no discharge of process waste water to local water courses. Prevention of accidental discharges has been incorporated into the design of the proposed development following a rigorous evaluation of all of the risks involved. The design philosophy is based on the concept of prevention rather than cure.

Mitigation of the impact on the local surface waters will primarily rest on the following design/operational features:-

- double containment or bunding of all bulk materials and oil storage tanks
- the transfer of process materials in above ground rigid pipe systems
- strict inventory control and documented operation procedures
- trained emergency spill/leak response team
- process and foul drainage systems will be designed and constructed to best engineering practice taking into account the nature of the waste water; In particular, the process waste water drains from the production building to the waste water treatment systems will be laid in concrete ducts, that is, double containment
- adherence to best practice in material selection for tanks, pipework and fittings
- pressure testing and, as appropriate, X-ray inspections of welding work prior to placing in service
- regular inspection of bund integrity and drains at manholes will be carried out so that any risk of leakage to the storm water system will be minimal; under ground service ducts will be similarly inspected.

Experience has shown that unloading of materials is one of the most common causes of spillage in processing industries. To protect against surface water contamination, the storm water drains in the bulk tanker off-loading area will drain to the organic / aqueous waste receivers.

It is proposed to construct a storm water detention pond which will be lined with an impermeable membrane. This will allow the discharge flow rate to the stream to be regulated and will allow the discharge to be stopped if contamination is suspected. This will be achieved by a motorised valve on the outlet from the pond. The discharge will be monitored regularly for relevant parameters.

The location of the proposed development in relation to the Doonally River is such that the possibility of drainage from the site reaching it is remote.

During the construction period there is a concern that silt or other material could be carried to local surface waters – particularly during the spawning season. To avoid the potential for such impacts a construction method statement shall prepared to protect the adjacent surface waters. The statement shall be submitted to the North west Regional Fisheries Board for agreement prior to the commencement of construction.

7.5.4 Groundwater

The hydrogeological investigation has established the presence of a minor aquifer beneath the property and the results of extensive analysis show that water quality is excellent with no indications of contamination.

The presence of clay-dominated overburden at the property provides a level of protection for the underlying limestone aquifer. However, the overburden is thin in places and consequently the degree of protection varies. The only below ground services will be process and storm water drains. The variation in natural protection to the groundwater regime has been considered in the design and location of these potentially polluting services and activities.

Essentially the same very comprehensive measures as proposed for the protection of the surface drainage will also protect ground water (see above section 5.4.3). A system of boreholes will be installed at strategic locations around the site and these will be monitored so that early warning of contamination will be given. Some of the boreholes were drilled as part of the baseline data gathering for this EIS.

7.6 SUMMARY

In summary, the proposed Abbott Ireland development will not cause any national or European Union water quality standard to be exceeded. These standards include both fresh, marine and intertidal waters.

The proposed discharge will not have any adverse impact on the Sligo municipal waste water treatment plant. The proposed development will be designed and operated to minimise impact on the environment. Sligo Corporation will advise the EPA of their requirements so that the proposed discharge from Abbott Ireland will not adversely affect the new municipal wastewater treatment plant.

The Integrated Pollution Control licence will require installation by Abbott Ireland of an environmental management system which will in turn require the company to address environmental issues in a proactive manner and to seek to reduce emissions on a targeted basis. Furthermore the company employs independent auditors to ensure and verify that compliance with external and Corporate internal environmental requirements are met.

CHAPTER 8 – AIR QUALITY

8.1 ATMOSPHERIC EMISSIONS - SOURCES & CHARACTERISTICS

Emissions to atmosphere from the proposed development can be described under the following headings:-

- Process Emissions — emissions from production and associated processes
- Utility Emissions — emissions from utilities on the site
- Construction Emissions — emissions from site preparation and construction

This section provides a general indication of the procedures and processes that will be put in place. The final details of emissions will be determined on a product by product basis.

General - Gaseous Emissions and Vents

Process Vents

Waste gas from the process vents will be collected in a vent header system. The main header is routed directly to an area guard condenser to reduce the carry over of solvents in the nitrogen stream (using a 2 °C tempered glycol loop). The outlet vent from this condenser passes directly to a VOC abatement unit which reduces the organics in the final vent emission to meet IPC licence limits (limit yet to be determined). This VOC system will be comprised of two main units: firstly an absorption tower where the VOC components of the vent stream are absorbed in and the clean vent is released to atmosphere via a detonation flame arrestor. The second tower is a steam stripper which is used to remove the absorbed organics enabling it to be recycled back to the absorption tower. There will be a waste organic stream from this unit which will be pumped to the main solvent waste tank TK905.

The reactors and process vessels which involve acid charging will have an additional vent route directing acid fumes to a process scrubber via a header. This process vent scrubber will use caustic (NaOH) as a circulating scrubbing liquor and the scrubber vent line will discharge directly to atmosphere. Spent scrubber liquors (aqueous) will be directed to the aqueous waste tank (TK904). Vessels such as acid header tanks will have the acid scrubber route as the only vent. Reactors will have the facility to automatically select the vent to scrubber when an acid charge is taking place, then to automatically divert to the main vent/VOC route when the acid charge is complete.
In the tank farm area, the solvent and aqueous waste tanks will have conservation vents to minimise any fugitive emissions.

The extract streams from the fans on the three process drum charging booths will be routed to the process scrubber.

Emergency Vents

Process vessels which normally vent to the main header will be fitted with relief devices such as bursting discs/pressure relief valves. The discharge line from these devices will be routed via a header to a catch pot. Any liquid contained in this catch pot can be drained into a drum for disposal.

Emergency vents on tank farm vessels will be routed to discharge to atmosphere.

8.1.1 Process Emissions

There will be two point sources of process emissions from the proposed plant, (i) one from the VOC abatement unit (Process Vent 001) and (ii) one from the scrubber (Process Vent 002). Some minor emissions will also arise from associated activities such as fume hoods, storage tanks and a filter exhaust.

(i) Production building – Vent 001

The principal waste gas stream will arise in the production building and will be vented to atmosphere, after treatment, through a single vent, 001 at a height of 3m above the roof and 19.2m above ground level. This stream will consist of the combined emissions from all significant sources in the production area, as well as working losses from some bulk storage tanks.

Under normal conditions, the waste gas flow will amount to 70 Nm^3 per hour, but at certain times this will increase to 193 Nm^3 per hour when the vessels are vented to purge any residual contents between batches.

The maximum predicted final emissions from the exhaust vent are as listed in table 8.1, and are compared with the expected emission limit values in table 8.2. These are the emission limits anticipated in the IPC licence from the EPA, and are based on the emission limit values (ELVs) listed in the BATNEEC Guidance Note for the Chemical Sector, issued by the EPA.

Table 8.1: Maximum predicted emissions to atmosphere from Vent 001			
Substance	Emission Concentration mg/Nm^3	Emission Mass kg/h	Volume Flow Nm^3/h
Acetone	<10	0.002	193
Diethyl ether	<10	0.002	
Ethanol	<10	0.002	
Ethyl acetate	<10	0.002	
IMS	<10	0.002	
Methanol	<10	0.002	
THF	<10	0.002	
Toluene	<10	0.002	
DCM	<10	0.002	

Table 8.2: Classification and ELV of emission		
Substance	BATNEEC Class	ELV
	TA Luft Organic	
Acetone Diethyl ether Ethanol Ethyl acetate IMS Methanol	III III III III III III	150 mg/Nm^3 at a mass flow of 3.0 kg/h or more
THF Toluene	II II	100 mg/Nm^3 at a mass flow of 2.0 kg/h or more
DCM	I	20 mg/Nm^3 at a mass flow of 0.1 kg/h or more

All individual solvent vapour emissions from vent 001 will have concentrations less than 10 mg/Nm3. At the maximum gas flow of 207 Nm3/h,this amounts to less than 0.002 kg/h in each case. These concentrations and mass flows are well below the relevant emission limit values and mass thresholds for each substance as listed in T.A. Luft (Table 8.2). The T.A. Luft limits are specified for these substances by the E.P.A. in the BATNEEC Guidance Note for the Chemical Sector.

In certain cases, there may be combined emissions from more than one production process through the abatement unit. This may result in higher emission rates to atmosphere but, given the large safety margin in each case, it is highly unlikely that any combination of processes will result in an exceedance of the emission limit values. The company can also control the combination of production processes to ensure that no breach of the licence limits will occur. It should also be noted that the values listed in table

8.1 represent the maximum (peak) emissions. Normal emission rates will be approximately 36% of the listed values.

(ii) Production building – Vent 002

The second emission point is the vent from the acid scrubber (vent 002). The acids used are HCl (hydrochloric acid) and H_2SO_4 (sulphuric acid), which are readily removed by caustic scrubbing. The emissions to atmosphere under maximum load are calculated at 0.12 kg/h, which comply with the EPA BATNEEC limits which are (BATNEEC Note Table 5.4):

Chlorides (as HCl):	10 mg/Nm3	at > 0.3 kg/h

Once again, there may be combined emissions from more than one production process through the scrubber unit. This may result in higher emission rates to atmosphere but, given the relative ease with which acid emissions can be controlled with caustic scrubbers, it is highly unlikely that any combination of processes will result in an exceedance of the emission limit value. The company can also control the combination of production processes to ensure that no breach of the licence limits will occur. It should also be noted that the values listed represent the maximum (peak) emissions.

The normal emission rate will be approximately 14% of the maximum rate. Vent 002 will extend to a height of 3m above the roof and 19.2m above ground level

(iii) Other process emissions:

The only other emissions from process operations will be :-

- vents from fume hoods in the two laboratories in building A. These will vent minor quantities of laboratory materials which will be used from time to time for quality control or other analytical tests. The emissions will not be significant.

- a dust collector will be used to control any dust that might arise during the tipping of solids into the mixing vessel to make the required solutions and from any tabletting machines. HEPA filters will be installed to control any emissions of pharmaceutically active ingredients and ensure compliance with the EPA BATNEEC limits which are (BATNEEC Note Table 5.4):

Dust – pharmaceutical	0.15 mg/Nm^3	at > 1g/h

The description of the process emissions relates to products and materials anticipated during the early phases of company operations. However, this is intended as a generic plant capable of producing a range of pharmaceutical products using similar processes and materials to those already described. The company will ensure, through the IPC licensing system, that any changes will be fully notified to the EPA, be properly licensed and will not result in a breach of any emission limit value.

8.1.2 Utility Emissions

(i) Boilers

Two boilers will be installed to provide process steam and space heating on a duty/standby basis. The boilers will have a capacity of 8000 kg steam/h each and will be fuelled by gas oil (35 sec.). The stacks will extend 3m above the highest building and 19.2 m above ground level. The predicted emissions and the predicted emission limit values are listed in table 8.3.

Expected emission characteristics from each boiler are as follows:

Exhaust Flowrate:	13047 Nm^3 /hr – 200^o with Economiser
Exhaust Temperature:	262^oC (200^oC with Ecomoniser)
Exhaust Stack Dia:	610 mm (24”)

The above figures are based on 3% O_2 on a dry basis.

Table 8. 3: Predicted Boiler Emissions and ELVs

Substance	Emission Concentration (mg/Nm^3)	ELV (TA Luft) (mg/Nm^3)
NO_x (as NO_2)	~ 223	250
SO_2*	~ 340	1,700
CO	< 70	170
Unburnt HC / PM_{10}	< 40	80

* SO_2 emissions are effectively controlled by the legal limitation on sulphur content in gas oil of 0.2% (S.I. No. 256 of 1994)..

The emissions will comply with the anticipated emission limit values.

(ii) Other utilities

Cooling Towers: There will be two cooling towers for water cooling. Each will have a cooling capacity of approximately 1.3 million Kcal/h and a water recirculation rate of 172 m^3/h. The only emission from the towers will be water vapour, which may form a visible plume under certain weather conditions.

Fire Water Pump: A diesel fuelled pump will be installed for pumping fire water. This will be required in the event of a fire and under normal circumstances will be run occasionally for test purposes only. Emissions will be diesel exhaust fumes, and will be similar to that from a truck.

Generator: A diesel fueled generator will be installed to provide emergency back-up in the event of power failure to the site. It will be run occasionally for test purposes only. The occasional emission of diesel exhaust fumes will not be environmentally significant.

8.1.3 Construction Emissions

There will be inevitably considerable movement of soil and building materials during the site clearance and the construction stages, which are expected to last 24 months. Such activities involve movements of trucks and other heavy machinery, and can give rise to dust emissions during periods of dry, windy weather. Should such conditions result in nuisance levels of dust off site, appropriate steps will be taken to control the emissions by damping down problem areas with water sprays.

8.2 RECEIVING ENVIRONMENT

The proposed development site is located approximately 2 km north-east of the centre of Sligo town. The surrounding area is largely rural by nature with scattered housing, but with encroaching urbanisation in the form of more intensive housing developments.

These developments are situated immediately to the south of the site (Yeats' Heights) and to the west (Ballytivnan Road), beyond the existing Abbott Ireland facility, which manufactures healthcare products. As such, the location is borderline between rural and urban and is expected to have relatively good air quality. Any air contamination is most likely to arise from the combustion of fossil fuels in domestic appliances, passing motor vehicles and from industrial units.

To assess the air quality in the area, a monitor was established towards the rear of the existing Abbott Ireland facility, at a distance of about 700 m from the proposed site. The sampling period was from 9 December, 1997 to 13 January, 1998 for the parameters sulphur dioxide (SO_2), smoke and nitrogen dioxide (NO_2), which were sampled because they are the principal contaminants from the combustion of fossil fuels

The NO_2 levels were measured using commercially available diffusion tubes with a sampling period of one week. The weekly nitrogen dioxide concentrations are expressed as average hourly values and compared to the hourly values contained in S.I. No. 244 of 1987 and in Directive 99/30/EC.

The SO_2 and smoke levels were measured using an 8-day monitor in accordance with the method specified in the Directive 80/779/EEC. This method gives daily average results which are compared with the existing National Air Quality Standards (S.I. No. 244 of 1987) and new EU Air Quality Standards which will come into effect in 2005 (Directive 99/30/EC),[1] as listed in table 8.6 The daily smoke concentrations are compared to the National Air Quality Standards (S.I. No. 244 of 1987). The new EU Air Quality Standards refer only to fine particulates (PM_{10}). Therefore, the smoke results cannot be compared directly to the PM_{10} fraction in the new Directive 99/30/EC.

The NO_2 results are listed in table 8.4 while the SO_2 and smoke results are listed in table 8.5.

Table 8.4: Average Hourly NO_2 Concentration

Sampling Period	Average Hourly NO_2 $\mu g/m^3$
9/12/97 to 16/12/97	2.4
16/12/97 to 23/12/97	16.5
23/12/97 to 30/12/97	4.7
30/12/97 to 6/1/98	7.4
Mean	**7.8**
Max	**16.5**

Table 8.5: Daily SO_2 and smoke concentrations

Date	SO_2 µg/m³	Smoke µg/m³	Date	SO_2 µg/m³	Smoke µg/m³
Dec 1997			**Jan 1998**		
9	13	12	**1**	8	8
10	29	9	**2**	11	9
11	53	7	**3**	12	5
12	15	20	**4**	12	9
13	17	6	**5**	21	17
14	14	2	**6**	16	8
15	19	6	**7**	12	11
16	15	5	**8**	22	6
17	16	5	**9**	20	6
18	12	8	**10**	25	5
19	12	5	**11**	20	8
20	8	11	**12**	20	8
21	8	5	**13**	9	6
22	8	9			
23	10	11			
24	13	2	**Mean**	**15**	**8**
25	11	5	**Median**	**13**	**9**
26	12	6	**Daily Max**	**53**	**20**
27	12	7			
28	13	11			
29	12	6			
30	10	5			
31	12	17			

The results can be compared with the Air Quality Standards, which are summarised in Table 8.6.

Table 8.6: Air Quality Standards S.I. No. 244 of 1987 and 99/30/EC[1]

Period	SO_2 ($\mu g/m^3$)	Smoke ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)
Annual Median (daily averages)	120* (80 if smoke >40)	80	-
Winter Median (daily averages)	180 (130 if smoke >60)	130	-
Daily Max. (98 percentile)	350 (250 if smoke >150)	250	-
Daily Max.[1] (99.2 percentile)	125	-	-
Hourly Max. (98 percentile)	-	-	200
Hourly Max.[1] (99.8 percentile)	-	-	200

***The Air Quality Standard for SO_2 in S.I. No. 244 of 1987 is dependent on the level of smoke present. When smoke levels are low, as in the present case, the higher limit for SO_2 is appropriate.**

The measured values for SO_2 and smoke in table 8.5 can be compared directly with the AQS values in table 8.6 because they are based on 24-hour samples. The daily maximum and median values are comfortably within the required limits for both parameters. The measured values for NO_2 in table 8.4 can only be compared indirectly with the AQS values in table 8.6 because the results are not based on 1 hour samples. Nevertheless, it can be seen that the highest measured value is well below the required limit of 200 $\mu g/m^3$.

Taken together, the measured values for SO_2, smoke and NO_2 indicate a good background air quality with relatively low levels of contamination from combustion sources. While it is recognised that the background data is over three years old it is still considered valid because there have been no significant developments in the immediate vicinity of the site which would adversely impact on those background air quality parameters described.

8.3 Mitigation

Measures will be taken to mitigate the impact of the atmospheric emissions on the receiving environment. The measures will arise through the legislative controls imposed by the licensing system and company policies and practices aimed at minimising emissions, in compliance with the principles of BATNEEC.

8.3.1 Legislative Controls

The company will be obliged to obtain an IPC licence from the EPA before it can start operating the plant. The IPC licence will contain the operating parameters and emission limits that the EPA consider necessary to meet BATNEEC for this industry sector. In issuing the licence the EPA is legally obliged to ensure that the licensed emissions will not cause a breach of any Air Quality Standard and are prohibited from licensing any emission that would result in air pollution. Consequently the conditions in the IPC licence will represent the main controls on the emissions, and will be verified by a monitoring programme to ensure compliance.

The requirements of the EPA are generally known because they have published a BATNEEC Guidance Note for the Chemical sector. This contains the emission limit values required to satisfy BATNEEC and all of these will be met by the company, as can be seen in tables 8.1 and 8.2.

8.3.2 Specific Measures

The BATNEEC Note contains a listing of possible mitigating measures with the emphasis placed on prevention techniques such as load minimisation and recovery rather than end-of-pipe treatments, although a list of such treatments is also included.

a) In order to minimise emissions of sulphur dioxide, gas oil will be used to fuel the boilers.

b) Treatment: The main process vent streams (vents 001 and 002) will be extensively treated before release to ensure there is no adverse impact on air quality.

8.3.3 Future Measures

In keeping with Abbott's commitment to environmental standards, continuous improvement in environmental performance will be an integral part of the operation of the facility.

8.4 Impact of Emissions

The impact of the emissions can be assessed by comparing the emission levels with appropriate emission limit values.

8.4.1 Comparison with Emission Limit Values (ELVs)

The nature and quantity of the predicted emissions are described in section 8.1. For the process emissions, the appropriate ELVs are those issued by the EPA because the activity is a scheduled one under the EPA Act, 1992. The ELVs are issued for each industry sector in the form of BATNEEC Guidance Notes (Best Available Technology Not Entailing Excessive Cost). In this case the applicable note is the one for the “Chemical Sector”. All process emissions will comply with the ELVs and therefore can be considered to be meeting BATNEEC requirements (table 8.1).

The boiler emissions are compared directly with the TA Luft limits. The emissions will readily comply with the appropriate limits (table 8.3).

There are no other impacts predicted from the emissions. All emissions will be well below the odour detection limit and none of the substances are listed under the Montreal Protocol.

CHAPTER 9 - NOISE

9.1 NOISE - SOURCES AND CHARACTERISTICS

9.1.1 Process

The production plant will effectively operate on a continuous basis. At any given time some part of the process and the purification stages will be operating.

The production building will contain numerous items of equipment associated with the production of the product and its purification. This equipment, which will mainly consist of pumps and agitators, will have small electrically powered motors generally not exceeding 3 kW. There will be no granulators, mills or powder handling equipment. The packaging equipment, which will be in a separate building, will consist of manual and automatic liquid filling machines, conveyor systems and packing machines which will be electrically or pneumatically powered. Measurements made at other similar pharmaceutical packaging plants indicate that such operations are not inherently noisy. Apart from the low noise characteristic of the equipment, the building envelope (walls and roof) is such that transmission of noise would be expected to be minimal.

The principal potential environmental noise sources will either be located outdoors or will be located indoors but will exhaust to or draw from the exterior. The main sources will be:

* Cooling towers
* Air emission scrubbers, blowers and pumps
* Heating ventilation and air conditioning (HVAC)
* Production building air intakes and exhausts
* Energy centre (boiler)

Some of the equipment will operate continuously and some intermittently. There will not be any sources of vibration.

There will be two cooling towers and each will contain a fan and a supply-circulation water pump. Normally the pumps and fans will operate continuously.

Air emission scrubbers will be similar to the cooling towers in that they will contain a fan and a water pump. There will be three scrubbers and these will operate continuously.

Some workspaces will require air conditioning and this will operate continuously because of the need to maintain hygienic conditions for staff comfort and safety and to minimise the risk of product contamination. The air conditioning will be provided by air handling units (AHU), which are self-contained noise-insulated units. The AHU's will be located in mechanical plant rooms at various locations in the two main buildings. The main source of noise will be the aerodynamic noise from the fans and the fan motors, which will supply air to the units. The intake for the packaging area will be in the south facing wall and the exhaust will be in the north-facing wall. The production building ground floor intake will be in the west-facing wall while its exhaust will be in the south facing wall. The first, second and third floor intakes will be in the west-facing wall with the exhausts in the east-facing wall.

Where air conditioning is not required general ventilation will be provided by fans mounted in the walls. These will operate continuously but all would not normally operate simultaneously.

The energy centre will contain the boiler, associated air supply fans and water treatment systems and plant for hot water generation and distribution (pumps). Equipment will operate continuously.

Compressors will be located in enclosed compartments and will operate intermittently. Two will be associated with the production area and two with the wastewater treatment area.

The plant and equipment to be installed is common to existing pharmaceutical production plants in Ireland and noise control methods have been developed for these to achieve low levels of environmental noise. Noise control measures are available to meet normal environmental criteria. Noise levels will be specified as an integral part of equipment selection and procurement.

9.1.2 Traffic

The road traffic associated with the development, both on and off-site, will generate noise. The vehicles to be used will be ordinary vehicles constructed in accordance with the road traffic acts. The increase in the number of vehicles will have a negligible environmental effect as the transportation of raw material and product involves about seven trucks per day. The traffic access route to the development will be via a new plant entrance on the N16.

Most employee vehicle movements will take place during normal hours with a small number around midnight when there will be a shift change.

9.1.3 Construction phase

The construction phase is estimated to last for 1 year commencing in late 2001. The initial work will consist of earth moving mainly at the northern end of the development site. This will be followed by pouring of concrete foundations, erection of the building steel framework and fixing of cladding. This will be the period of most noise generation. Thereafter, most work will be in the building interiors, which will have a lower potential for noise generation. There will be no demolition and it is not expected that piling or rock blasting will be needed.

The arrival and departure of vehicles and plant associated with the construction will be a source of noise.

9.2 EXISTING ENVIRONMENTAL NOISE LEVELS

9.2.1 Noise survey methodology

The site for the proposed development is at the interface of an urban and semi-rural area. There are a significant number of private dwellings in the vicinity as well as the existing Abbott Ireland factory and community health care facilities.

Baseline measurements were made in the environs of the site at three locations which were: -

Location N1	Former District Mental Hospital
Location N2	Residential area, Yeats' Heights
Location N3	Ballytivnan Road, at front of existing plant

The instrumentation used on-site consisted of a Larson-Davies type 820 Environmental Noise Analyser, Location N1, with associated microphone and calibrator and a precision modular Sound Level Meter, Bruel & Kjaer type 2231.

The sound level was sampled continuously and the following data was obtained for each period: -

L_{A01} - the sound level equalled or exceeded for 1% of the measurement period, the maximum levels.

L_{A10} - the sound level equalled or exceeded for 10% of the measurement period, the parameter usually used for traffic noise assessment.

L_{A90} - the noise level equalled or exceeded for 90% of the measurement period. This level is taken to represent the background noise level.

L_{Aeq} - the equivalent continuous noise level for the measurement period. This parameter is very sensitive to local high level short time sources, for example, bird-song and road traffic.

For the longer-term measurements the period (T) was one hour and for the short-term measurements the periods were 30 minutes by day and 15 minutes by night. This method of measurement is similar to that used in determining compliance with IPC licence conditions.

9.2.2 Noise Survey Results

The measurement results are shown in tables 9.1 and 9.2. The existing Abbott Ireland plant was audible at all three locations and the maximum levels were due to local road traffic or local activity. There was also some construction activity at the existing plant.

If it is assumed that the noise emission from the existing plant is continuous the night-time levels recorded were: -

Location N1	Former District Mental Hospital	30 - 35 dB(A)
Location N2	Yeats' Heights	38 - 40 dB(A)
Location N3	Front of existing plant	42 - 46 dB(A)

It should be noted that the L_{A90} at Location N1 increased abruptly in the early morning and this was due to start up of a nearby domestic type heating boiler. The principal components of the L_{Aeq} levels at locations N2 and N3 were traffic noise.

9.3 MITIGATION

9.3.1 Proposed Development - Operational

There are no statutory criteria for environmental noise levels in this country. Noise emission from industrial development has been controlled by conditions attached to planning permissions by planning authorities and more recently, in the case of scheduled activities, by conditions in IPC licences from the EPA.

For a continuously operating plant, the noise level at night is usually the main focus of attention. This is because the general environmental background noise levels are usually at a minimum at night and the relative level of the plant noise is at its greatest. Additionally, the noise levels in residential premises are also at a minimum and disturbance to sleep may become a factor.

A day time limit of 55 dB(A) and a night time limit of 45 dB(A) are suggested by the EPA in Draft Guidance Notes for Noise in relation to Scheduled Activities, IPC, 1996, as the target level appropriate for noise sensitive locations. An important aspect of acceptability is the absence of significant tones or impulses.

The results of the noise survey indicate that there is little or no impact on residences for the daytime operation of the existing plant. At night-time the existing plant is audible but the levels are within *or close* to the EPA's target values.

When the presence of the existing plant and the corresponding baseline noise levels are considered the recommended limit criteria, based on the EPA's targets, for the proposed plant are as follows:

- Night time 2300 - 0700 45 dB $L_{Aeq,\ 15\ mins}$
- Day time 0700 - 2300 55 dB $L_{Aeq,\ 15\ mins}$
- No strong tones perceptible.

The above levels relate to any private residence and residential healthcare facility in the area.

BATNEEC will be employed in the design of the noise control measures *and the overall target environmental noise levels will include the emission due to the existing facility.* The principal ameliorative measure will be the design and specification of the key items of equipment that have been identified as having potential for noise generation. In addition the structures enveloping the significant noise sources will be designed with noise control as a priority.

The noise control options include: -

- The specification of low noise equipment
- The specification of attenuators and silencers
- The specification of building cladding and roofing
- The control of internal noise levels
- The control of noise from exhaust emissions
- The control of noise from fan and duct casings
- The optimisation of propagation paths and distances to sensitive receivers.

Noise mitigation and control measures will be specified as required for each noise source, taking into account the location of the source, its acoustic transmission characteristics, the sound propagation path to a particular receiving point and the contribution of all other sources at that receiving point. As a practical example, the main external noise sources will be located to the rear of the site to maximise the distance from the nearest sensitive receptors.

Employee and goods transportation traffic noise will be minimised by speed limits on the internal roads and the design of the roads.

9.3.2 Construction Phase

British Standard BS 5228: 1997 on noise control on construction and demolition sites provides guidance on the methods available to control noise from construction work and is used on road and other large scale construction projects. Contractors and sub-contractors will be required to take into account the noise aspects of their undertakings where necessary and will be required to comply with any European Union directives and Irish regulations on noise emission from construction plant. Due to the distance to nearby residences significant disturbance is not expected.

9.4 IMPACT

Sound levels are measured in units called decibels (dB), and noise has often been defined as unwanted sound. Environmental noise levels are usually assessed in terms of A-weighted decibels, the dB(A). The A-weighting approximates to the response of the human ear. Industrial, occupational and environmental noise is usually expressed in terms of an equivalent continuous level, L_{Aeq}. This is based on the average energy level over the relevant time interval.

9.4.1 Proposed Development - Operational

The production process will be in continuous operation and the night time limit will control the noise emission of most of the plant.

The impact of noise from the development is based on four principal factors which are:

- The absolute level of noise generated
- The time at which the noise occurs
- The duration of the noise
- The existing ambient noise levels

In general, noise can provoke complaints when its level exceeds the level of the background noise by a certain margin or when certain absolute levels are attained. The criterion for industrial noise generally lies about 45 dB(A) at night and about 55 dB(A) by day.

In the UK industrial noise emission is usually assessed in terms of the background noise, but for planning purposes in this country the regulatory authorities, while noting the background level, assign an absolute value in most instances.

Compliance with the recommended criteria will ensure that the operation of the facility will not be expected to cause any undue disturbance to local residents. The plant will be designed and operated to comply with the conditions detailed in the IPC licence. There will be no sources of environmental vibration.

9.4.2 Construction Phase

The construction phase of the development will give rise to noise, which may be perceptible off-site at times. The construction phase may also give rise to local vibration but this will be of no significance off-site.

Table 9.1: Ambient noise levels at location N1, Former District **Mental Hospital (T = 1 h)**

Date	Day	Time	$L_{Aeq,1h}$	$L_{A01,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
20/1/98	Tue	00:00	37	43	40	33
		01:00	34	41	36	31
		02:00	34	42	36	31
		03:00	34	42	34	30
		04:00	32	37	34	30
		05:00	35	44	37	30
		06:00	41	49	44	36
		07:00	44	51	47	40
		08:00	49	55	51	46
		09:00	51	56	53	48
		10:00	51	56	53	49
		11:00	51	56	53	48
		12:00	51	56	53	48
		13:00	51	55	53	49
		14:00	51	55	52	49
		15:00	51	56	53	49
		16:00	51	56	53	48
		17:00	51	55	53	48
		18:00	49	55	51	46
		19:00	47	52	49	44
		20:00	47	52	49	43
		21:00	46	52	48	43
		22:00	44	50	47	40
		23:00	43	49	45	38
21/1/98	Wed	00:00	40	47	43	36
		01:00	39	45	41	35
		02:00	40	45	42	36
		03:00	39	45	42	35
		04:00	39	47	42	35
		05:00	40	46	43	36
		06:00	39	47	41	34
		07:00	42	49	45	36
		08:00	47	51	49	46
		09:00	49	53	50	47
		10:00	48	51	49	46
		11:00	48	53	49	46
		12:00	48	52	49	46
		13:00	48	52	49	46
		14:00	47	52	48	46
		15:00	47	50	48	46
		16:00	47	51	48	46
		17:00	45	49	47	38
		18:00	42	47	44	39
		19:00	46	51	48	42

Table 9.1, continued

Date	Day	Time	$L_{Aeq,1h}$	$L_{A01,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
	Wed	20:00	43	48	45	39
		21:00	42	46	44	38
		22:00	42	47	44	38
		23:00	40	45	41	37
22/1/98	Thur	00:00	41	46	43	38
		01:00	40	44	42	37
		02:00	36	42	38	33
		03:00	36	41	38	33
		04:00	37	42	38	34
		05:00	37	43	39	34
		06:00	39	48	42	35
		07:00	41	47	44	38
		08:00	48	52	49	46
		09:00	51	56	51	47
		10:00	48	54	50	46
		11:00	48	52	49	46
		12:00	48	52	49	46
		13:00	48	52	49	46
		14:00	48	53	49	45
		15:00	48	52	49	45
		16:00	48	53	49	45
		17:00	46	51	49	41
		18:00	43	50	46	38
		19:00	40	47	43	36
		20:00	39	46	42	35
		21:00	41	47	43	36
		22:00	43	49	45	39
		23:00	41	46	43	38
23/1/98	Fri.	00:00	40	46	42	36
		01:00	40	47	42	35
		02:00	39	46	41	35
		03:00	39	46	42	34
		04:00	36	44	39	32
		05:00	39	47	42	33
		06:00	38	47	41	33
		07:00	40	46	42	35
		08:00	48	54	50	46
		09:00	53	57	49	46
		10:00	47	50	48	45
		11:00	48	52	49	46
		12:00	48	53	49	46
		13:00	47	51	48	46
		14:00	48	51	49	46
		15:00	48	51	49	46
		16:00	48	52	49	46

Table 9. 1, continued

Date	Day	Time	$L_{Aeq,1h}$	$L_{A01,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
23/1/98	Fri.	17:00	47	52	49	40
		18:00	43	50	46	39
		19:00	44	51	46	39
		20:00	43	51	45	38
		21:00	40	46	43	36
		22:00	40	47	42	36
		23:00	40	48	43	34
24/1/98	Sat	00:00	40	48	42	35
		01:00	42	51	44	36
		02:00	38	46	40	34
		03:00	38	46	41	33
		04:00	39	47	42	34
		05:00	38	46	40	34
		06:00	37	46	40	32
		07:00	38	46	42	33
		08:00	48	54	50	46
		09:00	48	52	49	46
		10:00	48	53	50	46
		11:00	48	52	49	46
		12:00	47	50	48	46
		13:00	47	50	48	45
		14:00	47	51	48	45
		15:00	47	51	48	45
		16:00	47	52	48	45
		17:00	45	49	47	38
		18:00	39	45	42	36
		19:00	38	44	41	35
		20:00	39	44	41	35
		21:00	37	42	40	33
		22:00	36	42	38	32
		23:00	35	43	38	31
25/1/98	Sun	00:00	35	41	38	32
		01:00	36	44	38	32
		02:00	36	45	39	32
		03:00	36	43	38	31
		04:00	34	42	36	30
		05:00	33	39	34	30
		06:00	33	40	35	30
		07:00	38	48	39	30
		08:00	45	49	46	44
		09:00	46	50	47	45
		10:00	46	49	47	45
		11:00	46	49	47	45
		12:00	47	50	48	45
		13:00	48	54	48	45
		14:00	46	49	47	45

Table 9.1, continued

Date	Day	Time	$L_{Aeq,1h}$	$L_{A01,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
25/1/98	Sun	15:00	46	51	47	45
		16:00	47	51	47	45
		17:00	47	57	47	38
		18:00	41	48	44	35
		19:00	39	44	41	37
		20:00	39	44	41	36
		21:00	39	44	41	36
		22:00	37	42	40	34
		23:00	36	44	39	33
26/1/98	Mon	00:00	37	45	40	33
		01:00	39	45	42	35
		02:00	38	42	40	36
		03:00	39	42	40	36
		04:00	37	41	39	35
		05:00	37	47	39	33
		06:00	39	47	41	33
		07:00	43	52	46	36
		08:00	48	52	50	44
		09:00	48	53	50	46
		10:00	47	52	48	46
		11:00	47	50	48	46
		12:00	47	50	48	45
		13:00	50	59	48	45
		14:00	52	65	51	45
		15:00	46	51	47	45
		16:00	47	54	48	45
		17:00	46	52	48	41
		18:00	43	48	45	40
		19:00	42	48	44	39
		20:00	41	47	42	37
		21:00	40	46	42	37
		22:00	39	44	41	37
		23:00	36	41	39	34
		00:00	36	43	38	32
		01:00	35	44	37	31
		02:00	34	40	35	31
		03:00	32	36	34	30
		04:00	34	38	36	30
		05:00	34	39	35	32
		06:00	34	41	36	31
		07:00	38	44	41	33
		08:00	46	50	48	41
		09:00	47	50	48	45
		10:00	47	50	48	45
		11:00	47	50	48	45
		12:00	47	49	48	45

Table 9.1, continued

Date	Day	Time	$L_{Aeq,1h}$	$L_{A01,1h}$	$L_{A10,1h}$	$L_{A90,1h}$
26/1/98	Mon	13:00	47	49	48	45
		14:00	47	52	48	45
		15:00	47	51	48	45
		16:00	47	51	48	45
		17:00	46	50	47	43
		18:00	45	49	47	42
		19:00	44	49	46	41
		20:00	42	47	43	39
		21:00	42	46	43	40
		22:00	41	46	43	38
		23:00	41	45	42	38

Date	Day	Time	$L_{Aeq,15m.}$	$L_{A01,15m.}$	$L_{A10,15m.}$	$L_{A90,15m.}$
22/5/01	Tue	01:00	40	48	41	38

Table 9.2: Ambient noise levels at locations N2 and N3

N2. Yeats' Heights

Date	Time	$L_{Aeq,15m.}$	$L_{A01,15m.}$	$L_{A10,15m.}$	$L_{A90,15m.}$
17/1/98	00:25	58	70	60	41
31/1/98	00:40	52	67	50	38
22/1/01	01:25	45	56	41	33

Date	Time	$L_{Aeq,30m.}$	$L_{A01,30m.}$	$L_{A10,30m.}$	$L_{A90,30m.}$
30/1/98	15:00	63	74	68	40

N3. Ballytivnan Rd

Date	Time	$L_{Aeq,15m.}$	$L_{A01,15m.}$	$L_{A10,15m.}$	$L_{A90,15m.}$
17/1/98	00:50	53	64	47	43
31/1/98	01:05	58	71	50	42
22/1/01	01:50	48	50	49	46

Date	Time	$L_{Aeq,30m.}$	$L_{A01,30m.}$	$L_{A10,30m.}$	$L_{A90,30m.}$
30/1/98	15:00	63	74	68	40

CHAPTER 10 – LANDSCAPE

10.1 INTRODUCTION

This section describes the likely impact on the landscape in accordance with the EIA Regulations. In practice (and according to the EPA Guidelines and Advice Notes) this topic covers changes to the appearance and character of the landscape. The appearance is dealt with as 'Visual Impacts' and is examined using a series of computer simulated views. Impacts on the character of the landscape refers to the way in which changes in landuse cause a series of environmental topics – such as noise, emissions, traffic, as well as visual impacts – to interact so as to alter the perception of the place.

10.2 PROPOSED DEVELOPMENT

The attributes of the project which are likely to give rise to landscape and visual effects are:-

- The new entrance from the Manorhamilton road
- The cluster of buildings – but principally the administration and laboratory building 'A'.
- The carparking and access road.
- Site perimeter earthworks and associated landscaping.

The maximum height of the main process building is 16.2m above ground level, though the majority of the plant and buildings are between 9m and 11m high. Chapter Four contains a full description of the proposed development.

10.3 EXISTING ENVIRONMENT

10.3.1 CONTEXT AND CHARACTER

The landscape immediately north of Sligo consists of a series of shallow, steep sided, east to west oriented valley. These create a series of small, largely self contained landscape units which consist of small fields bounded by overgrown hedgerows of ash and hawthorn. Roads are generally oriented east to west and they support concentrations of private residences – in significant numbers in the immediate environs of Sligo.

The site of the proposed development is typical of these conditions, though modified by its close proximity to Sligo Town. The development site occupies the legal (i.e. County Council to Corporation) and land-use transition from the countryside to urban fabric. A mixture of health care institutional buildings and residences occupy the lands which overlook the development site from the south and south east. The existing Abbott Ireland industrial plant closes the valley to the west while the north and north-east are enclosed by steep slopes which are used for low intensity livestock production. The development site is overlooked from the south east by the N16 – a national primary route.

10.3.2 Views of the Existing Proposed Development Site

The existing appearance of the development site is represented by two views which have been chosen to examine the potential for any likely significant visual impacts. The description of the views, along with the rationale for its inclusion, follows:-

View 1
At this point the N16 is directly oriented towards the development site. This viewing point is also significant because it represents the first encounter with the major panorama towards the mountain skyline to the north.

View 2
Located at the sharp, right angled, bend on the N16, this view towards the development from an elevated viewing point represents a case where the proposed development will be clearly visible. In practice even a touring coach would have a lower viewing height while the views from Yeats' Height are set further back.

No site on or adjacent to public roads or viewing places were noted to the north or north east of the site.

10.3.3 Significance of the Existing Environment

Sligo is an important tourism centre in the north west and the area north and east of the town (including Ben Bulben, Kings Mountain ,Glencar) contain some of its most important scenic resources.

The development site itself and its immediate natural environs are a type of landscape which is common in the area and is visually robust[18] on account of the number of small and visually self contained valleys

In this area whenever topography and vegetation combine to provide open views from elevated stretches of road there are fine views of the adjacent mountain skylines. Therefore while the site and its environs are not themselves inherently significant – as amenities – their role in the maintenance of the wider visual amenity must not be underestimated.

10.3.4 Existing Designations

The N16 between Sligo and Manorhamilton has been recognised by County Development Plans and various tourist maps as a scenic route. The views from this road are valued on account of the panoramas both of Sligo Bay and Knockmorae to the west and south as well as views of the mountains skyline between Benbulben and Glencar.

10.3.5 Existing Landscape Sensitivities and Vulnerability

The views from the N16, which is likely to carry many tourist, and from the nearby residences to the south east are the principal groups (or 'receptors') who are likely to be sensitive to any significant adverse landscape or visual impacts.

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[18] *Visual robustness is a term used to indicate that a landscape has a capacity to absorb development without undergoing a significant change of character*

The principal vulnerability is the threat to significantly obscure views of the distant skylines.

10.4 IMPACTS AND MITIGATION MEASURES

The development will give rise to impacts from two sources:-

- Visual impacts caused by the visibility of the development
- Landscape impacts caused by the change in landuse from agriculture to industrial

10.4.1 Visual Impacts on Selected Views

While the upper portion of the main process building will be visible above hedgerows and trees, it will not be visually obtrusive or dominant on account of it's colour, shape and limited profile at distance of over 1 km.

The following "proposed views" illustrate the effect of the proposed development on the views. These represent the significant views on account of two factors:-

- The selection of viewing points to represent the maximum degree of exposure.
- The illustration of views *without* the ameliorative screen planting.

It is important to note therefore that once the landscape proposals are implemented the actual visual impacts will be further reduced annually as the tree and screen planting matures.

View 1(Proposed)

The roof and upper portions of the new building will be visible – though they will not obtrude upon the distant mountain skyline. Screen planting along the line-of-sight from the road will mitigate residual impacts. The environs of the new entrance will be carefully detailed to avoid excessive signage or inappropriately urban levels of planting or maintenance

View 2 (Proposed)

The majority of the administration and laboratory building and part of the secondary manufacturing building as well as the parking are visible from this location in the background the upper portions of the bulk manufacturing building are visible, though the Utilities building and all of the associated plant and equipment are screened. There is no significant effect on the mountain skyline. Road side planting is recommended along with the retention of existing mature vegetation (particularly along the line of the stream). Screen planting in the environs of the building will be undertaken. The upper portions of the bulk manufacturing building are likely to remain visible after screening.

10.4.2 Landscape Character Impacts

Notwithstanding the visual impacts of the development, there will be a change in how the character of the local landscape will be perceived on account of intermittent visibility, additional traffic, the new entrance and other residual environmental impacts. The local environment will be perceived as changing from agriculture and residential to agricultural, residential and industrial. The perception will be concentrated along and adjacent to a short section of the N16 in the vicinity of the development site entrance and the section of road to the east of that.

10.5 MITIGATION OF VISUAL IMPACTS (GENERAL)

A landscape mitigation strategy has been drawn up which describes a general strategy to use screen planting and site layout to minimise visual impacts.

(a) Woodland screen planting

This will comprise dense planting of two types of material:-

A nursery layer of fast growing, short-lived species such as birch, poplar and willow. This is to provide early and effective screening.

A self sustaining woodland of slower growing trees and shrubs which will form small woodland groups and which will be capable of self renewal. Species in the understorey will include hazel, holly, viburnum and cherry. The canopy trees will include ash, oak, beech, scotspine, sycamore and alder.

(b) Hedgerow screen planting

At the northern and western perimeters a raised (1.2 m) ‘ditch’ of earth will be planted with hawthorn and ash to create new boundary hedges to integrate the proposed development into the surrounding countryside and to provide additional screening.

(c) High limbed standards

London plane will be used within the site to provide internal spatial definitions and some additional screening. The trees will be ‘limbed up’ to create tall boles without lower branches topped by dense canopies. The effect will be to create framed views outward to the countryside.

(d) Shade tolerant under-planting

Cotoneaster dammerii and horizontis will be used in long ‘sheets’ beneath standards to provide low maintenance ground cover and seasonal colour.

Significant mitigation of visual impacts was achieved during the design stage by the consideration of alternatives for the following:-

Location and layout within the holding
Design and massing of the building form
Selection of colours and finishes

10.6 CONCLUSION

Landscape and visual impacts will be localised and will not create significant or adverse impacts. Effects will be concentrated on a short section of the N16 (which is a tourist route) but these will be largely mitigated by screen planting, site layout and the adherence to the colour scheme and design proposed.

CHAPTER 11 – WASTE MANAGEMENT

11.1 SOURCES, TYPES AND QUANTITIES OF WASTE

11.1.1 Introduction

The manufacturing of pharmaceuticals will result in generation of wastes which will require off-site disposal. The amount of waste that will arise directly from manufacturing operations will be very small because the integrated nature of the process means that residues generated in a batch can be recovered and re-used in a subsequent batch. Most of the waste will arise from ancillary activities such as emission abatement systems. The main types of waste, which are described in detail below, will be:-

Process wastes
Organic waste water

Non-process waste

General scrap
Spent oils
Laboratory residues
General trash

It is important to note that the quantities stated below will arise when output reaches its maximum in several years time.

11.1.2 Process Wastes

The small volumes of the Process Waste that are not recovered and recycled within the plant will be periodically discharged to road tanker s using Abbott - required environmental procedures and the waste shall be transported off site for authorised disposal. Final restrictions will vary according to the nature of the waste and shall be subject to conditions of the IPC Licence

11.1.3 Non-process Waste

(c) General scrap

This category includes scrap metals arising from plant and equipment replacement and maintenance. All metal scrap will be recycled and it is estimated that 5 t/a will arise for disposal. Light bulbs and tubes will be stored in dedicated containers and storge areas and collected by an authorised vendor.

(d) Waste oils

Various oil types will arise for disposal from sources such as motor gear boxes, compressors, vacuum pumps and boilers (drip trays). All will be collected for recycling and the estimated quantity arising is 1 m^3/a.

(e) General trash

Waste from the canteen and waste arising from grounds and landscaping maintenance will amount to one or two skip loads per week. An attempt will be made to recycle landscaping waste (as compost) as much as possible.

(f) Laboratory residues

Residues from the testing of raw materials, the product and in-process batches as well as surplus laboratory reagents will be segregated as appropriate for specialist disposal. The estimated quantity that will arise is 500 kg/a. These wastes, known as 'lab smalls', will be stored in dedicated containers and collected by an authorised contractor for proper disposal.

11.2 WASTE CLASSIFICATION AND DISPOSAL

11.2.1 Classification System

The European Commission has published a comprehensive list of wastes and has associated each waste type with a six digit code number. The list is commonly referred to as the European Waste Catalogue[19] (EWC). In 1994 a hazardous waste list (HWL) was published by the Commission[20]. The EPA published a waste list entitled 'Waste Catalogue and Hazardous Waste List' in 1996 using the same code number system. Within the EPA catalogue wastes from 'organic chemical processes' are listed under code 07 00 00 and sub-category 07 05 00 deals with 'waste from manufacture, formulation, supply and use of pharmaceuticals'. The sub-category contains ten classes of waste such as solvents, still bottoms, spent absorbents, mother liquors and filter cakes, most of which are automatically classified as hazardous.

To determine whether a waste is hazardous or not, it must first be included in the catalogue but it must also have certain properties which renders it hazardous. Some examples of possible relevant properties are listed below.

H3-A refers to highly flammable liquid substances
H3-B refers to flammable liquid substances
H4 defines 'irritant' as non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation
H5 defines 'harmful' substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks
H6 defines 'toxic' as substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.

11.2.2 Classification of Wastes

(a) Waste oils

The code for waste oils is 13 00 00 and all are classified as hazardous. This type of waste can be processed to make a fuel substitute at specialist facilities.

(b) Laboratory residues

Laboratory wastes are classified as 16.05.02 (inorganic chemicals) and 16.05.03 (organic chemicals). The properties of the waste determine whether or not it is hazardous and, consequently, the disposal route.

(c) Trapped VOCs

If the trapped VOCs cannot be recovered then the resultant waste will be assigned the code 07 05 03 and it will be regarded as hazardous (see above 11.1.2(e)).

11.2.3 Disposal

(a) Hazardous waste

[19] Decision 94/3/EEC
[20] Decision 94/904/EC

At present there are no licensed facilities in Ireland for the final disposal of hazardous waste. The current practice is to export such waste via specialist Irish companies acting as agents for facilities in and elsewhere. It is proposed to dispose of any still bottom and laboratory residue wastes by this route. There are licensed facilities in Ireland for treating and processing some types of hazardous waste so that a reusable product results. Examples include solvents, waste oils and fluorescent light tubes

(b) Non-hazardous waste
The general trash is suitable for disposal in an appropriate landfill site.

(c) Recyclable waste
Packaging waste (paper, board and plastic), pallets, glass and scrap metals will be collected by specialist companies engaged in recovery and recycling.

11.3 IMPACT

As no waste will be disposed of within the proposed development site there will be no impact on the local environment. All wastes will be managed and controlled prior to disposal to ensure that the risk of any adverse impact is negligible. In addition, it is the general policy of Abbott Laboratories to reduce generated wastes as much as possible, as a result, as much waste as possible will be diverted away from landfills or incineration and recovered and reused.

11.3.1 Exported Waste

Exported waste will be consigned to specialist contractors holding all necessary state and local permits for the treatment and disposal of the specific waste types. The facilities will be inspected by company staff to ensure that their wastes are being disposed of in accordance with the applicable regulations. Following disposal a certificate will be returned to the company by the contractor. Under existing legislation there is a pre-notification and tracking system (Trans-Frontier Shipment Regulations and amendments) which allows the control authority in the area where a waste originated to track the consignment to its final destination (and disposal) in co-operation with the control authority abroad. In this way the impact of the disposal operation is minimised.

11.4 MITIGATION MEASURES

11.4.1 Statutory Basis

With the passage into law of the Waste Management Act, 1996 a high level of statutory control over waste disposal now exists in Ireland. The Act puts particular emphasis on waste minimisation, waste recovery and recycling and, risk management by controlling waste collection, movement and disposal. The Act also gave special powers to the EPA in the area of licensing of disposal sites. Licensing of sites commenced recently.

The Waste Management (Packaging) Regulations, 1997 came into force in July 1997 and the main aim is to assist and promote the recycling of packaging waste. In effect the producers of packaging waste who meet the criteria must either participate in a waste recovery scheme operated by an approved body or, in the case of major producers, register with their local authority. As packaging waste constitutes a large proportion of the total quantity of waste disposed of to landfill nationally, the regulations will result in a substantial reduction.

The IPC licence will contain conditions which will regulate the disposal of all wastes arising from the proposed development.

11.4.2 Abbott Policy

The existing three Abbott Ireland manufacturing sites are certified for ISO 1400. Although voluntary, it is expected that the proposed site will adopt ISO 14001. However, the Corporation has developed an internal environmental, health and safety management system and all manufacturing sites worldwide are required to implement this system Such a system will be developed for the new manufacturing operation and emphasis will be placed on waste management and reduction. In addition the new facility will be required to operate in accordance with the Abbott Corporate and Abbott International Division Environmental Policy which is reproduced in Chapter Three for reference.

Procedures will be developed which will require wastes to be properly segregated as appropriate, labelled and stored in designated secure storage areas prior to disposal. Records of waste types, characteristics, quantities, disposal dates, contractors and destinations will be maintained. All waste disposal contractors will be assessed for suitability by the company and will be required to hold all necessary permits or licenses. Appropriate training will be provided for company staff so that the procedures relating to waste management and the reasons for them are known and understood.

CHAPTER 12 - ROADS AND TRAFFIC

12.1 SOURCES AND CHARACTERISTICS OF TRAFFIC

12.1.1 Employee Traffic

For traffic planning purposes it has been assumed that the proposed development will ultimately employ 150 persons. Seventy-five of these employees will be involved in management, administration and general maintenance of the property and plant. The other 75 employees shall be involved in production. It is envisaged that production will take place on a shift basis, seven days per week. The administration staff will work normal office hours.

The arrival and departure of employees from the proposed development is shown in Table 12.1.

Table 12.1: Employee traffic numbers and arrival and departure times

07.30	arrivals	100
08.00	departures	25
16.00	arrivals	25
16.00	departures	100
24.00	arrivals	25
24.00	departures	25

The above data indicates that the peaks in traffic activity will take place around 08.00 and 16.00. These peaks will be of the order of 100 arrivals and 25 departures in the morning and the reverse in the afternoon around 16.00. In practice the number of vehicles will be less than that indicated because some car pooling will take place, some employees will cycle and some will use motor cycles.

Employee traffic is likely to distribute as follows given that Sligo is the major urban centre in the locality:-

Manorhamilton direction (N16)	20 %
Sligo Town Centre direction (N16)	80 %

12.1.2 Materials and Finished Goods Movements

The movements of goods, raw materials and product by heavy commercial vehicles (HCV's) are summarised in Table 12.2. The data relate to full production and were calculated assuming 48 working weeks and acceptance of deliveries from Monday to noon on Saturday. Deliveries may occasionally happen outside these times when, for example, there is stormy weather at sea and a ferry is delayed. A movement is defined as an arrival and a departure.

Table 12.2: Expected movements of goods, raw materials and product by HCV's

Category of material	HCV movements per day
	Arrivals Departures
Raw Materials	1 - 2
Other materials	1
Product	2 - 3
Totals	4 - 5

To establish the percentage of HCV traffic coming from the Manorhamilton direction and from the Sligo direction, it is necessary to consider the likely sources of materials and the destination of product. With the exception of nitrogen and lime none of the other process substances are manufactured in Ireland and they are normally imported from the UK or from the rest of the continent via the UK. It is anticipated that the majority of the bulk raw materials will arrive via Northern Ireland - because of the use by UK suppliers of the northern ports (Belfast and Larne). However, other ports may be used from time to time depending on, for example, ferry availability and sailing times and the weather. Fuel oil is available from depots in the Sligo area. All of the product will be exported.

The anticipated sources of materials and destination of product is summarised in Table 12.3.

Table 12.3: Anticipated sources of materials and product destination

Material	Source	Direction from
Raw Materials	UK	M'hamilton
Raw Materials	Japan	M'hamilton
Sub-total HCV's per annum		180 (15 %)
Nitrogen	South	Sligo
Fuel oil	South	Sligo
Packaging		
Glass, cartons, foam	South	Sligo
Sub-total HCV's per annum		621 (50 %)
	Destination	Direction to
Product	N Ireland	M'hamilton
Sub-total HCV's per annum		432 (35 %)
Total HCV's per annum (or 26 average per week)		1233

In the case of raw material deliveries to the site, it is estimated that 77.5 % will come from the Sligo town direction and nearly 50 % of this will packaging supplies. 38.5 % of raw materials will come from the Manorhamilton direction and this will mostly comprise the bulk process raw materials. In total, it is estimated that 50% of the HCV's will travel the Sligo to Manorhamilton Road and 50 % will travel the road from Sligo to the site.

Transportation of such materials as will be required to conform to statutory requirements relating to transport, for example, the Dangerous Substance (Conveying of Scheduled Substances by Road) (Trade or Business) Regulations, 1980 will be by transport companies subjected to a rigorous selection process and will be fully licensed to handle such materials.

12.1.3 Other Commercial Traffic

In addition to the HCV's and employee traffic movements, there will be additional commercial traffic comprising light commercial vehicles, trucks, vans and cars. This source of traffic will include service vehicles to deal with factory plant, couriers, technical representatives, deliveries of supplies and waste removal. It is estimated that these traffic movements will number 20 - 25 per day with about 75% using the road from Sligo town and the balance travelling to and from the Manorhamilton direction.

12.1.4 Construction Traffic

The construction period for the proposed development will be approximately 24 months and approximately 100 persons will be employed on the site during the construction phase.

The construction site entrance will be located off the Manorhamilton Road at the proposed development site entrance.

Traffic generated during the construction period will include:-

construction workers cars
material deliveries
plant and equipment

Workers are likely to arrive on site shortly before 08.00 am and leave shortly after 17.00. Normally material deliveries and arrival and departure of construction plant will take place during the day time.

Traffic movements during the day (for example, material deliveries) are not likely to exceed 10 vehicles per hour depending upon site activity at the time. For example, bulk filling or excavation could involve a relatively high degree of traffic movement whereas building work would result in much more occasional delivery of building materials. The most significant movement of vehicles is just before and after the working day. Approximately 70 traffic movements can be expected at both times.

12.2 RECEIVING ENVIRONMENT

12.2.1 Existing Road Network

(a) The N16

The proposed site entrance is located on the N16, approximately 2 km from Sligo Town Centre and just inside the Borough Boundary. The N16 is the National Primary Route linking Sligo with Enniskillen and the major population centres of Northern Ireland, including Belfast.

The N16 plays an important role in the economic development of Sligo. It is one of the three major National Routes which meet in the town of Sligo, the others being the N15 (from Donegal) and the N4 (from Dublin).

The particular importance of the N16 is that it is the major cross border route connecting Sligo to Northern Ireland and also it is an important tourist route linking the West of Ireland to the Fermanagh lakelands.

(b) Proposed site entrance

The existing entrance to Marlbrook house is located at 90^{o} bend with a radius of about 70 m. The sight lines in each direction are slightly in excess of 100 m and the national maximum speed limit of 100 km/h or 60 mph applies.

The N16 in the vicinity of the proposed new entrance to the site is a single lane carriageway with an average width of 8 m. Street lighting and a pavement extends to a point opposite the entrance to Yeats Heights. The centre of the carriage is marked with double white lines and parking is prohibited on both sides of the road. The commencement of the urban zone speed restriction is south of the proposed entrance, that is, on the town side of the entrance.

12.2.2 Existing traffic flow and capacity

Traffic counts carried out by the National Roads Authority at the Sligo - Leitrim County boundary on the N16 have revealed the following AADT's (Average Annual Daily Traffic) (Table 12.4).

Table 12.4: Traffic counts at Sligo - Leitrim county boundary, N16

Year	AADT	HCV %
1993	1980	11
1995	2300	11
1996	2417	20

Table 12.5 shows the AADT's for the N16 at the Sligo side of Manorhamilton.

Table 12.5 Traffic counts at Sligo side of Manorhamilton, N16

Year	AADT	HCV %
1993	2346	17
1995	2393	13
1996	2645	13

As can be seen, the traffic leaving Manorhamilton on the N16 (Sligo Road) is on average some 10 % higher than that crossing the Sligo - Leitrim boundary. This can be explained by the presence of developments and housing on the outskirts of Manorhamilton outside the location of the traffic survey point. The same phenomenon will also exist in Sligo. It is reasonable to suggest that traffic at the County boundary will be the lowest on the N16 between Sligo and Manorhamilton.

To find the true AADT for the location of the proposed new entrance to Abbott Ireland, it is necessary to add the affect of commuters travelling to Sligo who live between the proposed site entrance and the County boundary. It is reasonable to assume that an addition of 15 % to the County boundary AADT would give a good estimate for the AADT for the N16 at the site entrance. This gives an estimated AADT of 2780 for 1996 at the site entrance.

Traffic flows on the N16 have been increasing quite considerably in recent years. From 1993 to 1995 it increased by 16 % on the N16 at the Sligo - Leitrim boundary. Between 1995 and 1996 the increase was 5 %. To estimate the 1998 AADT, 10 % growth in traffic is assumed. This gives a 1998 estimated AADT of 3058.

For the N16 at the entrance to the proposed site an AADT of 3058 is taken and a % HCV of 20 % is assumed (612).

12.3 PREDICTED IMPACTS

12.3.1 Local Roads

The development will connect directly to the N16 Sligo - Manorhamilton Road and will contribute to the overall loading. Sections of this road are presently being upgraded and further sections will be upgraded in the near future. Construction of the proposed roundabout and ancillary realignments will complement these improvements and will have a positive impact.

It is expected that the construction of the proposed development will take place over a 24 month period. The new facility will then be commissioned. Initially, the traffic will be that associated with the construction and this will be replaced at a later stage by the operational movements (the employees and the deliveries of supplies and materials).

(a) Proposed development in production

Table 12.6 shows the projected increase in traffic on the N16 between Sligo and Manorhamilton.

Table 12.6: Projected increase in traffic due to proposed development

	AADT	HCV	HCV %
Existing loading estimate 1998	3058	612	20
Development traffic, maximum*	182	7	4
Total estimate	3240	619	19
% increase	6	1	

*calculated from 150 private cars, 7 HCV's and 25 other commercial vehicles/cars

When the new facility goes into full production the increase in traffic is estimated at 6% with the HCV content remaining close to the existing 20%.

The capacity of the N16 in the vicinity of the site is such that the additional traffic generated by the proposed development can be readily accommodated without any significant loss in the level of service.

(b) Construction phase

Table 12.7: Projected increase in traffic due to construction phase

	AADT	HCV	HCV %
Existing loading estimate 1998	3058	612	20
Construction traffic, maximum	140	70	50
Total estimate	3198	682	21
% increase	5	11	

During the construction phase there will be an increase of 5 % in overall loading on the local relevant section of the N16. The increase in HCV's content is 1%. Local delays of a short duration at either end of Ash Lane and SLDMH road can be expected from time to time during the construction phase particularly when large slow moving vehicles such as low loaders are using these roads.

12.4 Mitigation Measures

12.4.1 Operational Phase

As the proposed entrance is located at a 90^{o} bend with sight lines of slightly in excess of 100 m and a speed limit of 100 km/h (60 mph), it will be necessary to carry out local road improvement works to facilitate the proposed development. The primary objective of these works is to allow existing local and other traffic to use the road with safety while at the same time to allow traffic entering and leaving the site to do so safely.

The important elements of the works will be:-

- provision of a roundabout at the site entrance
- public street lighting to be extended beyond the roundabout on the approach road from the town
- extension of the pavement along the west side of the existing road to the site entrance
- realignment of the approach road on the town side
- the speed restriction zone will be extended to the Borough boundary

The roundabout will have an internal diameter of 20 m and will be designed for 3500 vehicles per day. The design will be in accordance with RT 180 - Geometric Design Guidelines (Classification, Alignment, Cross-section) which is the design guideline used throughout Ireland for work on the public road system. It is the responsibility of the local authority to produce the design and it must be approved by the National Roads Authority.

Provision of a roundabout coupled with the moving of the speed restriction zone to the Borough boundary will result in a reduction in the speed of traffic approaching the entrance and the town. Drivers approaching the site on the public road will be able to see traffic leaving the site and similarly drivers leaving the site will be able to see traffic on the approach road to the site.

Provision of street lighting is intended to improve visibility for all road users including pedestrians. Pedestrian safety will be enhanced by the footpath extension to the site entrance.

12.4.2 Construction phase

A wheel wash bay will be provided to minimise the deposition of soil on the local public roads by construction vehicles leaving the site. The road will be cleaned as necessary.

CHAPTER 13 - CULTURAL HERITAGE

13.1 EXISTING ENVIRONMENT

13.1.1 Introduction

This chapter assesses the impact on the receiving archaeological environment and proposes ameliorative measures to ensure the safeguarding of any monuments, features or finds of antiquity. It includes a desk study and a field investigation of the area of land under development and its surrounding environs establishing the historical and archaeological context and evolution of the general area.

The primary source of information for an archaeological desk study is the Sites and Monuments Record of *Dúchas* the Heritage Service of the Department of Arts, Heritage, the Gaeltacht and the Islands. This is based on all published and publicly available documentary and cartographic sources and the information held in the SMR files is read in conjunction with the constraint maps (published at reduced 6" scale). The SMR records known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites identified on vertical aerial photographs. There are three recorded archaeological sites within the boundary of the proposed development. They are as follows; a mill complex; 014:023, and two ringforts, 014:024 and 014:025.

The National Museum of Ireland Topographical files identify recorded stray finds which are provenanced to townlands. These finds, which have been donated to the State in accordance with National Monuments legislation, sometimes include reports on excavations undertaken by NMI archaeologists earlier in the twentieth century. There were no stray finds located to the townland of Rathbraghan that the proposed development occurs within or the surrounding townlands.

The Sligo County and Corporation Development Plans were also consulted. The development plans lists items of cultural heritage (sites of artistic, historical, architectural and/or archaeological interest) for preservation and preservation consideration. The Sligo Heritage Officer was also consulted and apart from the three archaeological features which are detailed in the SMR record, no further protected structures were adopted by the new development plan for the development area.

Field investigation was undertaken to assess current and previous land use, access to the site, the topography and any additional environmental information relevant to the report. This also sought to identify the condition and status of the SMR registered monuments occurring within the footprint of development and locate any low visibility archaeological monuments with little surface expression.

13.1.2 The Receiving Environment

The proposed site lies within the townland of Rathbraghan in the parish of Calry. The land in the general area was described by Lewis (1903, 246) as ‘generally light, with a small quantity of bog and some mountain wastes, and is principally under tillage; the state of agriculture is improving; there is an abundance of limestone, which is used for building.’ He also described areas of antiquity occurring within the parish ‘… Sod Fort, which was defended by Sir Teague O’Reagan against Wm. III., the ruins of some churches in Church and Cottage Islands, and what area supposed to be druidical remains in Mr. Wynne’s park at Hazlewood’.

The area under assessment is part of a landscape rich in archaeological and historical content. The presence of archaeological monuments dating to the prehistoric period ensures that the area has attracted settlement from the earliest times and has a varied archaeological background. The presence of two ringforts within the proposed site (014:024 and 014:025) and the high number occurring in the surrounding townlands indicates that the area was settled intensively during the first millenium AD.

Ringforts are circular enclosures usually dated to the Early Christian period, which spans the period from the fifth century to the twelfth century, although their origins and chronology are uncertain (McCormick 1995,33) and some examples are dated much earlier than this. They are the most common monument type, with at least 30,000 examples recorded in Ireland (O’Riordain 1979,29).

Ringforts can be described as habitation sites or farmsteads and the most common type of fort consists of a circular area *c*.30m in diameter. Defined by a single earthen bank and external fosse (univallate) and with at least one entranceway consisting of a causeway across the ditch with a corresponding break in the bank. They can be classified according to the physical features they display; for example, the enclosing bank may be of stone in which case the site is known as a *cashel or cathair*; sites enclosed by earthen ramparts are usually known as a *lios* or *rath* and earthen banks may have a stone facing.

It has been suggested (McCormick 1995,34) that, given the value placed on cattle and the occurrence of cattle-raiding during the early Christian period, one of the primary functions of the ringfort may not just have been habitation, but could have been to keep cattle within the same boundary as the dwelling, thus allowing a close watch to be kept on the livestock. There are references, in the early Irish legal texts, to watch-dogs guarding the byres and the sheep-fold as well as the home and this may imply that these were all contained within the same enclosure.

Perhaps only 1% of the ringforts in Ireland have been fully investigated by archaeological excavation. Of this small number a remarkable amount of information has been compiled on the types of houses, economy and status of these enigmatic sites. In general *Houses* are circular in plan during most of the 1st millennium AD, changing to rectangular at the end of the 1st and beginning of the 2nd Millennium AD, conditions at some sites has allowed organic remains to be preserved in the form of wicker and wattle walls and also attest to an early form of cavity wall construction. *Souterrains* or man made underground chambers and tunnels are generally associated with rectangular or later houses and while they may have served a function as refuges from marauding cattle rustlers their primary function was for storage. *Economy* during this period is based largely around cattle and more importantly dairy farming, with sheep and pigs and indeed arable farming filling a more secondary role. *Status* can be gauged from the contemporary law tracts and literature. The artefactual record can give insights into the daily life of these early Christian period farmers with many examples of their tools, utensils, containers etc. surviving.

The remains of a milling complex (014:023) located on the western boundary to the rere of the existing plant show further usage of the land. This site will not be affected in any way by the proposed development.

13.1.3 Archaeological Desk Study

The archaeological sites.
Archaeological sites are generally classified for the purpose of impact assessment in such a way that their status and implication in the archaeological record and for the proposed development is suggested. The **Classification** carries a notional, and necessarily broadly based, costing for the full excavation of each category.

An **Area of Interest** is suggested for each site. This is a zone of archaeological potential around the known extant remains in which related archaeological features are likely to occur.

The numbers used to identify the sites are those of the Sites and Monuments Record; the sites are numbered according to the O.S. 6 inch sheet on which they are located, so that Site No. 25 on O.S. 6 inch sheet 14 is listed as 014:025.

There are three archaeological sites (014:025, 014:024 and 014:023) listed within the specified zone of the proposed development occurring on the SMR sheet 14 in the townland of Rathbraghan. All other sites described occur within a 1km radius of the site and are listed in the appendix. They establish the general archaeological presence in the area.

SMR No. 014:025 **Townland/Ward** Rathbraghan
Site Type Ringfort **NGR** 17059/33762
Classification D **Area of Interest** 30m
Distance This site occurs within the proposed development area but will not be directly affected by the proposed work.

Description This site is marked on all the Ordnance Survey editions. The ringfort is located on the top of a natural gentle rise in an area of fertile grassland. The site consists of a tree-covered circular univallate enclosure measuring 24.5m in diameter east/west. It is defined by a clearly visible bank of earth and stone 2.85m wide and 0.5m high internally. The exterior height varies from 1.55m to 1.68m and although much stone is visible in the construction, there is no revetting visible. There are several cattle tracks through the bank, including a gap of 2.9m wide at the east and north side where a field wall bisects the interior in two. That part of the site to the south of the wall is overgrown. The rest of the site is clear and the interior is featureless.

SMR No. 014:024 **Townland/Ward** Rathbraghan
Site Type Ringfort **NGR** 16988/33777
Classification D **Area of Interest** 30m
Distance This site occurs within the proposed development but is located at a sufficient distance so as not to be affected or interfered with.
Description The ringfort is marked on all editions of the Ordnance Survey maps. It is located on top of a natural rise in an area of poorly tended pasture. The site consists of an almost completely overgrown circular platform with an estimated diameter of 40m surrounded by a 1.5m-1.75m high steep earthen scarp. Along the north and northeast a low earthen bank 4m wide and 0.5m high stands on top of the scarp. The interior is overgrown and there is no sign of a fosse.

SMR No. 014:023 **Townland/Ward** Rathbraghan
Site Type Mill **NGR** 16982/33782
Classification D **Area of Interest** 30m
Distance This site occurs on the boundary of the proposed development area and will not be affected by the construction of the proposed development.
Description The site is marked on the 1st Ordnance Survey but not on the 3rd edition map. It is located on the Manorhamilton Road beside a stream and 'Fort Louis' cottage. The only visible trace of the mill site is an area of overgrown foundations but the millrace is visible as an overgrown channel and follows the field boundary northwards to the road and the stream. The mill was demolished by the Health Board several years ago.

13.1.4 Archaeological Field Inspection

The entire site was covered by field survey by Joyce Hickey on 17th and 18th December 1997 in wintry weather conditions. The land is generally under pasture although the southernmost portion (to the east of the existing Abbott Ireland facility and north of the Mental Hospital) is low-lying and very marshy. The area immediately surrounding Marlbrook House and to the east of the access to the house is also very marshy and muddy and could not be examined in detail.

The fields are described below in the order in which they were examined, and form three general areas: Area 1, (Fields 1-7 and 13), from the north of the existing facility and the building under construction to the Manorhamilton Road; Area 2, (Fields 10-20 excluding 13), from the east-west field drain westwards to the eastern side of the existing facility and north and eastwards to the site boundary; Area 3, (Fields 8 and 9), from the southern site boundary northwards to the large east-west field drain.

Area 1

Field 1

This field located to the north of the existing facility and of the building under construction. It is under grass and the ground rises towards the north.

Field 13

This small field is under grass and a number of trees of mixed species; it also rises towards the north.

Field 2

This field also slopes towards the north; the ringfort 'Rathbraghan' (SMR 014:024) is located on the top of the hill and a marked break in slope extends towards the east. The ringfort commands a good view in all directions; it survives in good condition and the tree-topped enclosing bank is best-preserved at the north-east. At the south, the top of the bank is level with the interior and appears to define a raised area. There is no sign of an external ditch and there are breaks in the enclosing bank at the north, north-east and north-west, each up to 1m wide. It is not clear whether any of these are original or whether they are caused by animal traffic. The bank is up to 2m high and is partially stone-faced; some of the stones originally from the bank are scattered on the surface of the field at the western side. The interior is very overgrown with hazel bushes; there is no undergrowth but the ground surface comprises soil and dead leaves. At the west side, the ground slopes sharply to the road which runs along the western site boundary.

There are a number of features to the north of the ringfort which appear to form part of the mill complex noted by the Sites and Monuments Record (SMR 014:023). There are some references to the mills at Rathbraghan in seventeenth-century documents; most of the structures are in a bad state of repair but the millrace, though overgrown, can be traced for up to 90m and is shown on the third edition of the Ordnance Survey.

Field 3/4

There is no boundary between these fields but it appears from the Ordnance Survey map to have originally been formed by the millrace, a channel diverted from the river which runs alongside the northern site boundary. The fields are under pasture and slope from south to north. The river bank was examined but no evidence for any archaeological site, such as a *fulacht fiadh*, an ancient cooking place, was noted.

Field 5

This field is also under pasture and a temporary encampment at the north side, adjacent to the road, is surrounded by a concrete block wall. The ground slopes from south to north and no archaeological features were noted.

Field 6

This field is wide open pasture with a shallow natural dip noted running east/west.

Field 7

The ground slopes sharply from north to south and the south side of the field marks the top of the ridge which continues westwards as far as the ringfort SMR 014:024 and eastwards as far as the ringfort SMR 014:025

Area 2

Field 10

Fields 10-12 are bounded on the south by the east-west field drain. Field 10, under pasture, is located to the west of the access road to Marlbrook and the northern portion slopes towards the north. Two features, (A and B) were noted within the eastern and western field boundaries. These features, low irregular grassy mounds, measured *c.*20m north-south and *c.*9m east-west. The western feature (A) is located 15m north of the field drain and extends eastwards from the field boundary for a distance of *c.*30m. The features are likely to be of natural origin, or derived from agricultural processes, and are not thought to have any archaeological significance.

Field 11

This field is generally flat, with a rise in slope at the north-west corner, and is under pasture. An overgrown area (C) adjacent to the field drain and *c.*15m east of the western field boundary was investigated as it was first thought to represent a *fulacht fiadh*. The feature measures *c.*5m north/south and *c.*10m east-west and is 0.60m high, and a low linear feature, 0.20m high and 2.0m wide extends eastwards from this for 40m. There is a possibility that these represent the remains of archaeological features although their precise nature could not be established during the field inspection.

Field 12

This field, though under pasture, is very waterlogged and the field boundary marked on the Ordnance Survey is no longer present, so that the field is bounded at the west by the fenced boundary of the existing facility. The ground slopes sharply to the north, and a boulder stands at the northwest corner of the field. This boulder is triangular in plan and as it is set into the south facing slope the front (south) side is 1.0m above the surrounding ground and the rear (north) side is just 0.30m high. It measures 1.20m north/south and 0.90m east/west along the wider (south) end.

Field 13

This small field to the west of field 14 is grassy with heavy tree overgrowth.

Field 14

This field, like fields 15-19, forms part of a marked south-facing slope. The farm buildings shown on the Ordnance Survey map are upstanding but unoccupied.

Fields 15-18

These fields are located on the south-facing slope which divides the study area. Fields 15 and 16 command a fine view to the west, south-west, south and south-east and over Sligo Bay. The slope in Fields 17 and 18 is more gradual and Field 18 was being grazed by heifers at the time of the field inspection.

Field 19

This field is under grass and the ringfort SMR 014:025 is located in the north-east corner, on the crest of the hill commanding a good view in all directions. The ringfort is bisected by the east/west field boundary and the bank has cattle-breaks at the east, north-east, north and south. The ringfort is in poor condition; the central area is overgrown and the bank is generally denuded, especially at the south and south-west where there is no grass and its sandy gravel content is visible.

Field 20

The eastern side of this field, near the road, is grassy and the west side near the access to Marlbrook house is very swampy. The site of the house was inaccessible due to ground conditions and was not closely inspected. The house has been almost totally demolished and the only upstanding remains consist of a portion of one east/west wall close to the field boundary at the south of Field 18. This wall is of coursed rubble construction and survives to a height of *c.*1.8m.

Area 3
Field 8
This field is under grass but there is heavy tree cover and the northern portion, towards the east/west field drain, is waterlogged and covered with rushy growth. A laneway, the access to Marlbrook House, runs north/south alongside the western field boundary.

Field 9
This field is under grass and slopes towards the east/west field drain at the northern boundary. The three field boundaries between the Marlbrook House access and the boundary fence at the eastern side of the existing facility, shown on the Ordnance Survey map, have been removed. Traces of two of the boundaries are represented by intermittent trees. The south-western corner of the site, i.e. immediately north of the grounds of the Mental Hospital and east of the boundary fence at the eastern side of the existing facility, is very marshy and was not examined in detail.

13.2 PREDICTED IMPACT OF DEVELOPMENT

Due to the nature of the land and the type and density of monuments in the general area it is highly likely that archaeological features, finds and/or soils will be discovered during the construction phase of the development (particularly the removal of topsoil).

The area in which the development is proposed centres on the site of Marlbrook house which has been almost totally demolished in the past. One feature (B) noted in Field 10 during the field survey is most probably a natural feature or is the result of agricultural processes. No upstanding archaeological remains will be affected by the proposed development.

13.3 SUGGESTED MITIGATION

Even though there are three known monuments (014:023, 014:024, 014:025) the proposed development will not affect these sites either directly or indirectly.

According to design drawings, the proposed development is located in the eastern section of the development lands in the region of the ruins of Marlbrook House. The nearest recorded protected structure is the ringfort (014:025) located on the northern border approximately 100m to the north. The rere and eastern side of the plant is to be screened, any landscaping or associated construction proposals such as temporary road ways or site huts associated with the development should avoid the archaeological site. To ensure this, a protective fencing encompassing the archaeological feature as well as a protective buffer zone of 30 m should be placed around the site during construction.

The features noted during the field survey in fields 10 and 11 should not be affected by the current proposal although feature B is located to the immediate western boundary. This presented as a low irregular grassy mound, measuring *c.*20m north-south and *c.*9m east-west. The assessing field archaeologist thought the feature likely to be natural origin, or derived from agricultural processes, and is not to have any archaeological significance. However it may be necessary to archaeological test this feature in advance of construction to ensure that it is indeed a natural anomaly. Archaeological testing has to be carried out by a under licence to Dúchas and it can take up to 3 weeks to have such licences approved from the submission of a method statement.

Marlbrook House has been demolished and its presence is marked by the remains of a low wall running east/west close to the field boundary at the south of Field 18. This wall is of coursed rubble construction and survives to a height of *c.*1.8m. Nothing of an architectural significance remains upstanding on the site. No other features of an architectural or cultural heritage significance will be affected by the proposal.

It is recommended that a licenced archaeologist be present during all preliminary earthmoving works on the site to ensure the appropriate excavation and recording of any archaeological soils, features or deposits which could be revealed during topsoil removal. If nothing of archaeological significance is revealed, the development should require no further archaeological involvement.

The developers attention is drawn to the National Monuments Legislation (1937-1994), which states in the event of the discovery of archaeological finds or remains, Dúchas (Heritage Service, Department of Arts, Heritage, Gaeltacht and the Islands) should be notified immediately. The developer should make provision to allow for and to fund the archaeological works that may be needed on the site if any remains are noted during the site preparation phase of development.

All recommendations regarding the site are subject to discussion with and approval from the Planning Authority and the National Monuments and Historic Properties Service, Department of Arts, Heritage, Gaeltacht and the Islands.

13.4 HISTORY OF THE TOWNLAND OF RATHBRAGHAN

Settlement and Population Groups in the Prehistoric/Early Historic Period:

The megalithic (passage tomb) cemetery of Carrowmore west of Lough Gill, the Deerpark tombs of Calgagh, and various earthworks throughout the barony, testify to occupation of the area from at least as early as the Neolithic through to the Iron Age. However, it is only as the latter period merges with the Christian era that the local historical record opens. The earliest identifiable population group in the vicinity is the Callraige, the second element from the Celtic **rigion* meaning a people or kingdom, and so pointing to an Iron-Age Continental heritage (MacNiocaill 1972, p. 3-4).

Whatever the likelihood that the Callraige once ruled a kingdom of some size between northern Connacht and the Ulster marches, in the historical period they are found settled in pockets throughout that entire district. One group is located in the adjacent barony of Tireragh, but the Callraige Mór have left their name on the Parish of **Calry** with which this study is concerned. The medieval Irish genealogists traced the Callraige to one Lugaid Cal son of Dáire Sírchréchtach, in turn an ancestor figure of various subject peoples especially in Connacht (Rawl B 502,143a 41,155a 9; O'Brien, *Corpus,* pp.155,256).

It is clear that by the eighth century, when contemporary records are found, the Callraige had already been reduced to the status of subject people (Rawl B 502, 143a 9; O'Brien, *Corpus,* p. 153). At the same time, there is reason to consider that the area which they occupied was intensively settled; Wood-Martin (1882-1902, I, p. 21) could account for no less than 407 ringforts within the Barony of **Carbury**, with 54 in the parish of Calry alone. Allowing that ringforts as a field-monument type have been dated from the late Iron Age right through the medieval period, this still represents a very high concentration within the district. The Grianán Chalgaigh, traditional fortress of the Callraige, lies within the parish.

Toponomy of the Area

The name of the townland at the centre of the study, **Rathbraghan**, in common with others in the immediate vicinty is, as might be expected in Connacht, purely Irish. Besides, most of the placenames contain elements indicative of settlement. In the case of Rathbraghan itself, the first element clearly indicates a ringfort and indeed two ringfort sites lie within the townland; while one (014: 025) is modest, measuring 24.5m across, the other (014: 024) consists of a circular platform some 40m in diameter. Braghan is probably a personal name and may well be a corruption of Breccán, Brocán or Breogan.

Of the neighbouring townlands, **Shannon** Eighter and Shannon Oughter apparently incorporate the element *sean-dún,* or old fort (Wood-Martin, 1882-1902, I, p. 93), and again they include two ringforts and an enclosure (014: 021, 022, 064). **Lisnalurg** represents the *lios,* or enclosure, of the hollow and certainly includes an enclosure (014: 015) not to mention a cemetery and a fort which will be discussed presently. **Ballytivan** includes the element *baile,* which frequently indicates a farmstead, and there is an earthwork in the townland (014: 066). **Farranacardy** (fearann: a measure of land, often implying agricultural activity) and **Barroe** (barr: a top, source?) feature a ringfort and an enclosure respectively (014:067, -:026).

Moving away from the level of townland, the parish name Calry is discussed above while the barony of Carbury bears the name of the dynasty Cenél Cairpri, which will be dealt with presently.

Ecclesiastical Settlement: Drumcliff, Lough Gill and Lisnalurg

It seems reasonable that an area of relatively intensive settlement should have attracted the interest of early Christian communities, and there are indications that ecclesiastical foundations existed in the vicinity at least by the end of the fifth century. Certainly, both the **Patrician** and **Brigidine** churches were involved in Carbury. According to the Tripartite Life, St. Patrick was expelled by the Calraige of *Cúl Cernadán,* a population group which O'Donovan placed in the Barony of Tireragh to the west. Significantly, Patrick is credited with founding *Druim Lias* (Drumlease, Co. Leitrim) east of Lough Gill *(Bethu Pátraic,* II, ll 1646-54, 1676-82; Mulchrone 1939, p. 87, 88-9; *c.f.* O.S. Letters transcript, p. 25-6, 27).

By the same token, Brigid is brought into contact with Bishop Brón *(Vita Prima,* §§39, 85-6; Connolly 1989, p. 23, 39; Wood-Martin 1882-1902, I, p. 89-90); the latter is associated with Cell Espuicc Bróin near Strandhill in west Carbury, where there was a St. Brigid's well. The **Columban connection** with the area is, however, more strongly attested. The *Vita S. Columbae* (I, §13; Sharpe 1995, p. 122) maintains that the saint of Iona blessed a king of Carbury named Óengus Brónbachall who, despite the reservations of Dr. Sharpe (p. 275) may indeed be associated with this area as his soubriquet indicates a dynastic connection with the cult of Bishop Brón. Certainly Drumcliff, just four miles NNW of Rathbraghan, supposedly founded by Columba in person but perhaps in fact by Mo Thoria, features among the leading Irish Columban houses (Herbert 1988, p. 78, 189, 283).

Within the Parish of **Calry** the Ordnance Survey Letters (transcript, p. 25) describe two ruined churches. One is in Td. Clogherbeg on the shore of Lough Colga. There is a tradition that St. Feichín visited this location *(Acta SS,* p. 135). Then there is a ruin on Church Island, Lough Gill, along with St. Conall's island and *Tobar Chonail* on the adjacent shore where it appears that a pattern was held on 2 June (Wood-Martin 1882-1902, I, p. 91). It does not seem possible, however, to identify this Conall with any of the saints so-named in the martyrologies.

Also associated with the Lough Gill area is a saint named Lommán son of Dallán who is commemorated on 4th February (Mart. Tallaght; Ó Riain 1985,pp. 55,171). Lommán is listed among the attendees of a convention which Columba is said to have called at *Es Dara* (Ballysadare) c. 575 *(Acta SS*, pp. 337,339,363). In the context of such intensive early Christian activity in the area, the cemetery at Lisnalurg (014:016) near Rathbraghan is a potentially important site which deserves some consideration.

Dynastic Politics: Early-Medieval Period

The record suggests that the **Callraige** had to all intents and purposes ceased to be a political entity by the commencement of the documentary period; the battle of Cúl Drebne, which marked the turning point of St. Columba's career, was fought in this area in 561 and it seems that the district was already under the rule of Uí Néill dynasties (Byrne 1973,244). A slaughter of the Callraige by the neighbouring Uí Fiachrach took place in 777, but the only ruler of Callraige named in the annals, Cathmugh (†792, A.U.), is almost certainly a member of **Cenél Cairpri**.

This dynasty, which claimed descent from a son of Niall Noígiallach, 'Niall of the Nine Hostages', enjoyed regional kingship from the 7th century over an area considerably more extensive than the Barony of Carbury which bears its name. Having established a branch in the midlands, the dynasty supplied kings of Cairpre Mór at least until the end of the 9th century, but would appear to have still controlled the area at the centre of the present study.

As already noted, Óengus Brónbachall (†648 A.U.), who belonged to this line, most likely included Carbury in his realms. Certainly Máeldúin (†666) and his sons Fergus (†683), Muirgius (†698) and Conchobar (†706) appear to have ruled the Sligo area. Fergus was slain in battle at Corann in the south of the county. A subsequent king Conall Menn, apparently a son of Fergus, was party in 707 to the slaying of Indrechtach son of Dúnchad of Murrisk (Ó Cléirigh, §857; Pender 1951, 71; Byrne 1973,248). The latter was over-king of Connacht, but his dynastic kingship of Uí Fiachrach has left its name on the neighbouring barony of Tireragh.

A grandson of Conall Menn, Cathmugh, was slain in 792 at *Ard Maicc Rimi* (apparently in Co. Sligo), in battle with the Uí Ailello dynasty whose realm was centred on the Barony of Tirerril (Byrne 1973, p. 249). The same year, the Annals of Ulster record the death of Cathmugh king of Callraige; as noted above, the two are probably identical. A later descendant of Conall Menn, Dúnadach son of Rogallach (†873) is expressly styled king of Cairpri Mór, but a verse in the Annals of the Four Masters maintains that he was buried at Drumcliff.

Dúnadach is the last king of Cenél Cairpri named in the annals and the extant pedigree of his line ends with his son Cathalán (see Ó Cléirigh, §857; Pender 1951, 71). In light of the intensive political activity in the area the impressive fort of <u>Lisnalurg</u>, described a century ago by Milligan (1892,576,582), is worthy of attention.

Dynastic Politics: Later-Medieval Period
From the 10th century, Carbury was drawn into the ambit of Uí Briúin and of its rulers who bore the surname Ua Ruairc (O'Rourke). The Irish Life of St. Máedóc cites *Cnoc Laegen* (Knocklane Hill, Carbury) as one of the boundary points of the kingdom of Bréifne (Plummer 1922, I, p. 204; II, p. 198, 369; Wood-Martin 1882-1902, I, p. 84). Increasingly from the 12th century, lordship of the area was contested between the west-Sligo ruler O'Dowd of Uí Fiachrach and other Connacht lineages including MacDermott of Moylurg and the O'Connor kings. Several O'Connor lords of Carbury are named in the annal-record of the 14th-15th century, often defending the territory against aggression from the O'Donnel lordship of Tír Chonaill to the north.

During the later medieval period prominent local families including Ua Máelchluiche (Mulclohy/ Muckley) and Ua Scannláin (Scanlon) were to a degree displaced by families of Uí Fiachrach stock including O'Dowd, O'Noone and O'Feeney - not to mention central Connacht families such as O'Connor and MacDonagh and that of O'Hart, originally from Meath but displaced by the Anglo-Normans (O.S. Letters, transcript, p. 88; Wood-Martin 1882-1902, I, p. 90-1; O'Rorke 1889, I, p. 33-4; Milligan 1892, 575).

The Early-Modern/Modern Period
The local aristocracy, including the families of O'Connor and O'Hart, retained prominence through the 16th and first half of the 17th century, holding extensive lands in the parish of **Calry** (Wood-Martin 1882-1902, II, p. 145, 150, 152). The mill at **Rathbraghan** (014; 023), adjacent to the ringfort on the west side of the townland, was in existence before the middle of the 16th century; apparently it was used for milling flax (O.S. Name-book, transcript, p.187; Wood-Martin 1882-1902, III, p. 240).

It may well have been the same local aristocracy that was responsible for re-fortifying one of the Rathbraghan ringforts during the Cromwellian war (Wood-Martin 1882-1902, II, p. 134). Notwithstanding plans to settle some of the disbanded Cromwellian soldiery in various parts of Co. Sligo (including the Barony of Carbury), several proprietors considered to have been 'politically safe' (such as the Earl of Strafford and Thomas Radcliffe) were restored to their lands by King Charles II. Amongst the properties involved were Lisnalurg, Shannon Eighter and Shannon Oughter. Later, during the war of 1689-91, **Rathbraghan** fort was occupied by the Williamite forces under General Mitchelburne prior to their attack on Sligo (Wood-Martin 1882-1902, II, p.87f, 134, 270-1).

In more peaceful times, the 18th century witnessed a considerable degree of economic growth in the area, as the export provision trade based in Sligo gained in importance (Wood-Martin 1882-1902, III, p. 241). Hides and tallow were amongst the largest exports, and so cattle raising increased as an activity. By the 19th century, the prominent families of the locality included those of Wynne and Ormsby, and **Rathbraghan** townland had acquired two houses of note, Marlbrook House and Rathbraghan House (O.S. Name-book, transcript, p.186-7).

In 1847-52, the mental hospital for counties Sligo and Leitrim was built in the Townland of Ballytivnan, just on the southern boundary of Rathbraghan. The authorities took due care to lay down a hollowed foundation stone into which a bottle containing newspapers of the day, a parchment giving particulars of the day's proceedings and a range of coins then current were placed for posterity! (Kilgannon 1926, p. 144-5).

The overview of local history sketched here, from the Early Christian period through the Medieval and into the Modern, helps to place Rathbraghan and its immediate surroundings in context. Early Christian saints, local Gaelic-Irish kings and later settlers have in turn left their imprint on the Parish of Calry, leaving the area with a rich tradition.

Abbreviations:

Acta SS; Acta Sanctorum Hiberniae. John Colgan O.F.M. Louvain, 1645.
Reprinted with introduction by Brendan Jennings O.F.M., Dublin 1947.

AFM; The Annals of the Four Masters - see O'Donovan

AU; The Annals of Ulster - see MacAirt and MacNiocaill

Rawl. B 502; Rawlinson B 502 - see O'Brien

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APPENDIX ON CULTURAL HERITAGE

Archaeological sites outside the development area

SMR No. 014:021 **Townland/Ward** Shannon Oughter
Site Type Ringfort **NGR** 16999/33814
Classification D **Area of Interest** 30m
Distance This site occurs northwest on the opposite side of the road of the proposed northern development site boundary.
Description This site is marked on the 1st edition of the Ordnance Survey (1837) and the 3rd edition (1940). The ringfort stands on top of a steeply sloping hill known locally as "Bleachgreen Hill". It is part of an east-west running ridge and in an area of fertile pasture. The southern slope is especially steep. An oval shaped platform measuring 41m north-south and 44m east-west is defined on the east and west by a steep earthen scarp measuring 1.25m and 2m high respectively. A vague inner edge 6m-8m wide low bank is visible along the eastern perimeter. The steep sides of the ridge at the north and south make the edges indistinct. The interior is featureless and covered with fertile grassland. There is no trace of a fosse or outer bank.

SMR No. 014:022 **Townland/Ward** Shannon Oughter
Site Type Ringfort **NGR** 17032/33842
Classification D **Area of Interest** 30m
Distance This site is located north of the proposed development.
Description The site is marked on the 1st and 3rd editions of the Ordnance Survey maps. The ringfort stands in the southwest corner of a large undulating field of pasture and is overlooked by higher ground to the north east. An oval platform measuring 26m north-south by 22m east-west stands between 0.7m and 0.9m high. Around the outside of the scarped edge is a 2m wide band of dense nettle growth possibly implying the former presence of an external fosse. A causeway 4m wide at the east may be the remains of the original entrance while a low bank along the southern perimeter was caused by field clearance. The interior is covered with lush pasture.

SMR No. 014:064 **Townland/Ward** Shannon Eighter
Site Type Enclosure **NGR** 16931/33752
Classification D **Area of Interest** 30m
Distance This archaeological feature is located to the west of the proposed development.
Description This site is on the 1st and 3rd Ordnance Survey editions. The enclosure is located beside a stream near the main road on top of a gentle rise in an area of fertile pasture. Nothing remains above ground of the enclosure marked on the maps. Only that the site is marked on the maps and the typical siting and topographical setting of the enclosure implies the presence of a fort.

SMR No. 014:066 **Townland/Ward** Ballytivan
Site Type Earthwork **NGR** 17024/33692
Classification D **Area of Interest** 30m
Distance This site is located to the south of the proposed development.
Description This feature is located on the 1st and 3rd editions of the Ordnance Survey maps. The site is placed by these on the south-south-east facing slope in the gardens of Sligo-Leitrim District Mental Hospital. No trace of the enclosure or earthwork is visible on the aerial photograph (ALP V203/33-4). The trees along the avenue have been removed and the road

widened since the O.S. map was drawn. It is possible that the enclosure was also removed at this time.

SMR No. 014:067 **Townland/Ward** Farranacardy
Site Type Ringfort **NGR** 17094/33687
Classification C-D **Area of Interest** 30m
Distance This site is located southeast of the proposed development.
Description This site is marked on the 1st and 3rd editions of the Ordnance Survey maps. It is located on top of a prominent hill overlooking Sligo town in an area of generally marshy poor quality pasture. A circular enclosure measuring in diameter 29m is defined along the south and south west by an earthen scarp 0.7m-0.9m high. Elsewhere a round topped steep-sided earth and stone bank 0.65m wide surrounds the site. This bank is 0.4m high internally and stands 2.1m high over the external fosse. The fosse averages 2.8m wide and 0.7m below the level of the exterior. There are several cattle gaps through the bank but there are no original entrances. The interior is covered with a bed of reeds and rushes.

SMR No. 014:026 **Townland/Ward** Barroe
Site Type Enclosure **NGR** 17111/33801
Classification D **Area of Interest** 30m
Distance This site is located to the north-east of the proposed development.
Description This archaeological feature is marked on the 1st edition Ordnance survey but not on the 3rd edition map. It is located on top of a southwest facing slope of a hill in an area of recently cleared and drained pasture. The field wall shown on the O.S. map has been removed and there is no clear trace of any monument except some undulations in the level of the land in the field.

SMR No. 014:016/01/02 **Townland/Ward** Lisnalurg
Site Type Cemetery **NGR** 16915/33830
Ash Pit/Dump 16915/33830
Classification D **Area of Interest** 30m
Distance This site occurs northwest of the proposed development.
Description This site is not marked on the 1st or 3rd edition Ordnance Survey map. It is described by J. Waddell on the 6th June 1969 as the following 'near the summit of a hill along the Sligo-Bundoran Road. During road widening in 1969 an inhumation cemetery, extending over a distance of 20m, was noted below the surface of an old embanked road. 12m from the edge of the cemetery a deposit of burnt clay and stones and charcoal was noted, a hearth or ashpit. The embankment has now been faced with stone.

SMR No. 014:015 **Townland/Ward** Lisnalurg
Site Type Enclosure **NGR** 16897/33812
Classification D **Area of Interest** 30m
Distance This site occurs northwest of the proposed development.
Description The site is not marked on the 1st edition but on the 3rd edition Ordnance Survey map. It is located on the summit of an east-west running ridge in an area of undulating fertile grazing. There is an excellent view from the site in all directions. An oblong enclosure measures 39m northsouth by 149m east-west is defined by an enclosing earth and stone bank 11m wide. On the northern side it was measure at 2m high externally and 1.2m high internally. It diminishes to the east and near the extreme east has been reduced to 0.9m high earthen scarp. The north and south sides have unclear outer edges where the natural slope

of the hill runs into the side of the monument. Each of the ends of the enclosure have been cut by a field fence leaving a rectangular central area flanked by a D-shaped enclosure at each end. About half way along the southern side of the enclosure stand two cylindrical gate pillars of stone and mortar with low supporting plinths. They are 1.1m in diameter and stand 2.9m high and are 3m apart. The interior, despite the high location, is waterlogged and cleared of excess overgrowth. Besides some modern cattle-gaps, the interior is featureless.

SMR No. 014:063 **Townland/Ward** Carton
Site Type Midden Site **NGR** 16846/33716
Classification D **Area of Interest** 30m
Distance This site occurs north-west of the proposed development.
Description This site is not marked on any edition of the Ordnance Survey. Located along the west and northwest facing muddy shores of 'Carton Marsh', a part of Sligo Bay. The shore is generally shingle with mud flats further out from the edge. A vertical cliff rises 4-5m above the beach at this part of the headland. Besides a few shells intermittently visible along the vertical cliff edge nothing of archaeological significance can be seen. A playing field has been constructed at the extreme edge of the point and it is possible that some landfilling took place in the area, observing the original cliff edge.

[1] **85/337/EC and 97/11/EC**
[1] **The Local Government (Planning and Development Act 2000) sets out the new legislative framework for the preparation of Environmental Impact Statements. Whilst this act has been passed by the Oireachtas the parts of the act relevant to EIS's have not yet become operational.**
[1] **EIA Regulations 1999 (S.I. 93/99), Article 25 Second Schedule 1(d)**
[1] **This convention is concerned with wetlands protection.**
[1] **Source: Dr D Cotton**
[1] **Source: Dr D Cotton.**
[1] **Source: Dr D Cotton**
[1] **Source: Dr D Cotton, 1993**
[1] **Source: F Marnell, NPWS**
[1] **Source: Whilde, 1993**
[1] **Statutory Instrument Number 81 of 1988**
[1] **BOD is traditionally used in waste water treatment design in Ireland. COD is usually used in continental Europe.**
[1] **Statutory Instrument Number 419 of 1994**
[1] **Directive 91/271/EEC**
[1] **Visual robustness is a term used to indicate that a landscape has a capacity to absorb development without undergoing a significant change of character**
[1] **Decision 94/3/EEC**
[1] **Decision 94/904/EC**

LOCKWOOD GREENE – IDC

Abbott Ireland

Planning Report

Project Apollo

Revision 0
20/December/04

Issue	Date	Pages	Issue Description	By	Check	Approved
A	28/Oct/04		Draft for Client review	GPD		
B	14/Dec/04	15	Final draft	GPD		
0	20/Dec/04	15	Issue for fire cert application	GPD		

Contents

1.0 Planning Application Drawing List

Drawing No.	Drawing Title	Rev no.
A1-IR00-FL-130-050	SITE LOCATION	0
A1-IR00-FL-130-051	SITE LAYOUT	0
A1-IR00-FL-130-052	TANK FARM LAYOUT	0
A1-IR00-FL-130-053	TANK FARM SECTIONS	0
A1-IR00-FL-130-054	AIR EMISSIONS ABATEMENT	0
A1-IR00-FL-130-055	DRUM STORE LAYOUT	0
A1-IR00-FL-130-056	CYLINDER CHARGING STATION	0
A1-IR00-FL-130-057	GROUND FLOOR PLAN	0
A1-IR00-FL-130-058	FIRST FLOOR PLAN	0
A1-IR00-FL-130-059	FIRST MEZZANINE LEVEL	0
A1-IR00-FL-130-060	SECOND FLOOR PLAN	0
A1-IR00-FL-130-061	SECOND MEZZANINE LEVEL	0
A1-IR00-FL-130-062	SOUTH & WEST ELEVATION	0
A1-IR00-FL-130-063	NORTH & EAST ELEVATION	0
A1-IR00-FL-130-064	BUILDING SECTION C	0
A1-IR00-FL-130-065	TK-400 AND TK-405 LAYOUT	0

2.0 Applicant

Abbott Laboratories are one of the world's leading health care companies with a worldwide manufacturing and distribution for its products. It was founded more than a century in Chicago in the USA. Today, the company has approximately 70,000 employees and has annual sales of over US $17 billion.

Abbott Laboratories of Chicago set up their first production facility in Ireland in Sligo in 1973. Since that time, Abbott has expanded in various areas in Ireland and now has 1700 + employees in the Northwest region. Today Abbott Ireland is regarded as a major overseas subsidiary of the company, with its headquarters in Sligo.

In 2002, Abbott Ireland built a multipurpose pharmaceutical manufacturing facility (Abbott Ireland Pharmaceutical Operations, AIPO) on a green-field site of 47ha (116 acres) at Ballytivnan on the north site of Sligo town, just off the manorhamilton road. This multipurpose, highly contained facility was designed, constructed and commissioned to manufacture pharmaceutical products, which would provide Abbott's global markets with quality healthcare products that would combat diseases in oncology, neurology, and urology.

The new facility was granted an IPC licence (Register No. 643) by the Environmental Protection Agency (EPA) in December 2002 and Abbott Ireland Pharmaceutical Operations commenced commercial production at the facility in May 2003.

As part of Abbott Ireland's on-going commitment to the development and growth of this site, Abbott Ireland Pharmaceutical Operations (AIPO) are initiating a new capital project (project Apollo) to increase the manufacturing capacity of this facility.

It is being proposed that two additional manufacturing cells are added to the existing vacant space within the sites Bulk Pharmaceutical Building (Building 40).

Currently, production of active pharmaceutical ingredients in this building is completed in two existing cells (Cell 42 and Cell 44). To support the addition of two new manufacturing cells (Cell 41 and Cell 43), AIPO propose on installing four (4) new tank-farm tanks, a new air emission treatment system, a new cylinder charging station and an expansion to the existing drum store.

It is envisaged that this new expansion will create at least 30-new jobs in the pharmaceutical facility.

3.0 Project Description – Building Works

As mentioned, this application is relevant to proposed modifications and expansion works associated with the expansion of production within Building 40. The project title is "Project Apollo" and is based on the AIPO site on the Manorhamilton road in Sligo.

Project Apollo works comprises the following components;

Bulk Pharmaceutical Building - Building 40

The bulk pharmaceutical building or building 40 currently has a building footprint of 1395 m^2. Presently, the interior of this building contains two contained manufacturing cells (cell 42 and cell 44) and a vacant shell and core. Cells 42 and Cell 44 have been used for the production of API for commercial use since May 2003.

It is now being proposed that two new contained manufacturing cells (cell 41 and cell 43) be installed inside this vacant shell and core.

This will involve minor modifications to the existing elevations, i.e. removal of external door, insertion of blast relief panels to match existing panels, provision of new external louvres. There will also be modification to the existing floor plan layout for the incorporation of new platforms. These new platforms will facilitate the installation of new process equipment inside this building. There will also be some deletion of existing upper floors. Overall increase in floor area is estimated at 104 sq. m.

Tank Farm

The existing tank farm has storage for solvents (fresh and waste) and aqueous waste. Four new bulk storage tanks will be added to the tank farm. These new tank are identical in size and appearance to the existing tank. Two of these tanks will be located in the existing tank farm bunded area (north side) and two will be located in a new bunded area adjoining the existing tank farm bund wall (east side). Refer to dwg. nos. A1-IR00-FL-130-052 and A1-IR00-FL-130-053

External Tanks (TK-400 & TK-405).

Two additional vessels will be located immediately north of building 40 in line with a number of existing external vessels. The new vessels will serve as effluent neutralisation tank, TK-400 and relief catch tank, TK-405 respectively. Again, each vessel will be installed in a bunded area.
Refer to dwg. no. A1-IR00-FL-130-065.

Drum Store

The existing drum store is to be increased in size, with new design to match that of the existing.
Refer to dwg. no. A1-IR00-FL-130-055.

Cylinder Charging Station

The position of the Cylinder Charging Station will be east of Building 40 beyond the future expansion building. The cylinder station will be located such that it is a minimum of 3 metres from existing buildings and roads. Refer to dwg. no. A1-IR00-FL-130-056. Design is in accordance with the British Compressed Gases Assoc. guidelines – GN2.

Air Emission Abatement System

A new Abatement unit to be located within the existing Tank Farm area due east of Building 70. Refer to dwg. no. A1-IR00-FL-130-054.

Building Form

All new works are to be in keeping with the existing building structures in scale, height and general appearance, material specifications and finish colours.

Access and Parking

Access to the site is via the existing site entrance from the south off the Manorhamilton road. The existing parking allocation of 150 car parking spaces, which is located to the south of Building 10 is considered ample car parking for the site population of 80 at present, including the nominal increase of 30 additional staff for these new works (giving a total staff forecast of 110). It is not intended to provide further car parking as part of this Planning application.

Façade Finishes

All amendments to the existing buildings will match that of the existing.
New Drum Store area to match the existing with a mid-grey finish colour
New tanks to match the existing with both stainless steel natural finish and navy-blue finish to carbon steel tanks – to match the existing.

Drainage

Refer to Appendix II - Environmental Report for drainage considerations.

Environmental Impact Statement

Refer to Appendix II - Environmental Report for EIS considerations.

Landscaping

Existing landscaping effected by the new works will be made good on completion Existing mature trees on the site will not be impacted by the new works.

4.0 Project Description – Mechanical Services

Air Conditioning/Ventilation:
For the proposed new Cells, the existing supply air system is sufficient to cater for the expansion needs. There will be a need to provide additional extract fan requirements. These new extract fans will all be located inside building 40.

Heating

The existing site system is sufficient to cater for the Building 40 expansion requirements.

Fire Protection

The existing firewater pumps, tanks and retention pond will be utilised to support the new works fire protection systems listed below.

a) Fire hose-reels.
b) A wet sprinkler system.
c) The system will be designed to the Insurers regulations.

Controls

The existing building 40 system shall be extended to accommodate the new works. A complete system of HVAC controls and outstations will be provided within the scope of this project.

5.0 Project Description – Electrical Services

Electrical supply

The existing site and building 40 system shall be extended to accommodate the new works. The whole of the electrical installation will be designed and installed in accordance with the requirements of the ETCI National rules for Electrical Installations.

Lighting

In general, the lighting system will be designed to provide the levels of illumination appropriate to each type of activity in the building as recommended in the current edition of the Chartered Institute of Building Service Engineers (CIBSE) Code for interior lighting. Emergency lighting will be in accordance with IS 3217:1989.

General services and small power

Single phase and three phase socket outlets will be provided at various points in the building for use with non-fixed equipment. Fixed items of equipment will be supplied via fused, switched cable outlets and isolators suitably rated. Motors will be provided with emergency stop push buttons wired to motor starter section of the relevant Motor Control Centre.

Fire alarm system

The existing site and building 40 system shall be extended to accommodate the new works. The system will be designed in accordance with IS 3218:1989.

Electrical supplies to Mechanical Equipment

A complete system of power supplies and control cables will be supplied and installed to cater for the Electro-mechanical systems in the building, i.e. servicing items of plant and connecting control panels to remote sensors and control devices. Refer to the mechanical description for further details of equipment and systems to be provided.

Appendix I

Abbott Laboratories

Project Apollo

Planning fee calculations

Description of Works	**Area –sq. m.**
Building 40 additional floorplan area with added mezzanines	104
Building 40 elevation amendments	80 Euro
Tank farm Expansion	93
Drum Store Expansion	400
Cylinder Charging Station	31
Abatement Unit	18
New Tank Area (TK-400 and TK-405)	52
Total area applicable	698

Planning fee payable = 3.60 x 698 = 2,592.8 euros.

Appendix II

Abbott Laboratories

Project Apollo

Environmental Report

Environmental Impact Statement (EIS)

The impact of the proposed new development on the existing environmental impact statement (EIS) was assessed.

In the original EIS for the facility, which was submitted with the original planning application, it was stated that the pharmaceutical manufacturing plant would be flexible in nature. This would permit the company to manufacture new products apart from those specified in the EIS. The products that were stated in the original were,

Rubitecan – Oral Cancer Therapy,

CisAtracurium – Neuromuscular blocking agent,

Atrasentan – Oral Cancer Therapy

Uprima – Male erectile dysfunction

As parts of Abbott ongoing product portfolio growth, the proposed new cells in Building 40 will be utilised for the manufacture of two new active pharmaceutical ingredients (APIs), Trandolapril API and ABT-510 API.

In this EIS, it was also stated that Production would be limited to the manufacture of drug components using general processes and in the equipment outlined in that report. Each proposal to manufacture new categories of product or significantly change the manufacturing processes or the nature and quantity of the new raw materials would be subject of an application to the Environmental Protection Agency for an amendment to the IPC licence.

As a result, AIPO have notified the EPA of the proposed modifications to the site and the two new processes that are being proposed for the site. A letter has been sent to an inspector at the Environmental Enforcement office on the 30th-Nov-04, enquiring if the proposed changes to the site require an amendment to the existing IPC licence, Reg. 643.

AIPO are expecting that a full review of the existing licence will be required and are currently preparing of this activity. As a result of this expected review, an update of the existing EIS is not deemed necessary.

Process Description

Outlined below is an overview of the two new processes that are being proposed for the site.

Trandolapril is an ACE inhibitor that lowers blood pressure by preventing a chemical (Angiotensin I) in the blood from converting to a more potent form that narrows the blood vessels.

ABT-510 is an angiogenesis inhibitor to be used in the treatment of cancerous tumours to slow the growth of new blood vessels, which are necessary for cancerous tumours to keep growing and spreading.

Both these APIs will be manufactured in a batch mode in the two new cells (Cell 41 and 43) of the existing Bulk Pharmaceutical Building (Building 40) using the following unit operations,

1. Reactions,

2. Crystallisations,

3. Purification using ion exchange,

4. Distillations,

5. Filtration,

6. Drying

7. De-lumping.

All these unit operations are currently used for the manufacture of the existing APIs that are currently being manufactured at the plant.

Raw Materials and Chemical inventory:

A range of materials are currently in use in Building 40 which include common organic solvents such as methanol, ethyl acetate, toluene, formaldehyde and acetone, inorganic salts such as potassium carbonate, sodium bicarbonate and sodium hydroxide and organic and inorganic acids such as formic acid and hydrochloric acid.

The following materials are not currently in use at the AIPO facility and are proposed for the two new products:

Trandolapril

Dichloromethane, intermediate - Benzyl Transcycloprolinate HCl, starting material - HOE498, Triethylamine, Propane Phosphonic Anhydride, Hydrogen Gas, Palladium/Carbon Catalyst

ABT-510

Hexapeptide, Tripedtide, Dimethylformamide, Isopropylalcohol, Isopropylacetate, Collidine, HOBt.H2O, EDAC.HCl

A review of the impact of the introduction of the above chemicals against the requirements of the SEVESO II Directive will be conducted by the facility.

Table 10 of the IPC licence application will be updated to include the materials used for the manufacture of Trandolapril and ABT-510.

Emissions

Air Emissions

The vent from the new proposed air emission abatement system will be routed to the existing emission point A2-1 through which the TO currently vents to atmosphere. The existing continuous monitoring equipment on A2-1 will be utilised.

The hydrogen vent from the new hydrogenation reactor vessel will introduce a new minor emission point to the site. There will be low levels of fugitive emissions from this vent.

There will be fugitive emissions points from two out of the four new tanks in the tank farm area. These fugitive emissions will not contain any chlorinated solvents.

The vents from the other two of the new tank farm tanks, which will contain fresh and contaminated dichloromethane, will be routed to the new air emission abatement system for treatment.

Detailed air dispersion modelling will be conducted by the facility to assess impact of these new emissions on the environment.

Emissions to surface water

There will be no impact on emissions to surface water as a result of the introduction of the new API's to the plant.

Emissions to sewer

There will no increase in the volumes of effluent emitted to sewer as a result of the introduction of the new API's to the plant. The aqueous waste streams will continue to be tested in accordance with Condition 6.7 of the licence to ensure they are suitable for release to sewer.

Protection of Groundwater

All the new tanks will be bunded which will contain the contents of the tank in the event of a leak. The bunds will be built in accordance with EPA guidelines.

Noise Emissions

There will be no impact on noise emissions as a result of the introduction of the new API's to the plant. All external equipment will be designed to that noised is minimized. This will also be monitored and verified by AIPO personnel during the construction and commissioning phase of the project.

Waste Emissions

Waste solvent containing dichloromethane (chlorinated waste) will be stored in one of the new tankfarm tanks. This will be a dedicated waste tank for this type of waste solvent. This solvent will be transferred off-site for disposal in accordance with current waste legislation.

Waste solvent, not containing dichloromethane (non-chlorinated waste) from the two new processes will be stored in one of the existing tank farms tank. Again, this solvent will be transferred off-site for disposal in accordance with current waste legislation.

Schedule 3 (i) Hazardous waste for Disposal/Recovery will be updated to include these wastes.

Abatement System Options

As previously stated this project will include the installation of a new air abatement system at the facility primarily for the treatment of dichloromethane air emissions but also to act as a back up to the on site Thermal Oxidiser. In accordance with EU Directive IPPC 96/61/EC and the recent introduction of the Protection of the Environment Act 2003 the facility are using the concept of Best Available Techniques (BAT) in deciding on a suitable air abatement technology.

The following air abatement options, which are all considered to be BAT, are currently being considered for the new air emission abatement system. All these system currently being considered are capable of treating VOCs to below TA Luft levels.

Carbon adsorption system

Catalytic oxidation system

Cryogenic condensation system

In addition to the VOC emissions to the new abatement system from the two new reactors in Building 40 emissions will be minimised by the installation of dedicated condensers serviced with cold glycol. The same process control technology employed by the facility for the automatic shutdown of operations in the event of a failure of the air abatement system will also be employed for the new abatement system.

All of the new tank farm tanks will contain conservation vents. Two of the new tankfarm tanks will have vent condensers serviced with cold glycol.

Utilities for New Facilities

The existing utilities on site will be adequate to supply the new proposed equipment. An upgrade to the existing liquid nitrogen supply tank may be necessary if a cryogenic condensation system is installed.

Project Timelines

The proposed project (which is referred to as Project Apollo) is currently in detailed design phase. Construction is due to commence in Quarter 1, 2005 with completion at the end of Quarter 3, 2005. It is anticipated that commissioning and validation batches will be run in Quarter4 2005

Appendix III

Abbott Laboratories

Project Apollo

Site Notices 1

SLIGO COUNTY COUNCIL

Abbott Ireland Pharmaceutical Operations, whose principal place of business is at Ballytivnan, Sligo, Co. Sligo is applying to the Sligo County Council for planning permission to install additional external equipment to serve a partial internal fit out of Building 40 on their site off the Manorhamilton road located within the Ballytivnan & Rathbraghan townlands, Co. Sligo.

The new works pertain only to an area on this site within the Sligo County Council jusidiction. (Previous Planning Ref. Nos. PD69/01 Sligo Corporation and PL01/481 Sligo County Council).

This area is located approximately 150m north of this sign location.

The proposed works consist of an internal fit-out of a section of the existing production building (Building 40 – Approx. 104sqm over 3 no. floors) incorporating minor alterations to the existing elevations.
External Works consist of the expansion of the existing Drum Store by 400sqm, existing Tank Farm by 90.72sqm and existing Pipe Bridge to enable new connections and the installation of an air Abatement System, an Effluent Neutralisation Tank, a Relief Catch Tank and a Cylinder charging Station including associated equipment and storage areas.

The work also provides for additional site signage, fencing, landscaping and site works.

The overall facility comprises an activity to which a license under Part IV of the Environmental Protection Agency Act 1992 is required. An Environmental Impact Statement was submitted with the Planning application for the original building and a license was granted. (Previous Planning Ref. Nos. PD69/01 Sligo Corporation and PL01/481 Sligo County Council). The proposed development does not alter this classification.

This application may be inspected or purchased at the Planning Offices, Sligo County Council,County Hall,Riverside, Sligo, Co. Sligo. Submissions/objections can be made within 5 weeks from the date of receipt of a valid application together with the appropriate fee of €20.00

Signed: Stephen Muldoon

(Site Director, Abbott Ireland Pharmaceutical Operations), Applicant

Date erected 23rd Dec 2004

Abbott Laboratories

Project Apollo

Site Notices 2

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Signed: Stephen Muldoon

(Site Director, Abbott Ireland Pharmaceutical Operations), Applicant

Date erected 23rd Dec 2004

Appendix IV

Abbott Laboratories

Project Apollo

Newpaper planning notification advert

SLIGO COUNTY COUNCIL

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Signed: Stephen Muldoon

(Site Director, Abbott Ireland Pharmaceutical Operations), Applicant

EIA Screening Report for Proposed Alterations & Extensions of Abbott Ireland Pharmaceutical Facility Manorhamilton Road, Sligo

prepared for

Abbott Ireland
Manorhamilton Road, Sligo

by

Environmental Impact Services
Second Floor
The Courtyard
25 Great Strand Street
Dublin 1

07 September 2015

Contents

1. Introduction

Environmental Impact Services has been engaged by Abbott Ireland for the provision of a screening report for the proposed Alterations and Expansions at the Abbott facility at Manorhamilton Road, Sligo.

The principal requirement for these services is to assist the relevant authorities in forming an opinion as to whether or not the proposed development should be subject to Environmental Impact Assessment (EIA) and if so, whether an Environmental Impact Statement (EIS) should be prepared in respect of it.

This report sets out the findings of an EIA Screening Assessment undertaken by Environmental Impact Services in respect of the proposed development which show that the proposed development does not need to be subject to EIA.

2. Proposed Development

The subject proposal is for alterations and extensions to 3 no. buildings on the existing Abbott Ireland Pharmaceutical Campus, as follows and as illustrated in 1 and 2:

a) 2 no. 3 storey extensions to the existing Administration/ Laboratory Building approximately 1661m² in area, (height 15.6 metres) located to the east and west of this facility and alterations to the existing south façade
b) 2 no, single storey extensions approximately 2072m² in area, (height 13.5 metres) to the existing Production/Tableting Building with internal mezzanines, located to the east and west of this facility
c) An extension to the existing single storey high bay Warehouse (including relocated docks) to the west of the existing 3 storey Manufacturing Building approximately 380m² in area (height 16.6 metres).
d) An inter-building 2 storey Link approximately 787m² in area, (height 13.5m metres) directly located to the west of a proposed link - currently subject to planning (planning reference number 11/411)
e) Alterations to building facades to include roof mounted equipment, external stairs and miscellaneous single storey porches to all buildings.
f) Ancillary works including 42 no. additional car spaces and revisions to roads and services, including pipe bridges, bunded tanks with canopy over and revised landscaping.

While he proposal does include expansion of tableting areas, it does not include expansion of any pharmaceutical production areas.

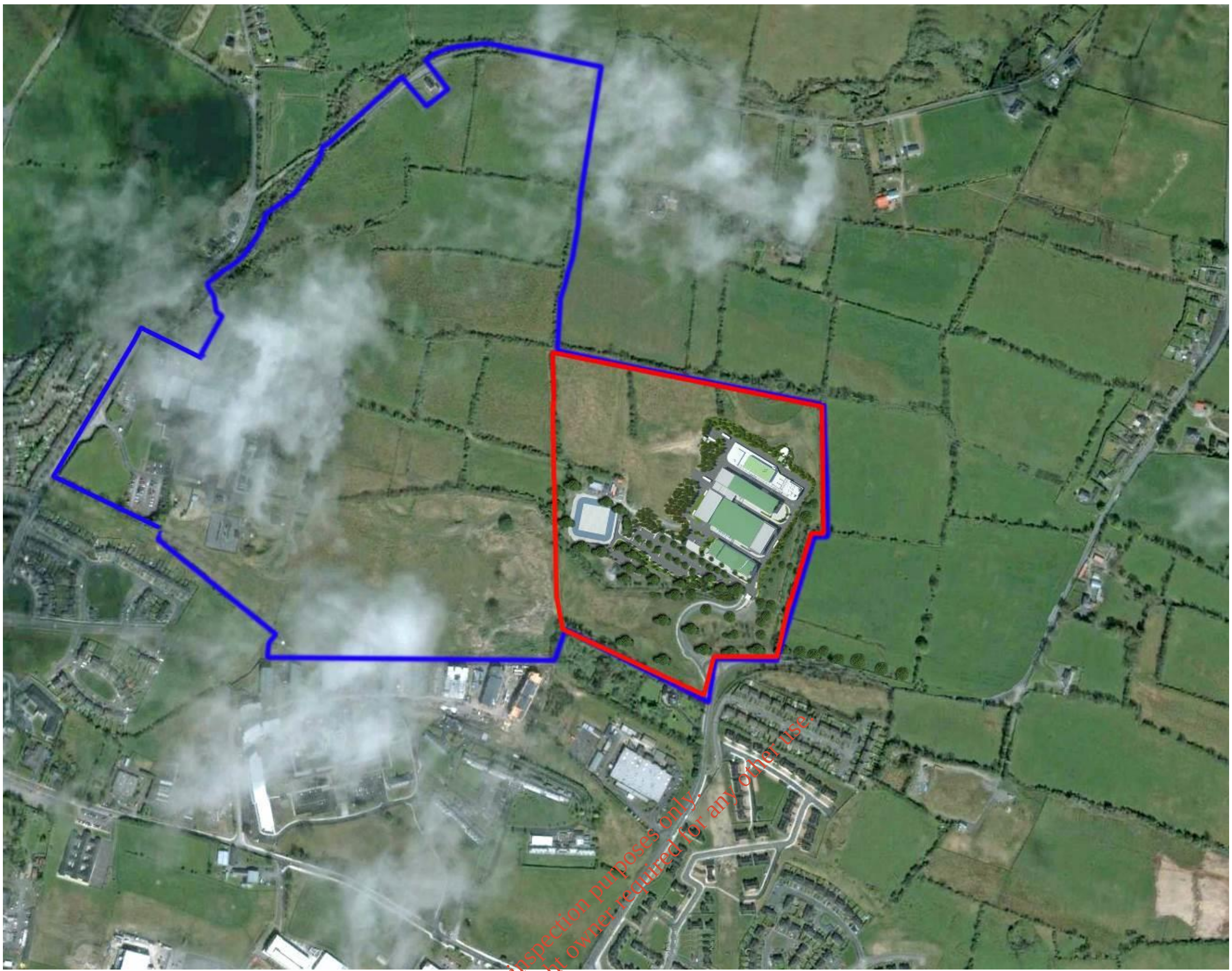

Figure 1 Subject Site[1]

[1] Outlined in red – blue line outlines Abbott landholding

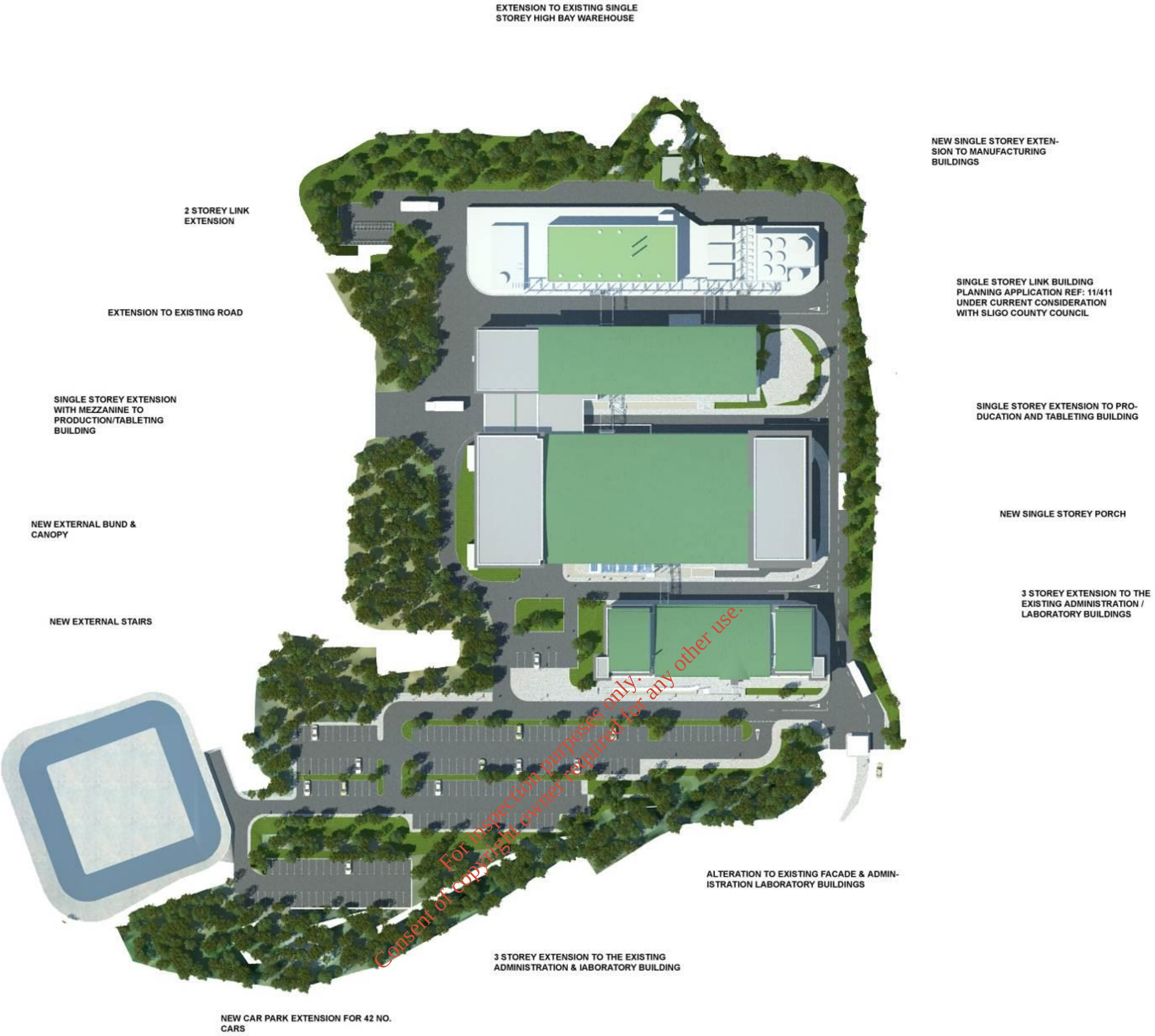

Figure 2 Principal Elements of Proposed Development

3. Legislative Basis for EIA

EIA requirements derive from EU Directive 85/337/EEC (as amended by Directive 97/11/EC) on the assessment of the effects of certain public and private projects on the environment.

The Directive was fully transposed into Irish law and EIA legislation as it relates to the planning process has now been brought together in Part X of the Planning and Development Acts 2000-2010 and Part X and Schedules 5, 6 and 7 of the Planning and Development Regulations 2001-2010.

Part 1 of Schedule 5 to the Planning and Development Regulations 2001-2010 lists projects included in Annex I of the Directive which automatically require EIA. Part 2 of Schedule 5 to the Regulations outlines thresholds for projects which also require EIA, as per Annex II of the Directive.

4. EIA Screening of Subject Development

EIA screening can be defined as the process of assessing the requirement of a project to be subject to Environmental Impact Assessment based on project type and scale and on the significance or environmental sensitivity of the receiving environment[2].

The proposed alterations and expansion includes expansion to tablet manufacturing area but not to pharmaceutical production areas. Hence none of the works to be carried out under the proposed development provide for an increase in pharmaceutical production area which would require an EIA to be carried out under Part X of the Planning and Development Acts 2000-2010 and Schedule 5 of the Planning and Development Regulations 2001-2011.

As such, the works neither automatically trigger environmental impact assessment, nor do they require to be considered in terms of sub-threshold development (i.e. where development is listed as requiring an EIA to be carried out but where the threshold for requiring its submission has not been met).

Schedule 7 to the Planning and Development Regulations sets out "criteria for determining whether a development would or would not be likely to have significant effects on the environment" in accordance with Annex III of the Directive. Schedule 7 effectively acts as guidance for consent authorities in Ireland in assessing whether a 'sub-threshold development' should be subject to EIA. However as the proposed development is not of a project type for which a threshold is defined in the Regulations, it is not a 'sub-threshold development' and the requirements of Schedule 7 are not applicable. Notwithstanding this a range of environmental reports, as detailed under the following heading, have been produced to assess potential environmental impacts and these find that the development is not likely to have any significant effects on the environment.

[2] Environmental Protection Agency (EPA) (2002) 'Guidelines to be contained in Environmental Impact Statements'

5. Environmental Reporting

A comprehensive Environmental Impact Statement supported the planning application for the overall parent facility (planning reference Sligo County Council no. p.d.01/481 dated 09/10/2001 and planning reference Sligo Borough Council no. p.d.01/69 dated 04/09/2001) that is now being extended. The site's emissions to air and water are controlled by an Integrated Pollution Prevention Control (IPPC) Licence (EPA ref P0643-02) which is subject to constant monitoring and periodic review.

Notwithstanding this, six environmental reports have been prepared to assess any potential environmental effects arising from the subject alterations and expansions development, as follows:

- Landscape & Visual Impact Assessment
- Noise Assessment
- Air Quality and Climate Assessment
- Soils, Geology and Hydrogeology Assessment
- Hydrology Assessment
- Traffic Impact Assessment

An Appropriate Assessment Screening report has also been prepared which assesses potential ecological impacts with particular focus on EU designated ecological sites.

All of these reports find that the proposed development will have no significant environmental effects.

6. Conclusion

In conclusion, it is prudent to consider whether or not, notwithstanding the fact that the proposed development does not automatically trigger an EIA, the proposed works would nonetheless require the submission of an EIS on the basis that it would have significant effects on the environment. In order to address this, a number of reports and surveys have been carried out on potential environmental impacts of the proposed development.

From the information gathered and presented in the accompanying reports it is clear that there will be no significant effect on the environment as a result of development works for which planning permission is sought. Thus, no EIS needs to be lodged with this application.

APPROPRIATE ASSESSMENT SCREENING

FOR PROPOSED

ALTERATIONS & EXTENSIONS OF

ABBOTT IRELAND PHARMACEUTICAL FACILITY

MANORHAMILTON ROAD, SLIGO

Abbott
A Promise for Life

by:

Environmental Impact Services

2nd Floor
The Courtyard
25 Great Strand Street
Dublin 1

22 FEBRUARY 2012

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Appendix A

Assessment of a stream at Abbott, County Sligo, AQUAFACT International Services Ltd, 2011

1 INTRODUCTION

1.1 BACKGROUND

This Screening Report was prepared by Environmental Impact Services in order to determine the potential for any negative impacts on the Natura 2000 network of sites from expansion to the Abbott Irland Pharmaceutical Facility, Sligo. This report contains a record of the Stage 1 Screening that was carried out.

In carrying out this screening report, potential impacts from the proposed expansion to the Abbott facility were assessed, both on their own and in-combination with other plans and projects. Consideration of the cumulative impact of the expanded facility also took into account the existing facility and its emissions to air and water, which are controlled by the implementation of an Integrated Pollution Prevention Control (IPPC) Licence (P0643-02).

1.2 LEGISLATIVE CONTEXT

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, better known as "The Habitats Directive", provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (cSACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC).

This legislation is implemented in the Republic of Ireland by the European Communities (Birds and Natural Habitats) Regulations 2011. These new regulations consolidate the European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats)(Control of Recreational Activities) Regulations 2010, as well as addressing transposition failures identified in the CJEU judgements.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect Natura 2000 sites (Annex 1.1). Article 6(3) establishes the requirement for Appropriate Assessment (AA):

"*Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*"

If, in spite of a negative assessment of the implications for the [Natura 2000] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the *overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.*"

1.3 STAGES OF APPROPRIATE ASSESSMENT

This Natura Impact Statement has been prepared in accordance with the following guidance:

- *Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government, 2009.
- *Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*, European Commission Environment DG, 2000.
- *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC:* European Commission, 2000

As set out in these guidance documents, AA comprises up to four stages:

Stage One: Screening

The process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant.

Stage Two: Appropriate Assessment

The consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts.

Stage Three: Assessment of Alternative Solutions

The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site.

Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain

An assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

The Habitats Directive promotes a hierarchy of avoidance, mitigation and compensatory measures. Firstly, the plan should aim to avoid any impacts on Natura 2000 sites by identifying possible effects early in the plan-making process and altering the plan or project in order to avoid such impacts. Secondly, mitigation measures should be applied, if necessary, during the AA process to the point where no adverse impacts on the site(s) remain. If significant effects on the site(s) are likely, and no further practicable mitigation is possible, the Plan or project may not proceed unless for imperative reasons of overriding public interest (IROPI test) under Article 6(4) of the Habitats Directive, in which case compensation measures are required for any remaining adverse effect(s).

This report documents the first of these stages. It's conclusion that significant impacts on Natura 2000 sites are unlikely means that further AA stages are not required.

2 ASSESSMENT CRITERIA

2.1 DESCRIPTION OF THE PROJECT

2.1.1 Existing Facility

Abbott Ireland Pharmaceutical Operations (AIPO) is involved in the manufacture of pharmaceuticals at its facility in Sligo. The AIPO facility is located in the town lands of Ballytivnan and Rathbraughan on the outskirts of Sligo town. Abbott holds an Integrated Pollution Control Licence (originally Register No. 643, which was replaced by Register P0643-02 in November 2005), as granted by the Environmental Protection Agency. The existing site layout is shown in Figure 2.1.

The current Abbott facility consists of four blocks, which represent the four primary buildings:

Building no. 10 contains the Administration, Canteen & Laboratory Block. This is a two storey Building located to the front of the site.

Building no. 20 is the Secondary Manufacturing Building where finished pharmaceutical products (i.e. tablets) are made for the market place. This is a single storey Building with an associated staging areas attached. The processing rooms are located on a single storey with separate rooms off a main material corridor. There are additional plant rooms and technical areas behind the process rooms and a mezzanine level for support equipment.

Building no. 40 is the Bulk Manufacturing Building where the active ingredients are made for the finished pharmaceutical products. This is a three storey Building also with an associated staging Warehouse attached.

Link - Under a planning application lodged with the County Council in December 2011; Building 20 & Building 40 will be linked due to the addition of a new loading dock and staging area connecting the 2 Buildings. The change in finished floor level to both Buildings will be addressed in this new link. Sligo Co. Co. planning ref. 11/411 - lodged on 23/12/2012

Building no. 70 is the Utility Building. It is a single storey structure where all the primary services are located to support the Buildings on site, such as boilers etc. These services are distributed to the other Buildings via a high level pipe bridge which runs through Building 40 and 20 and connects to the rear of Building 10. It has been determined that the CUB Building has sufficient capacity to support the new works. The existing pipe bridge is to be retained in its current location.

2.1.2 Proposed Development

A plan of the proposed developments on site is shown in Figure 2.2. The proposed alterations and expansions are as follows:

- The existing Admin. Building (Building 10) is to be expanded to the east for canteen facilities and offices and to the west for 2 storey laboratories.
- The existing Tableting Building (20) is to be expanded for more tableting operations.
- The existing Manufacturing Building (40) is to be expanded for integrated site warehouse operations.
- A new Link structure which is currently in planning, Ref. No. 11/411.
- 42 new car parking spaces

2.1.2.1 Building 10

It is proposed to construct two new 3 story extensions to either side of the existing Building 10. The extension to the west side will house new labs at ground floor level, offices at first floor level with a plant room over. This forms part of our concept study and these works are part of the estimate study.

Works will also include modifications to the existing toilets and locker rooms at ground level, changes to the existing lab layout (new air locks, extended stores and write up areas), new disabled toilet at first floor level and the relocation of an existing Kardex unit in the second floor offices. The plant room has been sized & designed that part of it could be converted to Offices at a future date.

New fresh air intake /extract modifications to the existing elevations are required due to the proposed extension. In addition some changes to existing Building 10 façade are proposed. These consist of swapping the mullion caps on all windows to white (the existing ones are black) and the introduction of a portico across the front of the existing Building to tie in the two new end bays.

The extension to the east will house the Canteen expansion required at the ground floor level, offices at first floor level and plant room at the second floor level.

2.1.2.2 Building 20

The eastern expansion at Building 20 shall consist of a shell type structure and envelope construction only.

The new extension comprises granulation suites, Tableting suites, blending rooms and both excipient and active dispensing. In addition to this, the production centre includes a future tableting room, a work-in-progress area, a wash suite and a central control room. New in-process laboratories are located on the mezzanine level and are accessed from the GMP area below via a dedicated access stairs and lift. Support areas for storage along with technical areas for the process utilities are also provided at the ground floor level. A mezzanine level will house the HVAC plant. New gowning rooms have also been incorporated in to the expansion along with a new entrance porch to the existing façade of Building 20.

2.1.2.3 Building 40

The new expanded Warehouse will provide (aprox.) 1000 pallet storage in aisles stacked 6 pallets high. The facilities also include sampling suites, a waste suite and a logistics centre. The Warehouse will house both finished goods and raw materials. The sampling suite shall be constructed in a clean room panelling system. The warehouse will deliver / receive material to/from both Building 20 & 40.

New single storey temporary loading docks, decon area and a cold room are to be constructed to the north of the existing Building 40. These are required to facilitate the construction of both phase 1 & 2. A new retaining wall is required externally to achieve access to the new loading docks. A new porch is to be provided at the existing main entrance the production Building. The existing approached is to be modified to provide a ramp up as required by the current Building regulations.

2.1.2.4 Ancillary site works

These include, but are not limited to, the diversion of existing fire mains and services, new truck turning circles, new loading docks, additional car parking, new temporary Contractors Compound, new paving, new fire truck routes, new site signage, relocation of road, relocation of existing site huts (TBC) and new access routes including ramps to Building 20 & 40 entrances. Additional disabled parking is to be provided to the side of Building 10. A new underground process water tank and pump is to be located to the south of Building 20.

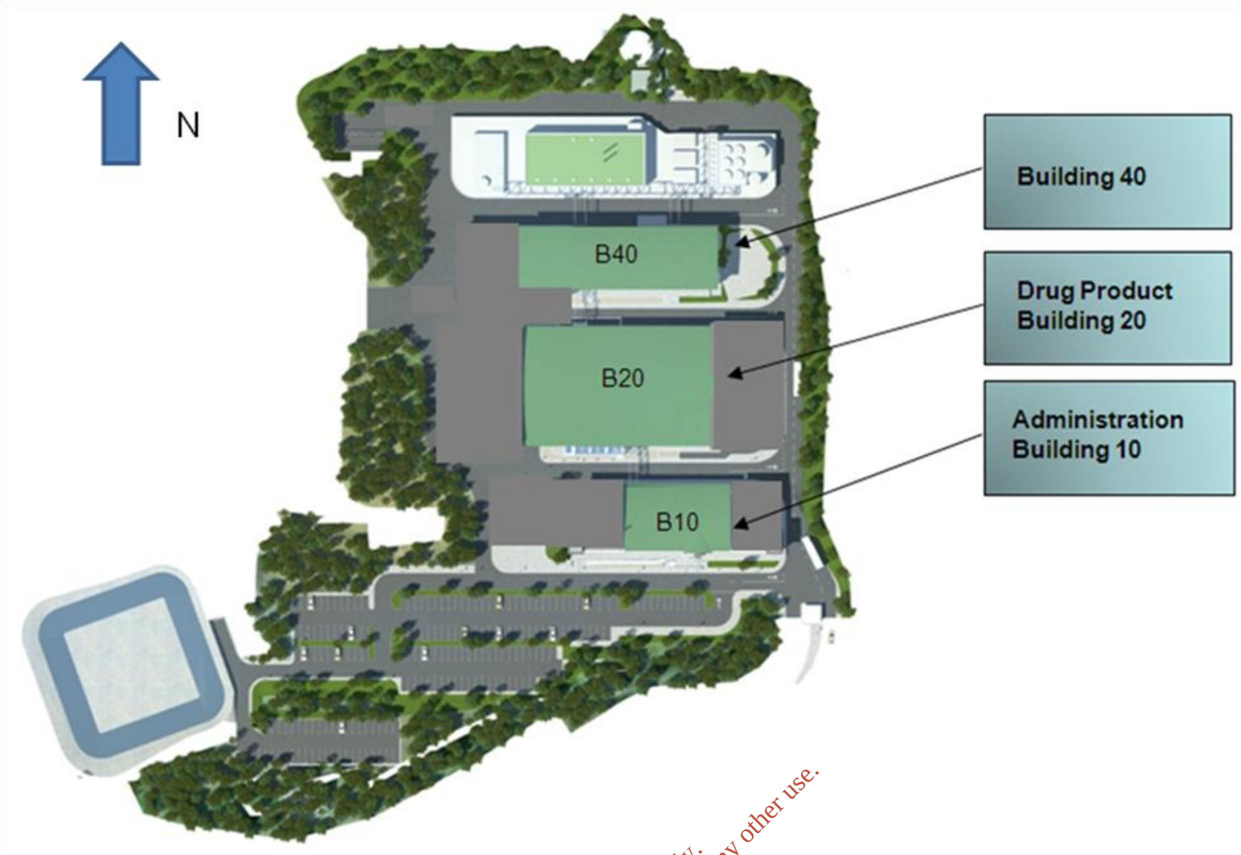


Figure 2.1 Existing Site Layout

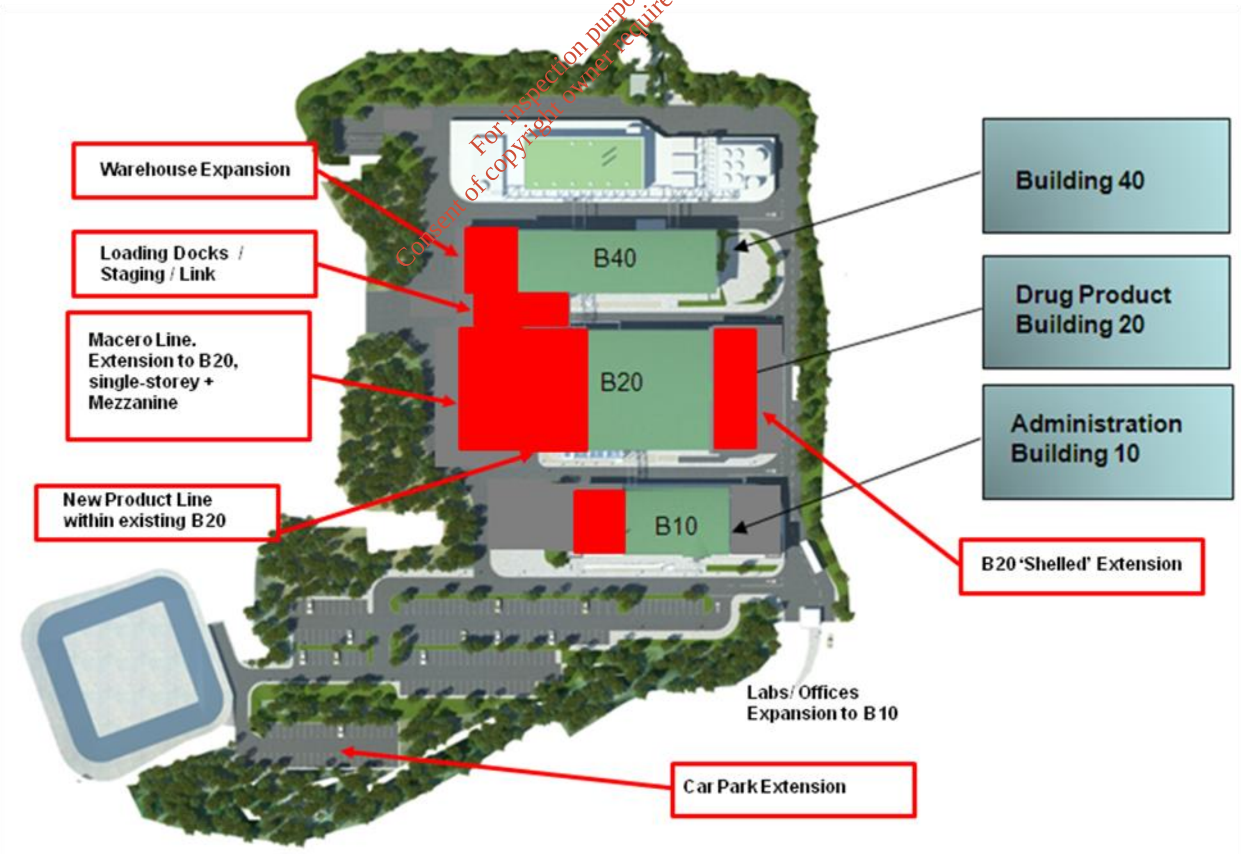


Figure 2.2 Schematic Drawing of Principal Proposed Alterations and Expansions

2.1.3 Emissions

Emissions to air and water from the Abbott facility are controlled by the implementation of an Integrated Pollution Prevention Control (IPPC) Licence (P0643-02). The following sections outline how these emissions are controlled to ensure that they do not impact significantly on the environment. Any changes to the licensed Emission Limit Values in the future will only occur following a review of the IPPCL.

2.1.3.1 Air

There are a total of 7 emission points to atmosphere at the Abbott facility;

- A1-1 and A1-2 from the boilers
- A2-1 (a) Thermal oxidiser
- A2-1 (b) Cryogenic Condenser
- A2-2 Scrubber
- A2-3 and A2-4 from the Dust Extraction System

There are four main emissions to atmosphere associated with the facility- Oxides of Sulphur (SO_X), Nitrogen Oxide (NO_X), Carbon Monoxide (CO) and Total Organic Carbon (TOC). Monitoring of emissions to air is carried out at the emission points above in accordance with the parameters, frequency and methods outlined in the IPPC Licence P0643-02. Ambient air is monitored on an on-going basis to ensure compliance with regulatory ambient air quality standards designed to protect human health and vegetation.

2.1.3.2 Groundwater

There are no emissions to ground from the installation. A condition of the IPPCL requires that groundwater monitoring of four boreholes bi-annually is carried out. The groundwater monitoring includes analysis for the organic solvents used on-site. Bulk storage tanks and one waste solvent tank are located in an existing bunded tank farm area and the bunding structures are regularly tested as per the IPPCL. The groundwater monitoring results outlined in the 2010 Annual Environmental report show elevated concentrations of electrical conductivity, ammonia, chloride and orthophosphate and concludes that these may all be related to agricultural activities upgradient of the site (e.g. fertilizer application, landspreading).

2.1.3.3 Water

All foul and trade emissions are discharged to the existing foul sewerage system and treated at the Sligo WWTP, which ultimately discharges under licence from the EPA, into the Garavoge Estuary (Cummeen Strand SPA and Cummeen Strand / Drumcliff Bay (Sligo Bay) cSAC). The EPA in their 'Inspectors report for the Application for a Waste Water Discharge Licence for Sligo Reg. No. DO01 4-01, 2009 concluded that the licensed WWTP '*will provide a high level of protection to the designated sites, as it will ensure that all discharges from the agglomeration will be provided with an appropriate level of treatment. By ensuring that all waste water is treated to a high standard the plant will act to improve the quality of the receiving water environment*".

Conditions are included in the IPPCL that require ongoing assessment of new pharmaceutical actives and periodic treatability trials on effluent are carried out in order to assess the impact of the undiluted process effluent on the receiving environment and Sligo wastewater treatment plant using toxicity testing and respirometry testing carried. This will ensure that any new aqueous waste streams produced on site will be tested prior to discharge to the foul sewer.

The surface water collection system collects surface and stormwater runoff from roofs, internal roads, car park and concrete hardstand paved areas. There is a firewater retention pond on site. Regard was had to draft EPA guidance on firewater retention facilities, when sizing the pond (capacity of 3316m3). Surface water flows through the pond via a monitoring chamber to the stream. TOC and pH is monitored continuously. In the event of a fire or a spillage to surface water, the site surface water shall be automatically diverted to the containment pond. An attenuation rate of 54l/sec is a planning requirement. In addition, silt traps and oil separators have been installed to ensure that all storm water discharges from the installation pass through a silt trap and oil separator prior to discharge. Surface water from the retention pond is discharged to the stream that runs along the western boundary of the site.

2.2 DESCRIPTION OF THE NATURA 2000 SITES

This section of the screening process describes the Natura 2000 sites within a 15km zone of impact of the proposed development site. A distance of 15km is currently recommended in the DoE document *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* and as a precautionary measure, to ensure that all potentially affected Natura 2000 sites are included in the screening process.

A map indicating the locations of the sites is given in Figure 2.3. Natura 2000 sites within 15km of the proposed development site are outlined in Table 2.1.

Table 2.1 Natura 2000 Sites within 15km of the proposed development site

Site Code	Approximate distance from development site	Site Name	Qualifying Feature
000623	6 km	Ben Bulben, Gleniff and Glenade Complex cSAC	*Vertigo geyeri* [1013] Otter (*Lutra lutra*) [1355] Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation [3260] European dry heaths [4030] Alpine and Boreal heaths [4060] *Juniperus communis* formations on heaths or calcareous grasslands [5130] Petrifying springs with tufa formation (*Cratoneurion*) [7220] Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) [8120] Calcareous rocky slopes with chasmophytic vegetation [8210]
001919	15 km	Glenade Lough cSAC	White-clawed crayfish (*Austropotamobius pallipes*) [1092] Slender naiad (*Najas flexilis*) [1833] Natural euthrophic lakes with Magnopotamion or Hydrocharition-type vegetation [3150]

Site Code	Approximate distance from development site	Site Name	Qualifying Feature
001976	1 km	Lough Gill cSAC	White-clawed crayfish (*Austropotamobius pallipes*) [1092] Sea lamprey (*Petromyzon marinus*) [1095] Brook lamprey (*Lampetra planeri*) [1096] River lamprey (*Lampetra fluviatilis*) [1099] Salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355] Natural euthrophic lakes with Magnopotamion or Hydrocharition-type vegetation [3150] Old sessile oak woods with *Ilex* and *Blechnum* in British Isles [91A0] Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (Alno-Padion, *Alnion incanae, Salicion albae*) [91E0]
001680	14km	Streedagh Point Dunes cSAC	*Vertigo angustior* [1014] Mudflats and sandflats not covered by seawater at low tide [1140] Perennial vegetation of stony banks [1220] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]
000627	1.5km	Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC	*Vertigo angustior* [1014] Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Common seal (*Phoca vitulina*) [1365] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] *Juniperus communis* formations on heaths or calcareous grasslands [5130] Petrifying springs with tufa formation (*Cratoneurion*) [7220]
001898	15km	Unshin River cSAC	Salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, *Alnion incanae, Salicion albae*) [91E0]
000638	7km	Union Wood cSAC	Old sessile oak woods with *Ilex* and *Blechnum* in British Isles [91A0]
004187	6km	Sligo/Leitrim Uplands SPA	Peregrine (*Falco peregrinus*) [A103] Chough (*Pyrrhocorax pyrrhocorax*) [A346]
004013	10km	Drumcliff Bay SPA	Whooper Swan (*Cygnus cygnus)* A038 Barnacle goose (*Branta leucopsis)* A045 Bar-tailed Godwit (*Limosa lapponica*) A157
004234	8km	Ballintemple and Ballygilgan SPA	Information not avalable
004035	1.5km	Cumeen Strand SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130]

Site Code	Approximate distance from development site	Site Name	Qualifying Feature
			Redshank (*Tringa totanus*) [A162] Wetlands & Waterbirds [A999]
004129	8km	Ballysadare Bay SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Grey Plover (*Pluvialis squatarola*) [A141] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Wetlands & Waterbirds [A999]

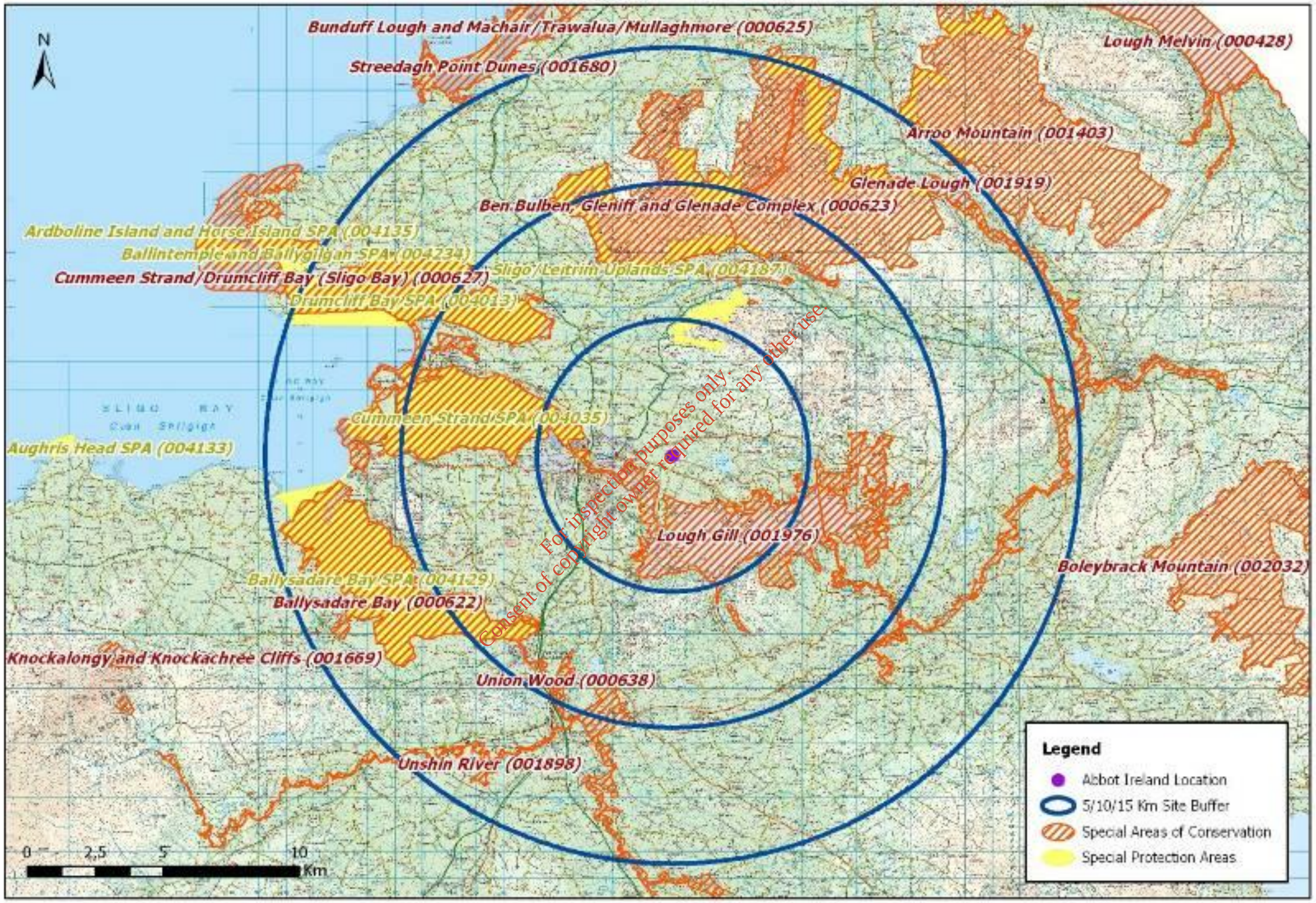


Figure 2.3 Natura 2000 sites within 15km of the proposed development site

2.3 DESCRIPTION OF THE SITE

2.3.1 General

The Abbott Ireland property is located at the northern edge of Sligo town and approximately 1.5 km from the coastline at Sligo Harbour and its associated designated sites (Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC and Cumeen Strand SPA. It is situated at the divide between the developed urban land to the south and south-west and agricultural land, predominantly pasture, to the east, north and north-west. A stream runs east to west across the southern boundary of the property. This stream is nominally a tributary of the Doonally River. After about 1 km of culverting the stream joins the Doonally river just before Rosses Point Road (R291) at the confluence with the Garavogue estuary. A location map is provided in Figure 2.4.

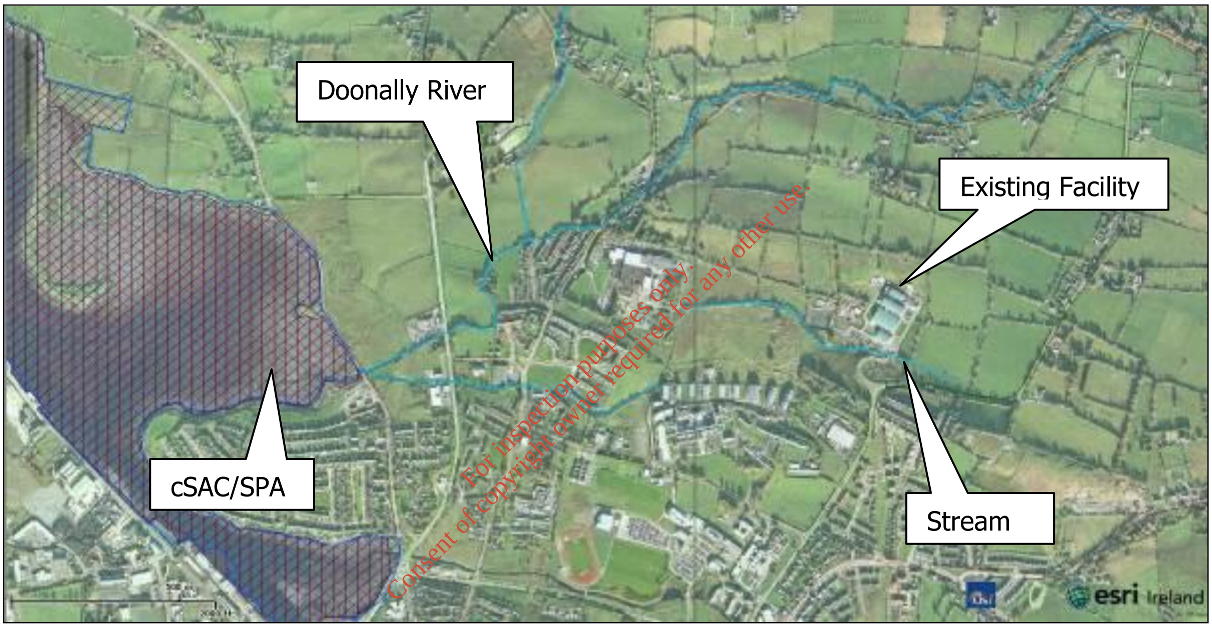


Figure 2.4 Location map **(**Source: NPWS 2012)

2.3.2 Methodology

2.3.2.1 Desk Study

A desk study was carried out to collect any available information on the local ecological environment.

The following resources assisted in the production of this report:

- Ordnance Survey Ireland maps
- Aerial photography
- Data on species that are rare, protected or threatened located within the vicinity (up to 10km) of the proposed alignment, as held by the National Park and Wildlife Service (NPWS) Database.

- Environmental Impact Statement for proposed Abbott Ireland Pharmaceutical Manufacturing Plant, Sligo, Ireland,2001
- Abbott Ireland Pharmaceutical Operations Annual Environmental Report, 2010
- Summary report on application for IPC licence from Abbott Ireland, Pharmaceutical Operations, Manorhamilton Road, County Sligo, Reg. No. 643. EPA, 2002

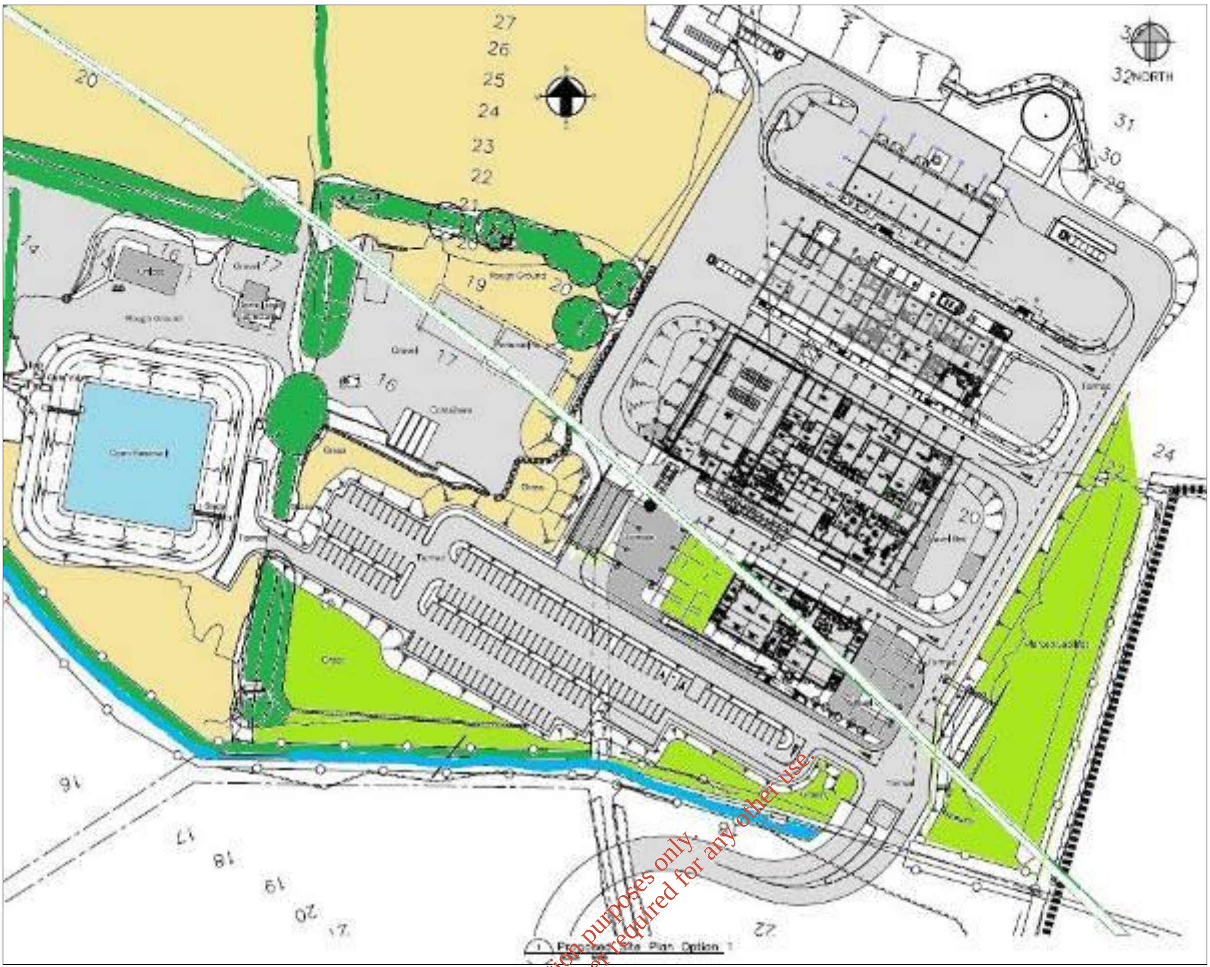
2.3.2.2 Field surveys

A field survey was carried out in January 2012 to identify, describe and evaluate habitats in the study area. The survey methodology used was based on the Phase 1 Habitat survey methodology, contained in the Joint Nature Conservation Committee (JNCC) Handbook for Phase 1 habitat survey – a technique for environmental audit. Habitats were classified using habitat descriptions and codes published in '*A Guide to Habitats in Ireland'* (Fossitt, 2000).

A freshwater biological assessment was carried out by AQUAFACT in September 2011. A full copy of this report is provided in Appendix A.

2.3.3 Proposed Development Site

The proposed development consists of alterations and extensions to the existing Abbott facility. The habitats that will be principally affected include Amenity grassland (GA2) and Buildings and artificial surfaces (BL3). The proposed new carpark will see the removal of a section of amenity grassland and discontinuous hedgerow (description provided in Section 2.3.5). A habitat map of the development site is provided in Figure 2.5.



Hedgerow and riparian habitat

Amenity Grassland

Stream

Agricultural Grassland

Built Land

Figure 2.5 Habitat Map

The amenity grassland comprises a well managed lawn adjacent to the western side of the facility. This grassland area is dominated by Perennial Rye Grass *Lolium perenne* and Creeping Buttercup *Ranunculus repens*, with White Clover *Trifolium repens* and Daisy *Bellis perennis* occasionally found (Figure 2.7). The artificial surfaces adjacent to the facility consist of areas of gravel and tarmac road surfaces (Figure 2.6 and 2.8).

Figure 2.6 Location of proposed extensions – east of existing facility

Figure 2.7 Amenity grassland – west of existing facility

Figure 2.8 Location of proposed extensions – east of existing facility

2.3.4 Lands Surrounding the Proposed Development Site

The principal natural habitat types identified within the boundaries of the Abbott lands included improved grassland, hedgerows and a stream. The Doonally River skirts the northern property boundary. None of the habitats noted were of particularly high value and are of local value only.

In addition there are buildings and artificial surfaces including the existing facility, associated access roads and carparks and a construction compound. A fire water retention pond is located to the south west of the facility.

2.3.4.1 Improved agricultural grassland GA1

Undeveloped land to the west of the facility consists of fields of improved pasture, separated from the buildings by an access road and a hedge of *Griselinia*. Perennial Ryegrass *Lolium perenne* is frequent to common in these fields with Common Bent *Agrostis capillaris,* Yorkshire Fog *Holcus lanatus,* Crested Dog's-tail *Cynosurus cristatus,* Annual Meadow Grass *Poa annua* and Red Fescue *Festuca rubra* as companion species. White Clover *Trifolium repens* is generally distributed throughout but locally abundant in some places. Creeping Buttercup *Ranunculus repens* is very common in the poorer swards and typical agricultural weeds such as Ragwort *Senecio jacobaea* and Spear Thistle *Cirsium vulgare* are scattered. Common Rush *Juncus effusus* occurs sparsely.

Figure 2.9 Grassland to the west of the facility

2.3.5 Hedgerows

Hedgerows of varying quality are present within the property, many of which are characterised by having a high proportion of tall trees. The hedgerows usually comprise an earthen embankment on which the trees grow and in some cases an accompanying ditch (mostly shallow and dry). Ash *Fraxinus excelsior* is the principal tree species present within the hedgerows. The main small tree or shrub species is hawthorn *Crataegus monogyna*, followed by blackthorn *Prunus spinosa*, holly *Ilex aquifolium* and occasional elder *Sambucus nigra*.

The ground layers of the hedgerows are dominated by brambles (Rubus spp.). Ivy (*Hedera helix*) is common and some wild rose (*Rosa* sp.) and honeysuckle (*Lonicera periclymenum*) occur. Owing to the time of year there was a low diversity of herbaceous species within the hedges - those recorded include hogweed (*Heracleum sphondylium)*, stitchwort (*Stellaria holostea*), goosegrass (*Galium aparine*) and nettle (*Urtica dioica*). The ferns *Phyllitis scolopendrium* and *Dryopteris filix-mas* occurred in the shaded areas. Those hedgerows dominated by trees often have sparse growth in the lower layers owing to shading by the tall trees.

2.3.6 Stream (FW2) Artificial Pond (FL8)

A stream runs east to west across the southern part of the property. This stream is nominally a tributary of the Doonally River. After about 1 km of culverting the stream joins the Doonally river just before Rosses Point Road (R291) at the confluence with the Garavogue estuary. The current water quality of the Doonally river is Q4 while the Transitional Waterbody Status (Water Framework Directive Status) of the Garavogue estuary is 'Good' according to current EPA data. The Doonally river has not been designated a Salmonid river under the EC (Quality of Salmonid Waters) Regulations of 1998 (S.I. No. 293, 1998). It is not listed as a major fishery in O'Reilly P, 1991 '*Trout and Salmon Rivers of Ireland*'.

The stream is very well sheltered by over hanging trees and species noted include willow (*Salix* sp.), hawthorn (*Crategus monogyna*), ash (*Fraxinus excelsior*), alder (*Alnus*), sycamore (*Acer pseudoplantanus*), cotoneaster and elder (*Sambucus niger*). Ivy (*Hedera helix*) was present on many of the trees and also as part of the understory flora which also included horsetail (*Equisetum*), bramble (*Rubus*), ferns (*Pteridium* and *Blechnum*), meadow sweet (*Filipendula*), iris (*Iris pseudacorus*), geranium (*Geranium versicolor*), dandelion (*Taraxacrum*), thistle (*Carduus*), oxeye daisy (*Chrysathemum leucathemum*), buttercup (*Ranunculus*) and bindweed (*Convolvulus*). Water cress (*Rorippa*) was present in the stream.

An artificial pond which serves as a fire water retention pond is located to the south west of the facility.

Figure 2.10 Fire water retention pond

2.3.7 Biological Water Quality

A biological water assessment was carried out on the stream located to the south of the existing facility in 2011. Two sites were sampled in the stream one close to the entrance gate and the second ca. 100m downstream of this. The stream substrate was sandy with some stones, sand and some moss-covered bed rock. Sediment in the stream bed was not hypoxic. No sewage fungus or filamentous algae was observed. Water colour was clear. The stream was ca. 60 cms wide, 20 cms deep and was flowing at a rate of ca. 30 cms sec.

A Hydrolab® MS5 water quality sonde was used to measure various parameters in the stream. Water clarity was variable clear to slight. Water temperature was 13.5°C. Additional measured stream parameters are presented in Table 2.2.

Water samples were collected at each of the two locations and were analysed for a suit of parameters (Table 2.3).

Table 2.2 Measured water parameters

Parameter	Unit	Measurement
Temperature	°C	13.5
Dissolved oxygen	mg/l	9.32
Dissolved oxygen	%	87.8
Wet width	cm	60
Average depth	cm	20

Table 2.3 Results of analyses on water samples

	Upstream	Downstream
Alkalinity	360mg/l $CaCO_3$	336mg/l$CaCO_3$
Hardness	391 mg/$CaCO_3$	381 mg/$CaCO_3$
Ammonia	0.036 mg/l	0.034 mg/l
Nitrate	<0.44 mg/l	4.43 mg/l
Nitrite	0.017 mg/l	0.063 mg/l
Total N	6.02 mg/l	1.58 mg/l
Phosphorous	0.041 mg/l	0.027 mg/l

The sites were sampled for invertebrate macrofauna using a kick sample method and analysed to determine the Q-value of the stream. Invertebrates identified in the samples are presented in Table 2.4. The majority of taxa belonged to Group C – the tolerant forms, three from group B (though in low numbers) two from Groups D and E. A Q-Value of Q3* was assigned. The Q3 rating denotes moderately polluted water (Class C). The additional qualifying criterion of excessive macrophyte growths does not apply to this site.

Table 2.4 Animals and their numbers present in samples taken in the stream at Abbott, Sligo

Upstream	Downstream
Simulidae 13	Simulidae 8
Chironomidae 21	Chironomidae 3
Gammarus sp. ± 200	*Gammarus* sp ± 200
Asellus sp 3	Caseless caddis 2
Hirudinae 4	Hirudinae 12
Turbellaria 7	Tubellaria 16
Lumbriculidae 8	Helmidae 4
Cased caddis 17	Ceratopogonidae 1
Caseless caddis 24	*Dicranota* sp 1
Helmidae 14	Oligichaeta *ca*. 100
Sericostomatidae 4	Goeridae 1
Coeleoptera 3	*Isoperla* 3
Dicranota sp 1	
Diptera 1	

2.3.7.1 Biological Assessment

The results of the macrofaunal analyses indicate poor water quality even though some sensitive forms were collected. However, given the high transparency, high dissolved oxygen and over all healthy appearance of the stream, a Q-index of Q3 was established for the stream. This value falls into Class C water category. Class C freshwater bodies are those which are moderately polluted, of doubtful water quality and of unsatisfactory condition. The source of impact on the stream probably stems from non-point source pollution such as agriculture. This same conclusion was arrived at for slightly elevated levels of nutrients in borehole data within the site.

2.4 DIRECT, INDIRECT OR SECONDARY IMPACTS

As part of this screening those features of the proposed development that have the potential to impact on features and conservation objectives of the Natura sites were assessed. European Commission Environment DG document *"Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC"* outlines the types of impacts that may affect Natura 2000 sites. These include impacts from the following activities:

- Land take
- Resource Requirements (Drinking Water Abstraction Etc.)
- Emissions (Disposal to Land, Water or Air)
- Excavation Requirements
- Transportation Requirements
- Duration of Construction, Operation, Decommissioning

In addition, the Guidance document outlines the following likely changes that may occur at a designated site, which may result in impacts on the integrity and function of that site:

- Reduction of Habitat Area
- Disturbance to Key Species
- Habitat or Species Fragmentation
- Reduction in Species Density
- Changes in Key Indicators of Conservation Value (Water Quality Etc.)
- Climate Change

The following sections discuss the likelihood of these impacts occurring.

2.4.1 Land take

The proposed development will not result in the loss of land from any designated site. Habitat loss will be confined to loss of low value habitats. The habitats that will be affected include Amenity grassland (GA2) and Buildings and artificial surfaces (BL3).

2.4.2 Resource Requirements (Drinking Water Abstraction Etc.)

Abstraction for water or other natural resources is not part of this proposed development. The proposed development will not have a significant impact on the Natura 2000 network in this respect.

2.4.3 Emissions (Disposal to Land, Water or Air)

No direct emissions to water will take place. All wastewater and trade effluent will be discharged to the municipal sewer. During construction, emissions of suspended solids, fuels and waste concrete to surface waters are possible. A range of measures will be put in place in order to prevent emissions generated during construction from entering local water courses.

2.4.4 Excavation Requirements

There will be some limited excavation required as part of the proposed works during construction. No excavation works will take place within or adjacent to any Natura 2000 site. Once all pollution prevention guidelines are adhered to, the proposed development will not have a significant impact on any Natura 2000 site.

2.4.5 Transportation Requirements

All construction works pertaining to the proposed development will take place within the boundary of the proposed development site. Transportation requirements both during the construction and operational phases will not have a significant impact on any Natura 2000 site.

2.4.6 Duration of Construction, Operation, Decommissioning

Construction works will take place over a number of months, while the facility will be in operation indefinitely. Considering the distance between the development site and the nearest designated sites (Cumeen Strand SPA/ Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC (1.5 km to the west) and Lough Gill cSAC (1 km to the south) and the built up nature of the intervening land, it is not likely that the duration of the construction or operation phases will impact significantly on the Natura 2000 network

2.4.7 Reduction of Habitat Area

The proposed development will not result in the loss or reduction of any habitats for which any site is designated. Habitat loss will be confined to the loss of low value habitats within the development site. No habitats will be lost within any designated site.

2.4.8 Disturbance to Key Species

The designated sites closest to the development site include Cumeen Strand SPA/ Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC (1.5 km to the west) and Lough Gill cSAC (1 km to the south). The proposed development will not result in the disturbance of any species for which these sites are designated, given the distance and the nature of the intervening lands.

2.4.9 Habitat or Species Fragmentation

Habitat and species fragmentation can occur through the breaking up of habitats resulting in interference with existing ecological units or when construction introduces a barrier to the free movement of species from one habitat to another, such as the construction of roads and bridges or the installation of overhead electricity supply lines. Such developments can often cause indirect impacts on designated sites. No element of the project will result in fragmentation of habitats or populations of species for which any Natura site is designated.

2.4.10 Reduction in Species Density

No element of the project will result in reduction in density of species for which any Natura site is designated.

2.4.11 Changes in Key Indicators of Conservation Value (Water Quality Etc.)

During the operational phase, there will be no direct discharge of effluent to local watercourses. All foul and trade effluent is discharged to the municipal sewerage system. The potential for accidental spillages is controlled at the facility through the implementation of an Environmental Management system and IPPCL. In the event of a fire or contamination of surfacewater, site surfacewater can be diverted to the containment pond on-site. Surfacewater from the site is discharged via a firewater retention pond to the on-site stream via a monitoring chamber.

During construction emissions of suspended solids, fuels, lubricants and waste concrete to surface water are possible. A range of measures will be put in place in order to prevent emissions generated during construction from entering the stream bordering the south of the property and subsequently the Garavogue Estuary.

2.4.12 Climate Change

The proposed development will not incorporate any elements that will contribute to climate change.

2.5 OTHER PLANS AND PROJECTS

Article 6(3) of the Habitats Directive requires an assessment of a plan or project to consider other plans or projects that might, in combination with the plan or project, have the potential to adversely impact upon Natura 2000 sites.

The potential for impacts from plans is examined in Table 2.5. It is unlikely that the proposed development at the Abbott facility will lead to an significant in combination effect with these plans, given the nature of the development, the localised and temporary nature of the construction impacts and the ongoing environmental controls in place at the facility.

Table 2.5 Plans & Projects Likely to Cause In-Combination Effects

International		
Directive	**Purpose**	**Potential Impacts**
EU Water Framework Directive (2000/60/EC)	Objectives seek to maintain and enhance the quality of all surface waters in the EU.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
EU Freshwater Fish Directive (78/659/EEC)	Objectives seek to protect those fresh water bodies identified by Member States as waters suitable for sustaining fish populations. For those waters it sets physical and chemical water quality objectives for salmonid waters and cyprinid waters.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
EU Groundwater Directive (2006/118/EC)	This directive establishes a regime, which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
EU Floods Directive (2007/60/EC)	The Floods Directive applies to river basins and coastal areas at risk of flooding. With trends such as climate change and increased domestic and economic development in flood risk zones, this poses a threat of flooding in coastal and river basin areas.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
Nitrates Directive (91/676/EEC)	This Directive has the objective of reducing water pollution caused or induced by nitrates from agricultural sources and preventing further pollution.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
The Urban Wastewater Treatment Directive (91/271/EEC)	The primary objective is to protect the environment from the adverse effects of discharges of urban wastewater, by the provision of urban wastewater collecting systems (sewerage) and treatment plants for urban centres. The Directive also provides general rules for the sustainable disposal of sludge arising from wastewater treatment.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
Sewage Sludge Directive (86/278/EEC)	Objective is to encourage the appropriate use of sewage sludge in agriculture and to regulate its use in such a way as to prevent harmful effects on soil, vegetation, animals and man. To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
The Integrated Pollution Prevention Control Directive (96/61/EC)	Objective is to achieve a high level of protection of the environment through measures to prevent or, where that is not practicable, to reduce emissions to air, water and land from industrial sources.	No risk of likely significant in-combination effects will result as the primary purpose of the Directive is to improve environmental quality.
National Plan	**Purpose**	**Potential Impacts**
National Development Plan 2007-2013	Objectives of the NDP are to promote more balanced spatial and economic development.	Potential impacts may arise where there is a requirement to provide for new infrastructure.
National Spatial Strategy 2002-2020	Objectives of the NSS are to achieve a better balance of social, economic and physical development across Ireland, supported by more effective planning.	Potential impacts may arise where there is a requirement to provide for new infrastructure.
Regional	**Purpose**	**Potential Impacts**
Border Regional Planning Guidelines 2010 (RPGs)	Policy document which aims to direct the future growth of the Mid West Region over the medium to long term and works to implement the strategic planning framework set out in the National Spatial Strategy (NSS)	Potential impacts may arise where there is a requirement to provide for new infrastructure.

Local		
Sligo County Development Plan 2011 – 2017 Sligo and Environs Development Plan 2010-2016	Overall strategy for the proper planning and sustainable development of the administrative area of the relevant Local Authority.	Potential impacts may arise where there is a requirement to provide for new infrastructure.

A search of the planning applications on Sligo County Council's website was also completed. The area considered included the townlands of Ballytivnan, where the Abbott facility is located and Shannon Eighter, the townland through which the on-site stream flows through before reaching the Garavogue Estuary.

A review of the applications over the past three years found that the proposed developments within these townlands are small scale projects which will not result in any trade effluent discharges or significant impacts on the Natura 2000 network. Therefore, they will not contribute to significant in-combination impacts in conjunction with the proposed development

Table 2.6 Planning Applications in Ballytivnan townland

Planning Ref.	Decision	Location	Development
1123	Application Finalised	Ballincar Td Sligo	(1) construct one detached two storey dwelling house,(2) construct two detached two storey dwelling s...
1019	Application Finalised	Bundoran Road, Shannon Eighter Sligo	(a) Change of use of existing car wash structure to restaurant with drive-thru takeaway facility (228m2) (b) Additional floor area provided at first floor level for storage and staff facilities (total floor area of overall development 302m2)
1042	Further Information	Shannon Eighter Bundoran Road Sligo	for a 24 metre multi-user monopole to carry 9 no. antennae and 4 no. link dishes together with associated equipment cabinets and fencing to form part of their 3G Broadband telecommunications network
11384	New Application	Shannon Eighter Sligo	construction of a septic tank and percolation area to serve existing dwelling

Table 2.7 Planning Applications in Ballytivnan townland

Planning Ref.	Decision	Location	Development
1181	New Application	St. John's Hospital Ballytivnan Sligo	development consisting of a new garden room (150m2 gross floor area) including a kitchen area, WC facilites, landscaping and associated works at St John's Community Hospital
1025	Application Finalised	Abbott Ireland Ballytivnan Sligo.	Demolition of 5 No. dilapidated farm buildings on agricultural lands at Ballytivnan, Sligo
1120	Application Finalised	Holy Family Care Centre Clarion Road Ballytivnan Sligo	construction of a single storey extension of 109m2, provision of 2 no new window openings to existing room on North Elevation and all associated site development works
1017	Application Finalised	Abbott Ireland Ballytivnan Sligo.	extension of the existing Administration and Laboratory Building,
1161	Application Finalised	Health Service Executive St Johns Hospital Ballytivnan Sligo	1) change of use from residential accommodation to office accommodation and (2) to demolish four brick chimneys and a 30.0 sqm single storey toilet block on the east elevation plus ancillary site works at the Old Convent Building
1128	Application Finalised	St. Joseph's Church Ballytivnan Sligo	construction of a new outbuilding to be used as an oil tank enclosure
107	Application Finalised	St.Joseph's Church Ballytivnan Sligo	construct a new Parish Centre consisting of an oratory, office and ancillary accommodation.
11411	New Application	Abbott Ireland Ballytivnan Sligo Co Sligo	construction of a single storey link approximately 301m2 in area (height 9.8 metres) with associated roof equipment located between the tableting building and the manufacturing building and minor elevational changes to the tableting building including an external lobby to the west approximately 7.4m2 in area (height 3.75 metres).
10126	Application Finalised	Manorhamilton Road Ballytivnan Sligo	extension of the existing Administration and Laboratory Building, Building 10.

2.6 ELEMENTS OF THE PROJECT WHERE THE IMPACTS ARE LIKELY TO BE SIGNIFICANT

As outlined in **Section 2.4**, no direct impacts will arise from the proposed development. During construction, accidental of suspended solids, fuels, lubricants and waste concrete to surface water are possible. These discharges have the potential to impact on the small stream that runs along the southern boundary of the Abbott property. This stream eventually enters the Garavogue Estuary which is part of the Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC and Cumeen Strand SPA.

Any impact from construction at the Abbott facility will be localised and of a temporary nature and is not likely to have a significant impact on the integrity or the conservation objectives any designated site. All emissions from the site during both construction and operational phases are strictly controlled by the existing Environmental management System and the IPPCL.

During the construction phase, all works will be subject to the existing Abbott Environmental Management System. A variety of best available techniques are applied to ensure a high standard of environmental protection is provided during the operational lifetime of the facility. The measures focus on preventing residuals from initially being generated and having control measures in place for any accidental emissions. Compliance with the measures and requirements is ensured through regular auditing by the Abbott Environmental Department.

All contractors have to complete Environmental, Health and Safety Induction on arrival to site. This training includes training in emergency procedures for spills. Spill kits are kept onsite to deal will spills.

Best practice will be implemented at all times in relation to any activities that may impact on surface water (stream and river) or riparian habitats. Comprehensive surface water management measures will be implemented at the construction and operational stage to prevent any pollution of local surface waters. Temporary site drainage and silt control during construction will incorporate wheel washes, temporary siltation ponds, ditches and filter drains. Precautions will be taken to ensure there is no entry of solids, during the connection of pipe-work, to the existing surface water system. Only clean, uncontaminated surface waters must be permitted to discharge to the surface water network in the area so that the ecological integrity of surface waters is protected. During construction and operation, all surface water will be discharged to the fire water retention pond. Discharges from the retention pond are continuously monitored for pH and TOC in accordance with the Abbott IPPCL. In the event of a fire, the outlet valve closes if the fire alarm activates, ensuring that excess surface water is retained in the pond .

The disturbance of riparian habitats will be avoided. An undisturbed buffer zone between the development area and river bank will be retained (10m minimum). Riparian vegetation will be retained in as natural a state as possible at all times.

The guidelines document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites www.fishingireland.net/environment/constructionanddevelopment.htm will be consulted when planning to undertake works on this site.

During the operational phase, a comprehensive environmental management system operates to ensure staff onsite are suitably trained and know how to both prevent releases from occurring and what to do in the event of a release. This includes defined procedures to ensure that chemicals are handled and stored correctly. By applying best available techniques and operating a comprehensive environmental management system in order to prevent chemical releases to the environment, potential residuals associated with water and land in particular are also minimised.

2.7 CONCLUSIONS OF STAGE 1

The likely impacts that will arise from the implementation of the proposed development have been examined in the context of a number of factors that could potentially affect the integrity of the Natura 2000 network. On the basis of the findings of this Screening for Appropriate Assessment, it is concluded that the proposed development:

(i) is not directly connected with or necessary to the management of a Natura 2000 site; and

(ii) will not have any significant impacts on the Natura 2000 network of sites

Therefore a Stage 2 Appropriate Assessment is not required.

3 FINDING OF NO SIGNIFICANT IMPACTS MATRIX

Name of project or plan	Abbott Pharmaceutical Facility, Sligo
Name and location of Natura 2000 sites	Ben Bulben, Gleniff and Glenade Complex cSAC Glenade Lough cSAC Lough Gill cSAC Streedagh Point Dunes cSAC Cummeen Strand/Drumcliff Bay (Sligo Bay) cSAC Unshin River cSAC Union Wood cSAC Sligo/Leitrim Uplands SPA Drumcliff Bay SPA Ballintemple and Ballygilgan SPA Cumeen Strand SPA Ballysadare Bay SPA
Description of the project or plan	Expansion of the existing Abbott Pharmaceutical facility, Sligo. • The existing Admin. Building (Building 10) is to be expanded to the east for canteen facilities and offices and to the west for 2 storey laboratories. • The existing Tableting Building (20) is to be expanded for more tableting operations. • The existing Manufacturing Building (40) is to be expanded for integrated site warehouse operations. • A new Link structure which is currently in planning, Ref. No. 11/411. • Ancillary site works such as rerouting roads and car parking
Is the project or plan directly connected with or necessary to the management of the site (provide details)?	No
Are there other projects or plans that together with the project or plan being assessed could affect the site?	Other plans and projects have been examined. There will be no significant effects from the proposed development in combination with other permitted developments in the proposed development area
The Assessment of Significance of Effects	
Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.	The proposed development is not likely to affect any Natura 2000 site.
Explain why these effects are not considered significant.	The proposed development is not likely to affect any Natura 2000 site
List of agencies consulted.	The screening report will be forwarded to the Development Applications Unit of the Department Environment Community and Local Government
Data Collected to Carry Out the Assessment	
Who carried out the assessment?	Dr. Marian Coll, Environmental Impacts Services
Sources of data	NPWS Database and Site Synopses Environmental Impact Statement for proposed Abbott Ireland Pharmaceutical Manufacturing Plant, Sligo, Ireland,2001 Abbott Ireland Pharmaceutical Operations Annual Environmental Report, 2010

	Summary report on application for IPC licence from Abbott Ireland, Pharmaceutical Operations, Manorhamilton Road, County Sligo, Reg. No. 643. EPA, 2002
Level of assessment completed	Stage 1 AA screening
Where can the full results of the assessment be accessed and viewed?	Full results of the screening assessment are included in attached report
Overall Conclusion	Stage 1 Screening indicates that the proposed development will not have a significant negative impact on any Natura 2000 site. Therefore, a Stage 2 'Appropriate Assessment' under Article 6(3) of the Habitats Directive 92/43/EEC is not required.

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Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government, 2009.

Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, European Commission Environment DG, 2000.

Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC: European Commission, 2000

Appendix A

Assessment of a stream at Abbott, County Sligo

Produced by

AQUAFACT International Services Ltd

On behalf of

EIS
September 2011

AQUAFACT INTERNATIONAL SERVICES ltd

12 KILKERRIN park

TUAM rd

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Introduction

AQUAFACT was commissioned by EIS to carry out a freshwater biological assessment of a stream at the Abbott site, County Sligo (see Figure 1). The stream is defined by a discontinuous row of trees that runs from right to left directly below the car parking zone.

Figure 1: Aerial image of the Abbott facility, Co. Sligo.

Even though there are a number of pipe crossing from the Abbott facility over the stream, no liquid effluent from either the Abbott plant or the car park, is directed into this water course.

Methodology

Biological Assessment

Site description

Two sites were sampled in the stream one being close to the entrance gate (upstream, see Figure 2.) and the second *ca.* 100m downstream of this. Primary surrounding land use was managed lawns within the Abbott site and a wooded habitat on the opposite bank (see Figure 3).

Figure 2. Image of upstream site showing vegetation on the bank of the stream and in the stream.

Figure 3. Lawn and vegetation along course of stream, Abbott facility, September, 2011.

The stream substrate was sandy with some stones, sand and some moss-covered bed rock (see Figure 2). Sediment in the stream bed was not hypoxic. No sewage fungus or filamentous algae was observed. Water colour was clear. The stream was *ca.* 60 cms wide, 20 cms deep and was flowing at a rate of *ca*. 30 cms sec.

A Hydrolab® MS5 water quality sonde was used to measure various parameters in the stream. Water clarity was variable clear to slight. Water temperature was 13.5°C. Additional measured stream parameters are presented in Table 2.1 below.

Table 4.1: Measured water parameters, Abbott, Sligo, September 27th, 2011.

Parameter	Unit	Measurement
Temperature	°C	13.5
Dissolved oxygen	mg/l	9.32
Dissolved oxygen	%	87.8
Wet width	cm	60

Parameter	Unit	Measurement
Average depth	cm	20

Water samples were collected at each of the two locations and were analysed for a suit parameters and the results are presented in Table 2.2 below.

Table 4-2: Results of analyses on water samples, Abbott, Sligo, September 27th, 2011.

	Upstream	Downstream
Alkalinity	360mg/l $CaCO_3$	336mg/l$CaCO_3$
Hardness	391 mg/$CaCO_3$	381 mg/$CaCO_3$
Ammonia	0.036 mg/l	0.034 mg/l
Nitrate	<0.44 mg/l	4.43 mg/l
Nitrite	0.017 mg/l	0.063 mg/l
Total N	6.02 mg/l	1.58 mg/l
Phosphorous	0.041 mg/l	0.027 mg/l

The stream was very well sheltered by over handing trees and species noted include willow (*Salix* sp.), hawthorn *(Crategus monogyna),* ash (*Farxinus excelsior*), alder (*Alnus*), sycamore *(Acer pseudoplantanus*), cotoneaster and elder (*Sambucus niger*). Ivy (*Hedera helix*) was present on many of the trees and also as part of the understory flora which also included horsetail *(Equisetum),* bramble *(Rubus),* ferns *(Pteridium* and *Blechnum),* meadow sweet *(Filipendula),* iris (*Iris pseudacorus*), geranium (*Geranium versicolor*), dandelion (*Taraxacrum*), thistle (*Carduus*), oxeye daisy (*Chrysathemum leucathemum*), buttercup (*Ranunculus*) and bindweed (*Convolvulus*). Water cress (*Rorippa*) was present in the stream.

Kick sampling method

The sites were sampled for invertebrate macrofauna using a kick sample method. Weather on the day of the sampling was clear and sunny in a light wind. A standard pond net (500μm mesh size) was used to retrieve samples. Riffled sections were selected for sampling. The mouth of the net was positioned downstream and the substrate disturbed in order to dislodge animals clinging to the substrate. The sampling took place during a two minute (timed) period approximately half of which consisted of weed sweeps.

The sample was washed carefully into a large white plastic tray filled with stream water. The sample was retained in its entirety in a 10l bucket of stream water and returned to AQUAFACT for detailed examination and identification of invertebrate species. The sample included a substantial amount of aquatic plant material.

Seasonal and other relevant factors (i.e. drought, floods) must be taken into account when calculating Q-values. Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams or those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc. Single specimens may be ignored as they may have drifted from upstream. Q5 is generally only applied in absolutely pristine conditions with a diverse and balanced faunal community. Provided filamentous algae if present are not excessive (in the case of Q5), and that sewage 'fungus' and other slime moulds are absent (in the case of Q4), Q5 and Q4 may also be ascribed where faunal criteria are not met due to:

- Significant ground water input
- Very hard, calcareous conditions
- Very oligotrophic conditions
- Other relevant factors

EPA ecological quality rating (Biotic Index or Q- Value)

The invertebrate macrofaunal samples were returned to AQUAFACT and analysed in the laboratory by expert staff. Live animals were identified down to family/genus level where necessary with the aid of microscopes, dissection equipment and taxonomic keys (see Section 5 References).

In order to determine the biological quality of the river, the EPA ecological quality rating method was used whereby the analyst assigns a Biotic Index or Q-Value to each of the samples based on macroinvertebrate results. The Q-index is a quality measurement for freshwater bodies that ranges from Q1 – Q5 with Q1 being of the poorest quality and Q5 being pristine/unpolluted (see Table 2-2). For the purposes of the EPA assessment procedure benthic macroinvertebrates have been divided into five arbitrary 'Indicator Groups' as follows: Group A, the sensitive forms, Group B, the less sensitive forms, Group C, the tolerant forms, Group D, the very tolerant forms and Group E, the most tolerant forms. Q-value assessment criteria are presented in Appendix 1.

Table 4.2: Q Value Index.

'Q'	Value	Macroinvertebrate Diversity	Condition	Quality Status	Quality Class
Q5	High	Good	Satisfactory	Unpolluted	**A**
Q4	Reduced	Fair	Satisfactory	Unpolluted	**A**
Q3	Low	Doubtful	Unsatisfactory	Slightly polluted	**B**
Q2	Very low	Poor	Unsatisfactory	Moderately polluted	**C**
Q1	Little/None	Bad	Unsatisfactory	Seriously polluted	D

Results

Biological Assessment

Animals identified in the samples are presented in Table 3-1 below. Note that not all of these animals influence the calculation of the Q-value for the site. The majority of taxa belonged to Group C – the tolerant forms, three from group B (though in low numbers) two from Groups D and E. A Q-Value of Q3* was assigned. The Q3 rating denotes moderately polluted water (Class C). The additional qualifying criterion of excessive macrophyte growths does not apply to this site.

Upstream	**Downstream**
Simulidae 13	Simulidae 8

Chironomidae 21	Chironomidae 3
Gammarus sp. + 200	*Gammarus* sp + 200
Asellus sp 3	Caseless caddis 2
Hirudinae 4	Hirudinae 12
Turbellaria 7	Tubellaria 16
Lumbriculidae 8	Helmidae 4
Cased caddis 17	Ceratopogonidae 1
Caseless caddis 24	*Dicranota* sp 1
Helmidae 14	Oligichaeta *ca*. 100
Sericostomatidae 4	Goeridae 1
Coeleoptera 3	*Isoperla* 3
Dicranota sp 1	
Diptera 1	

Table 4.3: Animals and their numbers present in samples taken in the stream at Abbott, Sligo.

Birds noted on the day included magpie, wood pigeon, rook, robin, wren, blue tit and blackbird. A single tortoise shell butterfly was seen.

Discussion

Biological Assessment

The results of the macrofaunal analyses shown in Table 3.1 indicate poor water quality even though some sensitive forms were collected. However, given the high transparency, high dissolved oxygen and over all healthy appearance of the stream, a Q-index of Q3 was established for the stream. This value falls into Class C water category. Class C freshwater bodies are those which are moderately polluted, of doubtful water quality and of unsatisfactory condition. The source of impact on the stream probably stems from non-point source pollution such as agriculture. This same conclusion was arrived at for slightly elevated levels of nutrients in borehole data within the site.

Species diversity tends to be quite low during this time of year with many animals in the system having metamorphosed into their adult forms. The EPA Q-value methodology is specifically designed for use at this time (summer-autumn) when conditions in the watercourse are at their most stressful for the animal community living there (highest temperatures, lowest dissolved oxygen levels). Identification of animals is complicated somewhat by the small size of instars present for many species at this time of year.

The main defining species for this site in order of decreasing numbers of specimens in the sample were:

- Gammarids (sand hoppers) – hundreds present in the samples
- Oligochates – up to 100 in one sample.
- Caddis flies – over 50 present in the samples
- Simulidae – 13 in one of the samples

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Appendix 1

EPA Q-Value

Assessment Criteria

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure. See overleaf for details of the Faunal Groups.						
Macroinvertebrate Faunal Groups**	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous *Baetis rhodani* often Abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few or Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few / Absent to Common	Dominant
Additional Qualifying Criteria						
***Cladophora* spp.** Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growths	Absent to Abundant	Present/Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from < 80% to >120%	Very unstable. Potential fish-kills	Low (but > 20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic

Note occurrence/abundance of groups in above table refers to <u>some</u> but not necessarily <u>all</u> of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account.

* Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.

** See Further Observations overleaf.

Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except *Leuctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera danica*	Baetidae (excl. *Baetis rhodani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		*Aphelocheirus aestivalis*	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gastropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	*Margaritifera margaritifera*		*Anodonta* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminthes			All		

Observations on Q Determination Scheme

Q5 assigned if :-

a) Group A at least *common** : Typically with ***either*** one or more Heptageniidae spp or *Ephemera* sp. plus three or more Plecoptera spp ***or else*** four or more Plecoptera species present
b) Group B ranging from scarce/absent to numerous
c) Group C not more than *common** but *B. rhodani may be* dominant*
d) Groups D and E *scarce** or absent.
e) Macrophytes, if present, diverse and not excessive in development.
f) Filamentous algae if present not excessive
g) *Cladophora*, sewage 'fungus' and other slime growths/complexes absent.
h) substrata clean and unsilted.
i) DO close to 100% at all times.
* As defined below.

Q4 assigned if :-

a) At least ***one*** Group A taxon present in, at least, *fair numbers**
b) Group B taxa may be *common**, *scarce** or absent
c) *B. rhodani* usually *dominant** Other Group C taxa never *excessive**
d) Groups D and E may be present in *small numbers** or absent
e) Macrophyte & algal growths not excessive
f) *Cladophora,* if present, not excessive
g) Sewage 'fungus' and other slime growths absent
h) Substrata may be lightly silted
i) DO ranging from 80 to 120%

Q3-4 assigned if :-

a) At least ***one*** Group A taxon present in, at least *small numbers**.
b) Group B *common**, *scarce** or absent
c) Group C *numerous**, *dominant* or excessive**.
d) Group D *common**, *scarce** or absent
e) Group E *scarce** or absent.
f) Macrophytes and algal growths usually luxuriant, often excessive.
g) *Cladophora*, usually excessive.
h) Sewage 'fungus' and other slime growths sometimes present in small amounts.
i) Substrata may be considerably silted.
j) DO ranging from < 80 to >120%.

Q3 assigned if :-

a) Group A absent.
b) Group B *fair numbers**, *scarce** or absent
c) Group C usually *excessive** (*Gammarus, Hydropsyche* etc. may be fungus infested).
a) Groups D (excl. *Asellus) common**, *scarce** or absent
e) Group E *scarce** or absent
f) Macrophytes, if present often silted and/or infested with epiphytic algae.
g) *Cladophora* usually excessive.
h) Sewage 'fungus' and other slime growths/complexes may be considerable.
i) Substrata may be heavily silted.
j) DO ranging from <80 to >120%.

Q2 assigned if :-

a) Groups A and B absent.
b) Group C *scarce** or absent.
c) *Asellus sp. common* to excessive**. Other Group D taxa may be *common**, *numerous** or *excessive**.
d) Group E may be *common**.
e) Macrophytes, if present silted and/or infested with epiphytic algae/sewage fungus.
f) *Cladophora* not usually apparent.
g) Sewage fungus and other slime growths/complexes usually considerable.
h) Substrata usually heavily silted. Often smells of sewage/detergent.
i) DO usually quite low (20 - 50%)

Q1 assigned if :-

a) Groups A, B and C absent.
b) Groups D *scarce** or absent
c) Group E *dominant**.
d) Macrophytes absent.
e) *Cladophora* absent.
f) Sewage 'fungus' and other slime growths/complexes present or absent.
g) Substrata usually heavily silted with anaerobic deposits. Often smells of H_2S.
h) DO usually very low, sometimes zero.

Continued

1) The above scheme outlines the typical macroinvertebrate composition of rivers and streams unaffected (Q5) or variously affected (Q4 to Q1) by organic waste inputs.

2) Where possible all available habitats should be sampled by kick sampling, stone washing and weed sweeping.

3) Single specimens may be ignored as they are likely to have drifted from upstream.

4) Q5 only ascribed in absolutely pristine conditions with diverse and balanced faunal community.

5) Providing points f and g (at Q5 and Q4 above) not breached Q5 and Q4 may be also ascribed where faunal criteria not met due to:-
a) significant ground-water input
b) very hard, calcareous conditions
c) very oligotrophic conditions
*d)*other relevant factors

6) The terms "Taxon/Taxa" are defined by the level of identification for each Class/Order as follows :-

Platyhelminthes	genus
Oligochaeta	family
Hirudinea	genus
Mollusca	genus
Crustacea	family
Plecoptera	genus
Ephemeroptera	genus
Trichoptera	genus
Odonata	genus
Megaloptera	genus
Hemiptera	genus
Coleoptera	family
Diptera	family
(Chironomidae :- *thummi-plumosus* or non-*thummi-plumosus*)	
Hydracarina	presence

Abundance Category	**Approximate Percentage Frequency of Occurrence***
Present	1 or 2 individuals
Scarce/Few	<1%
Small numbers	<5%
Fair numbers	5 -10%
Common	10 - 20%
Numerous	25 - 50%
Dominant	50 - 75%
Excessive	>75%

* Per 2 minute kick sample + stone washing.

Quality Classes	Class A		Class B	Class C	Class D	
Quality Ratings (Q)	Q5	Q4	Q3-4	Q3	Q2	Q1
Pollution Status	Pristine, Unpolluted	Unpolluted	Slight Pollution	Moderate Pollution	Heavy Pollution	Gross Pollution
Organic Waste Load	None	None	Light	Considerable	Heavy	Excessive
Maximum B.O.D.	Low (< 3 mg/l)	Low (< 3 mg/l)	Occasionally elevated	High at times	Usually high	Usually very high
Dissolved Oxygen	Close to 100%	80%-120%	Fluctuates from <80% to >120%	Very unstable Potential fish-kills	Low, sometimes zero	Very low, often ze
Annual Median ortho-Phosphate	~0.015 mg P/l	~0.030 mg P/l	~0.045 mg P/l	~0.070 mg P/l	usually > 0.1 mg P/l	usually > 0.1 mg P/l
Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
'Sewage Fungus'	Never	Never	Never	May be some	Usually abundant	May be abundant
Filamentous Algae	Limited development	Considerable growths Diverse communities	*Cladophora* may be abundant	*Cladophora* may be excessive	May be abundant	Usually none
Macrophytes	Diverse communities Limited growths	Diverse communities Considerable growths	Reduced diversity Luxuriant growths	Limited diversity Excessive growths	Tolerant species only. May be abundant.	Usually none or tolerant species onl
Macroinvertebrates (from shallow riffles)	Diverse communities. Normal density. Sensitive forms usually numerous.	High diversity. Increased density. Sensitive forms scarce or common.	Very high diversity. Very high density. Sensitive forms scarce.	Sensitive forms absent. Tolerant forms common. Low diversity.	Tolerant forms only. Very low diversity.	Most tolerant form Minimal diversity
Water Quality	Highest quality	Fair quality	Variable quality	Doubtful quality	Poor quality	Bad quality
Abstraction Potential	Suitable for all	Suitable for all	Potential problems	Advanced treatment	Low grade abstractions	Extremely limitec
Fishery Potential	Game fisheries	Good game fisheries	Game fish at risk	Coarse fisheries	Fish usually absent	Fish absent
Amenity value	Very high	High	Considerable	Reduced	Low	Zero
Condition	Satisfactory	Satisfactory	Transitional	Unsatisfactory	Unsatisfactory	Unsatisfactory

HYDROLOGY ASSESSMENT

FOR

ALTERATIONS & EXTENSIONS AT THE EXISTNG ABBOTT PHARMACEUTICAL CAMPUS, MANORHAMILTON ROAD, SLIGO

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A Promise for Life

eis

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EXECUTIVE SUMMARY

AWN Consulting Limited (AWN) were commissioned by Environmental Impact Services (EIS) Limited to assess the impact of a proposed alterations and extensions to the existing Abbott Ireland Pharmaceutical Operations (AIPO) manufacturing plant at Manorhamilton Road, Sligo on water environment (surface water, wastewater and water supply).

The assessment of the potential impact of the proposed extension on the water environment was carried out according to the relevant guidance documents.

An on-site stream flows through the southern part of the site, 20m from the proposed extension, and this is a small tributary of the Bellanurly_Willsborough Stream. This Stream is located 0.5km to the north of the site and it enters Sligo Estuary/Bay 1.6km to the west of the site. The subject site is located in the Western River Basin District (WRBD). The current status of the Bellanurly_Willsborough Stream under the Water Framework Directive (WFD) in the vicinity of the proposed extension is "Good". In 2009, the Bellanurly_Willsborough Stream was given a biological water quality classification of Q4. This 'Q value indicates that the waters are satisfactory and unpolluted.

A review of the records for previous floods in the area was carried out. No flood events have been recorded on the site.

Surface Water

The existing AIPO surface water collection system drains to a retention pond via a hydrocarbon interceptor which discharges to the on-site stream via a flow control device and is continuously monitored as per AIPO Integrated Pollution Prevention Control (IPPC) licence. Surface water from the proposed extension will discharge to the same surface water drainage system.

The potential impacts on the surface water environment during the construction phase include contamination of watercourses due to silt laden run-off, concrete run-off and the spillage or leaks of fuels. The potential impacts during the operational phase include contamination of the surface water environment from fuel and/or chemical spills or leaks.

The mitigation measures for the construction phase include minimising disturbance of soils, carefully managing stockpiles of soil, assessing soil for signs of contamination, controlling silt laden run-off, wheel washes, the use of bunded areas for storing fuel, oil, solvents, paints, refuelling only in designated areas, the use of spill kits, spill training, double skinned fuel tanks, concrete mixing off-site and adherence to the AIPO Environmental Management Plan (EMP). The mitigation measures proposed to be put in place during the operational phase will include control of surface water runoff, the use and maintenance of hydrocarbon interceptors, bunded tanks/drum storage, adherence to the AIPO EMP, loading/unloading of chemicals in bunded areas and regular integrity testing of bunds, drains and lines and surface water monitoring.

Wastewater

AIPO generates domestic and process wastewater. The domestic wastewater is discharged to the Sligo County Council sewer. As part of their IPPC licence AIPO can also discharge process wastewater to the sewer, depending on the contaminant concentration. However, some of the process wastewater in exceedence of the contaminant concentration is disposed of offsite by a permitted/licenced waste contractor.

The proposed expansion will generate additional domestic and process wastewater. The additional process wastewater volumes will be approximately 45m^3/day and a maximum of 180m^3/week. AIPO's current IPPC licence limit is 230m^3/day. Their average discharge over the last two years was 50-80m^3/day. Therefore, even with the proposed additional process wastewater volumes, the daily discharges will still be well below this limit. However, the hourly discharge limit of 10m^3 and the temperature limit of 20^{o}C currently imposed by the IPPC licence are more stringent. AIPO intends to seek approval from the Environmental Protection Agency (EPA) to increase these limits.

The potential impact on wastewater during the construction is the additional domestic wastewater from the construction personnel, temporary disruption to the sewer network or there is potential for leaks from the sewer during the rerouting of these pipelines. During the operational phase, there is the potential contaminated wastewater to enter the sewer and for exceedances of the limits imposed by the IPPC licence for hourly discharges (10m^3) and temperature (20^{o}C). The mitigation measures proposed include the requirement for a detailed method statement from contractors detailing the procedures for rerouting the sewer during construction. During the operational phase monitoring of process wastewater prior to discharge to the sewer will continue as part of the AIPO IPPC and AIPO Environmental Management Plan (EMP). AIPO will seek approval from the EPA to increase limits for hourly wastewater discharges and temperature.

Water Supply

AIPO currently uses 100-150m^3/day. The AIPO site is currently supplied by the Sligo County Council water supply. The proposed expansion will add approximately 100% to the water consumption i.e. an additional 100-150m^3/day.

The potential impacts on the water supply during construction and operational phase are the potential for leaks from or contamination of the water mains during the connection of the new spur and an increased demand for water from the municipal water supply system. The mitigation measures proposed include the requirement for a detailed method statement from contractors detailing the procedures for connecting to the mains. The Sligo County Council water supply has sufficient capacity for the increased demand for water for the proposed extension.

Residual Impacts

The proposed development will have an **imperceptible** residual impact on the water (surface water, wastewater and water supply) environment provided the mitigation measures detailed in this report are implemented during the construction and operational phases.

Report Prepared By: **Report Checked By:**

Katrina Foley

Elaine Neary

KATRINA FOLEY
Environmental Consultant

ELAINE NEARY
Senior Environmental Consultant

CONTENTS

1.0 INTRODUCTION

AWN Consulting Limited (AWN) were commissioned by Environmental Impact Services (EIS) Ltd to assess the impact of a proposed alternations and extensions to Abbott Ireland Pharmaceutical Operations (AIPO) manufacturing plant at Manorhamilton Road, Sligo on the surrounding surface water, wastewater and water supply environment.

The existing pharmaceutical manufacturing plant was constructed in 2001 and prior to this the site was primarily used for agricultural, livestock grazing. It is propose to extend a number of the buildings on the existing site.

The proposed extension will comprise the following:

- 2 no. 3 storey extensions to the existing Administration/ Laboratory Building approximately 1661m² in area, (height 15.6 metres) located to the east and west of this facility and alterations to the existing south façade;
- 2 no, single storey extensions approximately 2072m² in area, (height 13.5 metres) to the existing Production/Tableting Building with internal mezzanines, located to the east and west of this facility;
- An extension to the existing single storey high bay Warehouse (including relocated docks) to the west of the existing 3 storey Manufacturing Building approximately 380m² in area (height 16.6 metres);
- The proposed works also include an inter-building 2 storey Link approximately 787m² in area, (height 13.5m metres) directly located to the west of a proposed link currently subject to planning (planning reference number 11/411);
- Alterations to building facades to include roof mounted equipment, external stairs and miscellaneous single storey porches to all buildings; and
- Ancillary works include 42 no. additional car spaces and revisions to roads and services, including pipe bridges, bunded tanks with canopy over and revised landscaping.

The expansion of the site will require excavation works and they will be as follows;

- Foundations for new building extensions
- A new underground process water tank and pump
- Underground utilities (Fire Main, Foul Water, Surface Water, Process Water and LV Electrical Ducting) in the footprint of the new buildings will be diverted to allow for the construction of the new extensions.
- Expansion of car parking areas

The potential impacts and mitigation measures for water (surface water, wastewater and water supply) for the construction and operational phase of the proposed development are set out in the following sections.

2.0 ASSESSMENT METHODOLOGY

The assessment of the potential impact of the proposed extension on the water environment was carried out according to the methodology specified by the Environmental Protection Agency (EPA) [1, 2].

The following sources of information were consulted to establish the baseline water environment:

- EPA water quality monitoring data for watercourses in the area [3];
- WRBD Management Plan – Garavogue Water Management Unit and Programme of Measures – WRBD [4]
- Office of Public Works flood mapping data (www.floodmaps.ie) [5];
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW)) [6]
- The Geological Survey of Ireland (GSI) well card and groundwater records for the area were inspected, with reference to hydrology [7];
- Water Framework Directive Monitoring Programme, EPA 2006 [8];
- Western River Basin District Characterisation Reports [9];
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001) [10].

In addition, the following reports and information provided by AIPO were made available:
- AIPO IPPC Licence (Reg. P0643-02) [11];
- AIPO Annual Environmental Reports 2006 – 2010 [12]

3.0 SURFACE WATER

This section has been prepared to identify and assess the impact of the proposed extension on the surrounding surface water environment and introduce the relevant mitigation measures.

3.1 Receiving Environment

The site is located in townlands of Ballytivnan and Rathbraughan, Co. Sligo and is accessed from the N16, Sligo to Manorhamilton Road, 2km north of Sligo Town. The overall site area is approximately 47 hectares (116 acres) comprising of a number of fields. The overall site has an "L" shape and the site topography is defined by 2 valleys oriented east-west separated by a central spine plateau area. The elevations range from a low of 8 m OD (ordnance datum) in the south-western end to a high of 40m OD at the north Eastern end. This overall site bounds the existing Abbott Ireland, Ballytivnan plant to the west, private housing (Yeats Heights) to the south east, the Bellanurly Stream, a tributary of Willsborough Stream, approximately 0.5km to the north and west of the site, and the Clarion Hotel and the Sligo and Leitrim Mental Health Services building to the south west. The existing pharmaceutical manufacturing plant is situated to the east of this overall site and is approximately 12.5 ha (31 acres).

AIPO is located within the Western River Basin District (WRBD) in Hydrometric Area No. 35 of the Irish River Network. It is within the Garavogue catchment area. The Garavogue River (EPA site code 35/G/01), is located approximately 1.4km to the south of the site and enters Sligo Estuary/Bay which is located approximately 1.6km to the west of the site.

A stream flows through the southern part of the site, 20 m from the proposed extension site. This on-site stream is a small tributary of the Bellanurly Stream which is tributary of Willsborough Stream. The Willsborough Stream, also referred to in previous reports as the Doonally River, rises in northern Sligo and enters Sligo Estuary/Bay.

Figure 1 illustrates for the hydrological environment of the AIPO site and surrounding area.

3.2 Water Quality

The EU Water Framework Directive (2000/60/EC) European Communities Directive 2000/60/EC establishes a framework for community action in the field of water policy, (commonly known as the WFD).

The WFD requires 'Good Water Status' for all European waters by 2015 to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'good ecological status' and 'good chemical status'. In 2009 the WRBD River Management Plan (RMP) 2009-2015 was published. In the WRBD RMP the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015.

Each river catchment within the WRBD was assessed and a water management plan detailing the programme of measures was put in place for each. The Garavogue Water Management Action Plan (GWMUP) covers the area where the site is located and outlines current status of all rivers and lakes within the catchment area. From this document the current status of the Bellanurly_Willsborough Stream (IE_WE_35_3327) in the vicinity of the proposed extension is "Good". The GWMUP overall objective is to protect the Bellanurly_Willsborough Stream and in 2009 it was rated as having an overall risk of 1a (at risk).

The EPA carry out biological quality surveys of all major rivers and their more important tributaries in Ireland and the results are published on their website. In 2009, the Bellanurly_Willsborough Stream was given a biological water quality classification of Q4. This 'Q value indicates that the waters are satisfactory and unpolluted. Table 1 illustrates the biological water quality classification for the Willsborough Stream from 1982 - 2009.

Table 1 Biological Water Quality Classification for Bellanurly_Willsborough Stream (1982 - 2009)

Station No.	1982	1990	1994	1997	2000	2003	2006	2009
0060	-	4-5	-	4	4-5	4-5	4-5	4
0150	-	-	4	-	-	4-5	4-5	4
0300	5	4	3-4	3-4	4-5	3-4	4	4
Assessment: Good ecological conditions persist at all stations sampled on the Willsborough stream in 2009. However, a decline from high to good status was noted at both 0060 and 0150. Heavy silt deposition and cattle access was noted at the bridge south of Glackbaun (0060).								

A water quality survey of the on-site stream was conducted in December 1997 as part of site investigations for the development of the existing AIPO facility. The results indicate that the water quality in the vicinity of the AIPO property was good at the time the survey was completed. There is no direct or indirect discharge of wastewater effluent from the site into the stream. Surface water is currently indirectly discharged from the site to this on-site stream via a hydrocarbon interceptor, retention pond and controlled flow device. The surface water quality is monitored continuously.

3.3 IPPC Compliance

The EPA conducts regular audits of the site in accordance with the IPPC licence. Based on a review of the EPA inspection reports over the last three years, AIPO have consistently been in compliance with the conditions of their IPPC licence relevant to surface water.

An incidents log is kept as part of IPPC licence and published in the AER. The logs for the last three years have been reviewed and there were no incidents reported in the log which could have impacted on the hydrology of the site and surrounding area.

As part of AIPO's IPPC licence there is continuous monitoring of the surface water quality before it is discharged to the on-site stream. A review of the surface water monitoring results from the last three years (as detailed in the AIPO AER's for 2010, 2009 and 2008) show that there were no exceedences of surface water limits as set out in the AIPO IPPC licence.

3.4 Flooding Events

The Office of Public Works (OPW) Flood Hazard Database was used in order to obtain information on historical flooding events within the study area. There are no historical flood events recorded for the subject site. However, there have been flooding events nearby in the Barroe area on the N16, which is less than 1km from the site. The 2005 flood report for the Barroe area (Flood ID 4994) states the "*road flooding in Barroe area on N16. There is inadequate drainage in the adjacent fields to deal with runoff during periods of heavy rain. Infrequent flooding".*

However, it is not expected that this flooding event would impact on the proposed development site.

3.5 Characteristics of the Proposed Development

3.5.1 <u>Construction</u>

Excavations of the soils and subsoils will be required to facilitate construction of foundations, underground tanks, underground utilities and additional car parking areas.

As part of the construction phase of the proposed extension there will be a requirement for temporary site drainage and silt control which will include temporary situation ponds, ditches, wheel washes and filter drains to allow for outfall close to existing stream. The internal site road is already carried over the stream by a short culvert and during the proposed construction phase an extension to this will be added. It will be a 5m pipe to facilitate the separate contractor access.

3.5.2 <u>Operation</u>

The existing AIPO surface water collection system collects surface and storm water runoff from roofs, internal roads, car park and concrete hardstand paved areas and drains to a retention pond via a hydrocarbon interceptor. This retention pond is located in the south of the site and is also used as the fire water retention pond. Surface water from retention pond discharges to the on-site stream via a flow control device. The proposed extension will increase the impermeable areas on the site by approximately 0.2 hectares i.e. 5.8%. Surface and storm water from the additional impermeable area will discharge to the existing surface water drainage system i.e. into the retention pond via a hydrocarbon interceptor and subsequently discharge to the on-site stream via a flow control device. The existing surface water drainage system was originally designed to allow for future expansion and as such has sufficient capacity for the additional runoff.

The capacity of the on-site stream is determined by a culvert which passes under the Ballytivnan Road and another culvert downstream of this. It is necessary to regulate the volume of surface water discharging from the site. It is for this reason that the flow control device was installed. An attenuation rate of 54l/sec has been agreed with Sligo Borough Council to mitigate impact on the small stream. This flow rate will be maintained following the proposed extension.

As noted in Section 3.3, as part of AIPO's IPPC licence there is continuous monitoring of the surface water before it is discharged to the stream. Chemical Oxygen Demand (COD), Total Organic Carob (TC) and pH are monitored continuously. There is also a daily inspection of colour, odour and COD carried out. Any exceedences the limit levels trigger an alarm. AIPO's EHS check the alarm log daily and all exceedences are investigated and the appropriate action taken. There is also an automatic diversion to a containment pond, in the event of a fire or contamination of surface water. This is the same procedure will be followed for surface water drainage from the proposed extension.

3.6 Potential Impact

The potential impacts of the construction and operational phases of the proposed extension on the surface water environment are outlined in the following paragraphs.

3.6.1 Construction Phase

The proposed extension is located within 20m of the aforementioned on-site stream which flows along the southern end of the site. It is vital that construction work for the proposed extension does not result in the deterioration of water quality in this water body.

Silt Laden Run-off
The nature of the construction activities will involve the stripping vegetation and soil and the stockpiling of topsoil and other excavated material. There is the potential that rain falling on such stockpiles may result in slippage and a washout of sediments, which may affect the water quality of nearby watercourses. Any excess material not required for re-use on site will be removed for re-use or disposal off- site by a suitable permitted/licence waste contractor.

Concrete
Due to the nature of the proposed extension concrete will be required on site; therefore there is the potential for washout of this material to the nearby water courses. Concrete (specifically, the cement component) is highly alkaline and any spillage could adversely impact on surface quality.

Accidental Spills and Leaks
During the construction phase there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of oils, fuels and chemicals stored on site.
- Spillage or leakage of oils and fuels from construction machinery or site vehicles.
- Spillage of oil or fuel from refuelling machinery on site.

Accidental spillages may result in contamination of the local surface water on site and downstream.

In relation to the construction phase the potential impact is considered to be **slight-moderate**.

3.6.2 Operational Phase

The impermeable surface area drained by the existing development will increase as a result of the proposed development by 0.2 hectares i.e. 5.8%. There will be no direct discharges to the surface water environment during the operational phase. All surface water runoff will discharge to the retention pond via a petrol interceptor and discharge to the on-site stream via a flow control device which has sufficient capacity to accommodate the additional runoff. This discharge to the on-site stream is continuously monitored as part of AIPO's IPPC licence.

There is a potential for leaks and spillages during operation and maintenance of the proposed extension. Any accidental emissions of chemicals or oil, fuel and chemical leaks could cause contamination of the surface water environment. However, all discharges are monitored continuously and flow through petrol interceptor, retention pond and flow control device prior to discharge to the on-site stream.

In relation to the operational phase the potential impact on the water is considered to be **slight**.

3.7 Mitigation Measures

The following mitigation measures have been developed to mitigate the potential effects on the surface water environment and seek to avoid or minimise these potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

3.7.1 Construction Phase

Precautions will be taken to minimise contamination of the stream, during earth-works and construction, from surface water runoff. As part of the construction phase of the proposed extension there will be the following mitigation measures put into place;

Temporary storage of spoil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. If all soil excavated at the site is not to be re-used on the site it will be removed by a permitted/licensed waste contractor.

All excavated soils will be visually assessed for signs of possible contamination such as staining or strong odours, which may have occurred from leaks or spills from construction machinery or from historic activities at the site. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that contamination has not occurred. Should it be determined that any of the spoil excavated is contaminated, this will be dealt with appropriately as per the Waste Management Acts of 1996 – 2008 and associated Regulations.

Silt Laden Run-off
The Surface Water Management Plan will be implemented including;

- Temporary site drainage and silt control;

- Temporary ponds, ditches, wheel washes and filter drains to allow for outfall close to existing stream.

Concrete
Concrete will be mixed off–site and imported to the site. The pouring of concrete will take place within a designated area using a geosynthetic material to prevent concrete runoff. The wash down of concrete transporting vehicles will take place at concrete batching facilities with the appropriate infrastructure.

Accidental Spills and Leaks
To minimise any impact on the surface water environment from material spillages, all fuels, oils, solvents and paints used during construction will be stored within specially constructed, dedicated, temporary bunded areas or in bunded containers. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area of the site. Spill kits and hydrocarbon adsorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. Should it not be possible to bring a vehicle to the refuelling area, fuel shall be delivered using a double skinned mobile tank. Refuelling operations will use drip trays to collect any minor leaks or spills. A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their Environmental Management Plan (EMP) and will be implemented during the construction phase of the proposed development.

Implementation of the above mitigation measures during the construction phase and the application of AIPO's EMP plan to the construction phase will reduce the impact from slight-moderate to **imperceptible.**

3.7.2 <u>Operational Phase</u>

The site-wide mitigation measures and spill control programme in place at the AIPO site which is implemented as part of their EMP will apply to the proposed extension during the operational phase.

The objective of maximising the quantity of clean runoff water discharged indirectly to the on-site stream while avoiding discharges of contaminated water is met by AIPO by an integrated surface water management system incorporating the following features:

- Treatment of surface water from hardstanding areas via a petrol interceptor
- Collection of site runoff waters at the site retention pond
- Continuous monitoring of the surface water (for COD, TOC and pH)
- Attenuated/limited discharge rate to the on-site stream using a flow control device
- Diversion of contaminated surface water to the containment pond on-site (if necessary)

There is no discharge of wastewater to surface water drains or watercourses.

The site will use chemical substances which have the potential to cause ground pollution if not handled, stored and transported correctly. All tank and drum storage areas are bunded on-site. Any oil and chemical product, waste storage or transfer areas will be locally bunded with the design of all bunds conforming to standard bunding specifications - BS8007-1987. All oil and fuel storage tanks will be stored in designated areas with an impervious base. These tanks will be areas which will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). As part of AIPO's EMP, all loading and unloading of chemicals, takes place in designated bunded areas and the integrity of these bunds are assessed annually. Foul drains and doubled contained lines will be appropriately maintained and checked for leaks every three years as part of AIPO's IPPC Licence compliance. A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their EMP and will be implemented as part of the operational phase of the proposed extension.

If an accidental spill occurs in this area, the spill can be tested and dependent on the contaminant concentration this can be disposed of through the local sewer network or be disposed off-site.

Implementation of the above mitigation measures during the operational phase and the application of AIPO's environmental management plan will reduce the impact from slight to **imperceptible**.

3.8 Residual Impact

The proposed development will have an **imperceptible** residual impact on the surface water environment provided the mitigation measures outlined in Section 3.7 and the AIPO's EMP are implemented during the construction and operational phases.

3.9 Monitoring

Monitoring of the surface water quality in accordance with the IPPC licence compliance monitoring requirements will be carried.

All bunds, interceptors, retention pond, flow control device will be inspected regularly and in particular after heavy rainfall events to ensure that they are not blocked or overflowing.

A regular inspection and maintenance/desludging programme will be implemented whereby any oil/solids/debris trapped within the interceptor will be removed and disposed of by an appropriately licensed EPA approved waste disposal contractor.

A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their EMP and will be implemented as part of the construction and operational phases of the proposed development.

4.0 WASTEWATER

This section has been prepared to identify and assess the impact on the surrounding foul and combined sewer networks in the area of the proposed extension.

4.1 Receiving environment

AIPO generates domestic and process wastewater. The domestic wastewater is discharged to the Sligo County Council sewer. As part of their IPPC licence AIPO can also discharge process wastewater, depending on the contaminant concentration, to this sewer via the existing onsite process water treatment system. However, some of the process wastewater is disposed off-site by a permitted/licenced waste contractor. AIPO's current IPPC limit for emissions to sewer is 230m^3/day. In 2010 and 2009, the volumes discharged were 80 and 50m^3/day, respectively, well below this limit.

The AIPO IPPC licence currently also limits the hourly discharge to 10m^3 and limits the temperature of the discharge to 20^{o}C. AIPO intends to seek approval from the EPA to increase these limits during future IPPCL review.

AIPO's existing connection to the Sligo County Council sewer is approximately 380m from the AIPO site. The Sligo County Council sewer discharges to the Sligo Wastewater Treatment Plant (WWTP) which subsequently discharges treated effluent to Sligo Bay. The Sligo WTTP was constructed after the construction of the existing AIPO facility and, has a current capacity of 50,000 p.e. (population equivalents).

4.2 IPPC Compliance

The EPA conducts regular audits of the site in accordance with the IPPC licence. Based on a review of the EPA inspection reports over the last five years, AIPO have consistently been in compliance with the conditions of their IPPC licence relevant to wastewater.

An incidents log is kept as part of IPPC licence and published in the AER. The logs for the last three years have been reviewed and there were no incidents which could have impacted on the wastewater of the site and surrounding area. A review of the sewer monitoring results also showed there were no exceedences of sewer emissions as set out in the AIPO IPPC licence.

4.3 Characteristics of the Proposed Development

The proposed expansion will generate domestic type wastewater from the canteens and sanitary facilities (toilets, washrooms etc.) and process wastewater from the manufacturing facility. The expansion proposed will generate additional process wastewater volumes of approximately 45m^3/day and a maximum of 180m^3/week. The current IPPC sewer emission limit is 230m^3/day. Their average discharge over the last two years was 50-80m^3/day. Therefore, even with the proposed additional process wastewater volumes, the daily discharges will still be well below this limit. However, as already noted, the hourly discharge limit of 10m^3 and the temperature limit of 20^{o}C currently imposed by the IPPC licence are more stringent. The extended facility will have to comply with these limits. AIPO intends to seek approval from the EPA to increase these limits.

Process wastewater will comprise 'low strength' process wastewater (i.e. cleaning rinses etc.) which will be discharged to sewer via the onsite treatment system subject to agreement with the Council and EPA and initially all 'high strength' process wastewater will be disposed of offsite by a permitted/licensed waste contractor. The high strength wastewater will then be charactertised to determine if it is suitable for discharge to sewer subject to agreement with the Council and EPA.

4.4 Potential Impacts

The potential impacts of the construction and operational phases of the proposed extension on the wastewater environment are outlined in the following paragraphs.

4.4.1 Construction Phase

There will be no process wastewater generated during the construction phase. There will be additional domestic wastewater from construction workers. However, they will use the existing on-site welfare facilities which have sufficient capacity.

During the connection of existing to temporary and from temporary to new, contamination of or from the existing sewer may occur due to leaks. There may also be some temporary disruption to the sewer in the area.

In relation to the construction phase the potential impact is considered to be **slight**.

4.4.2 Operational Phase

Wastewater will consist of domestic and process wastewater. The proposed extension will result in a slight increase in the domestic waste water discharged from the site to the public sewer system. However, the Sligo WWTP has spare capacity and therefore it is anticipated that the potential impact of this additional domestic wastewater is considered to be **imperceptible**.

As part of their IPPC licence AIPO can discharge process wastewater from the plant to the Sligo County Council sewer, depending on the contaminant concentration prior to discharge. All process wastewater is tested for contaminant concentrations and if process wastewater exceedence the agreed concentration limits it will require disposal of offsite, therefore no process wastewater exceeding the agreed criteria will be discharged to sewer. Therefore, the potential impact of this additional effluent on the foul drainage system is considered to be **imperceptible**.

The annual average volume of emissions to the sewer in 2009 was $50m^3$ and $80m^3$ in 2010, the licensed emission volume limit is $230m^3$. Therefore, there is available capacity for the increase in the volume of process wastewater discharges and therefore, the potential impact is considered to be **imperceptible**.

The hourly discharge limit of $10m^3$ and the temperature limit of 20^oC are more stringent. There is the potential that AIPO may exceed these limits. However, AIPO intend to apply to the EPA for an increase to these limits so the potential impact is considered to be i**mperceptible**. If an increase is not granted, AIPO will have to comply with the current limits.

4.5 Mitigation Measures

The following mitigation measures have been developed to mitigate the potential effects on the wastewater and seek to avoid or minimise these potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

4.5.1 Construction

Construction contractors will use existing welfare facilities on site which have sufficient capacity. There will be no additional process wastewater generated during the construction phase.

A detailed method statement will be required from the construction contractor to set out how the sewer mains are to be diverted and to outline what measures are to be taken to ensure that there is no interruption of service during the works.

4.5.2 Operational Phase

There will continued monitoring of the process wastewater prior to discharge to the sewer as per the AIPO IPPC licence. AIPO's EMP produces will be followed, including all foul drains and doubled contained lines will be appropriately maintained and checked for leaks every three years.

AIPO will seek approval to increase the limits currently imposed by their IPPC licence for hourly discharge and temperature.

The Sligo County Council WWTP has sufficient capacity for the increase in the volume of domestic and process wastewater discharges and therefore, the impact of the operational phase on the wastewater environment is considered be **imperceptible**.

4.6 Residual Impact

The proposed development will have an **imperceptible** residual impact on the wastewater environment provided the mitigation measures outlined in Section 4.5 and the AIPO's EMP are implemented during the construction and operational phases.

4.7 Monitoring

Construction phase monitoring will be carried out to ensure that construction methodologies are adhered to, that pressure testing of sewer, cleansing of sewer and the making of sewer connections are carried out to accepted standards and meet Sligo County Council requirements.

This existing monthly monitoring of the sewer emissions as part of AIPO's IPPC licence compliance monitoring will be continued.

5.0 WATER SUPPLY

This section has been prepared to identify and assess the impact of the proposed extension on the water supply and introduce the relevant mitigation measures.

5.1 Receiving Environment

AIPO currently uses approximately 100- 150 cubic metres of water per day (m^3/day). The annual water usage for the site in 2010 was 41,477m^3. The AIPO site is currently supplied by the Sligo County Council. The Sligo County Council water supply is from raw water sources at Lough Gill. The water is treated in a water treatment plant at Kilsellagh which was designed to produce 11,000 m^3 per day over a 20 hour period equating to 550 m^3 per hour. The treated water is supplied via a network of 30km of new trunk and distribution mains. The water levels in Lough Gill are controlled by a weir constructed on the Garavogue River at Riverside in Sligo Town.

5.2 IPPC Compliance

The EPA conducts regular audits of the site in accordance with the IPPC licence. Based on a review of the EPA inspection reports over the last five years, AIPO have consistently been in compliance with the conditions of their IPPC licence relevant to water supply.

An incidents log is kept as part of IPPC licence and published in the AER. The logs for the last three years have been reviewed and there were no incidents which could have impacted on the water supply of the site and surrounding area.

5.3 Characteristics of the Proposed Development

It is proposed to connect a new spur from the existing 50mm diameter watermain located adjacent to the existing buildings within the site boundary. The proposed expansion will add approximately 100% to the water consumption i.e. approximately 100- 150m^3/day. However, it is understood that there is available capacity in the local authority water supply.

5.4 Potential Impact

The potential impacts of the construction and operational phases of the proposed extension on the water supply are outlined in the following paragraphs.

5.4.1 <u>Construction Phase</u>

During the connection of existing to temporary and from temporary to new, contamination of the existing mains supply may occur. There may also be some temporary disruption to the water supply in the area.

In relation to the construction phase the potential impact is considered to be **slight**.

5.4.2 <u>Operational Phase</u>

The proposed extension will result in an increased demand for water from the municipal water supply system, estimated to be 100 -150m^3 per day. However, the increase in water demand is small in the context of the available water network and there is spare capacity in the Sligo water supply network, therefore, the potential impact is considered to be **imperceptible**.

5.5 Mitigation Measures

The following mitigation measures have been developed to mitigate the potential effects on the water supply and seek to avoid or minimise these potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

5.5.1 <u>Construction Phase</u>

A detailed method statement will be required from the contractor to set out how the connection to the watermain is to be carried out and to outline what measures are to be taken to ensure that there is no loss of service during the works.

5.5.2 <u>Operational Phase</u>

There will be no mitigation measures required during the operation phase.

5.6 Residual Impact

The proposed development will have an **imperceptible** residual impact on the water supply network provided the mitigation measures outlined in Section 5.5 during the construction phase.

5.7 Monitoring

Construction phase monitoring will be carried out to ensure that construction methodologies are adhered to, that pressure testing of mains, cleansing of mains and the making of mains connections are carried out to accepted standards and Sligo County Council requirements.

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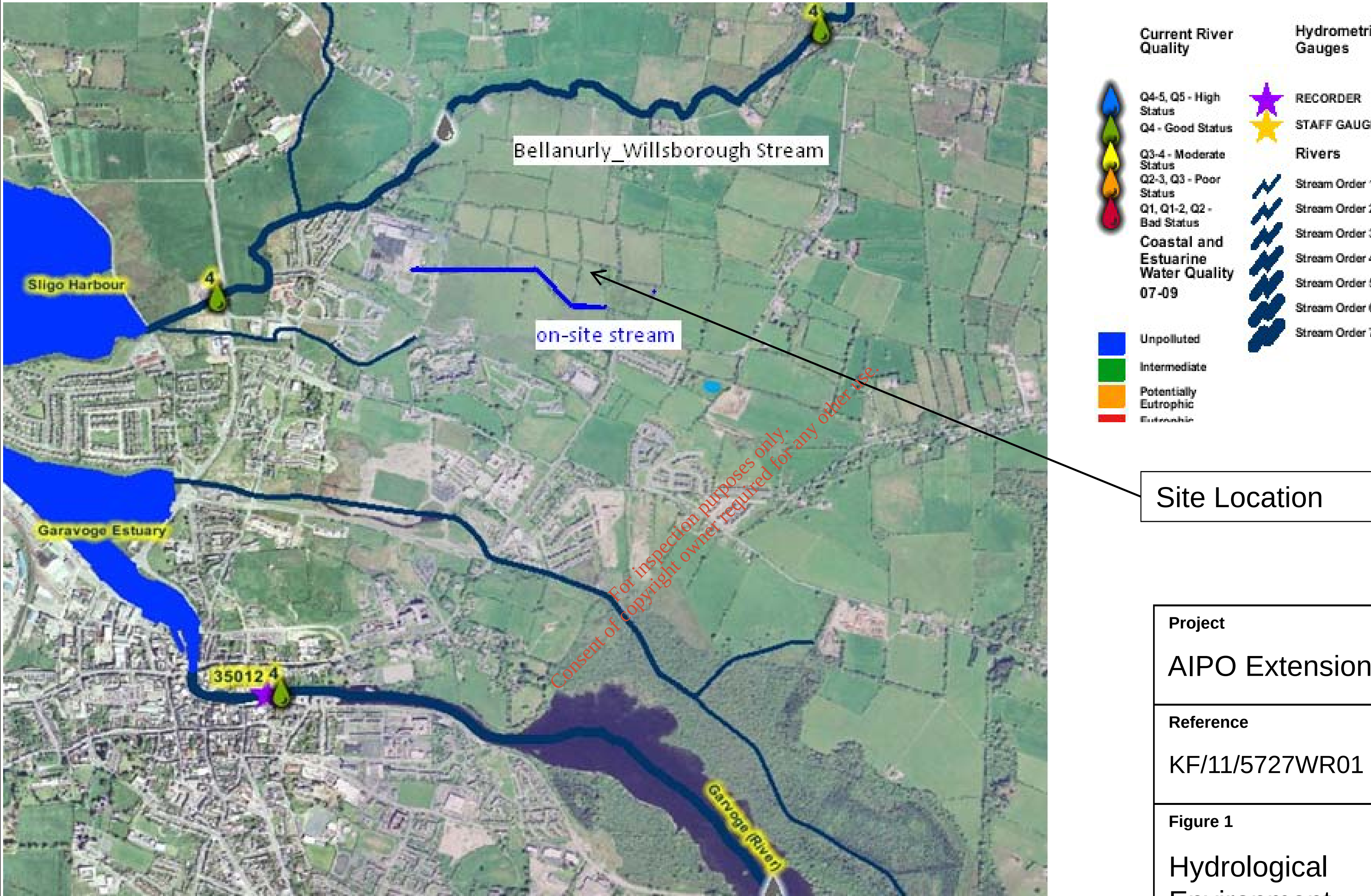

Project

AIPO Extension

Reference

KF/11/5727WR01

Figure 1

Hydrological Environment

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AIR QUALITY & CLIMATE ASSESSMENT

FOR

ALTERATIONS & EXTENSIONS AT THE EXISTING ABBOTT PHARMACEUTICAL CAMPUS, MANORHAMILTON ROAD, SLIGO

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A Promise for Life

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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to conduct a desktop assessment of the potential air quality and climate impact of the proposed extension at the Abbott Manufacturing Facility in Sligo.

In terms of the existing air quality environment, annual monitoring data from Abbott and data available from similar environments indicates that levels of nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and benzene are generally well below the European Union (EU) ambient air quality standards.

The operational impact of the scheme has been assessed using the UK DMRB Screening Model, which is a recommended screening model for assessing the impact of traffic on air quality. The inputs to the air dispersion model consist of information on road layouts, receptor locations, annual average daily traffic movements (AADT), annual average traffic speeds and background concentrations. The assessment was carried out for the opening year (2013).

The results of the air dispersion modelling assessment show that pollutant concentrations for the "do nothing" scenario will be significantly within the EU ambient air quality standards. The additional impact of the proposed development will account for less than 1% of the respective EU limit values for any of the five pollutants assessed (NO_2, PM_{10}, $PM_{2.5}$, CO and benzene). Levels of these pollutants will be significantly within the ambient air quality limit values with the proposed development in place, ranging from 22 - 58% of the respective limit values in 2013. Based on the relevant assessment criteria, the impact of the development in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is deemed negligible.

There are no new air quality emission points required as part of the proposed development. Abbott undertake regular monitoring of all air quality emission points to ensure compliance with their IPPC Licence. There were no exceedances recorded at any of the air quality emission points monitored during the period of January to September 2011.

Mitigation measures in relation to traffic-derived pollutants have focused on improvements in both engine technology and fuel quality, with vehicles over recent years significantly cleaner than those prior to this period. With regard to the construction phase, a dust minimisation plan will be formulated as construction activities are likely to generate some dust emissions.

In summary, levels of traffic-derived air pollutants will not exceed the EU ambient air quality standards with the proposed development in place. Furthermore, the impact of the development in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is deemed negligible.

In terms of climate, Ireland ratified the Kyoto Protocol in May 2002 agreeing to limit the net growth of the six greenhouse gases to 13% above the 1990 level over the period 2008 to 2012. In relation to the current proposal, road traffic would be expected to be the dominant source of greenhouse gas emissions. Vehicles will give rise to CO_2 and N_2O emissions in the region of the proposed development. However, greenhouse gas emissions, as a result of this scheme, will be insignificant in terms of Ireland's obligations under the Kyoto Protocol.

Report Prepared By:	Report Checked By:
Claire Lynch	Edward Porter
CLAIRE LYNCH	**DR. EDWARD PORTER**
Environmental Consultant	Director, Air Quality

CONTENTS

1.0 INTRODUCTION

AWN Consulting Limited has been commissioned to conduct an assessment into the likely impact on air quality associated with the proposed development.

1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Tables 1 - 4 and Appendix 1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate Council Directive 2008/50/EC (published 11/06/08), which combines the previous air quality framework and subsequent daughter directives (see Table 1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 1).

1.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002[2,3]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012[4,5]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emissions Trading and burden sharing. The most recent Conference of the Parties (COP17) to the agreement was convened in Durban, South Africa in December 2011.

2.0 METHODOLOGY

The air quality assessment has been carried out following procedures described in the publications by the EPA[9,10] and using the methodology outlined in the guidance documents published by the UK DEFRA[11-17]. The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA[11]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "hot-spots" identified. An examination of recent EPA and Local Authority data in Ireland[17-20], has indicated that SO_2 and smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres[18-21]. Benzene, although previously reported at quite high levels in urban centres[19], has recently been measured at several city centre locations to be well below the EU limit value[18-21]. Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres[18-21].

The current assessment thus focused firstly on identifying the existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, benzene and CO in the region of the proposed development, both currently (by analysis of both site specific monitoring data and suitable EPA monitoring data), and with the proposed development in place (through modelling). Thereafter, the impact of the development on air quality at the neighbouring sensitive receptors was determined relative to the existing baseline for the opening year (Year 2013). The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model[13] (Version 1.03c, July 2007) and the NO_x to NO_2 Conversion Spreadsheet[22] and following guidance issued by the NRA[1], UK DEFRA[14-17] and the EPA[6,7]. The inputs to the air dispersion model consist of information on road layouts, receptor locations, annual average daily traffic movements (AADT), annual average traffic speeds and background concentrations. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data. This worst-case concentration is then added to the existing background concentration to give the worst-case predicted ambient concentration. The worst-case predicted ambient concentration is then compared with the relevant ambient air quality standard to assess the compliance of the proposed development with these ambient air quality standards.

Although no relative impact, as a percentage of the limit value, is enshrined in EU or Irish Legislation, the NRA guidelines[1] detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the development. The NRA significance criteria have been adopted for the current development and are detailed in Tables 5 - 7. The significance criteria are based on PM_{10}, NO_2 and $PM_{2.5}$ as these pollutants are most likely to exceed the limit values. However the criteria have also been applied to the predicted 8-hour CO and annual benzene concentrations for the purposes of this assessment.

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)[23]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Belmullet meteorological station, which is located approximately 98 km west of the proposed development. For data collated during four representative years (1993,1995-1997), the predominant wind ranges from southerly to westerly in direction with an average wind speed of approximately 6-7 m/s (see Figure 1).

3.2 Trends In Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources[13]. Thus, residential exposure in urban and suburban areas will be determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In assessing baseline air quality, two tools are generally used: ambient air monitoring and air dispersion modelling. In order to adequately characterise the current baseline environment through monitoring, comprehensive measurements would be required at a number of key receptors for PM_{10}, NO_2 and benzene. In addition, two of the key pollutants identified in the scoping study (PM_{10} and NO_2) have limit values which require assessment over time periods varying from one hour to one year. Thus, continuous monitoring over at least a one-year period at a number of locations would be necessary in order to fully determine compliance for these pollutants. Although this study would provide information on current air quality it would not be able to provide predictive information on baseline conditions(12), which are the conditions which prevail just prior to opening in the absence of the development. Hence the impacts of the development were fully assessed by air dispersion modelling(12) which is the most practical tool for this purpose. The baseline environment has also been assessed using modelling, since the use of the same predictive technique for both the "do nothing" and "do something" scenario will minimise errors and allow an accurate determination of the relative impact of the development.

3.3 EPA Monitoring Data and Background Concentrations

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is the "*Air Quality Monitoring Report 2010*"(19). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments(18).

In terms of air monitoring and assessment, the region of the proposed development is categorised as Zone C(18,19). Long-term monitoring data from the EPA has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

Long-term NO_2 monitoring is carried out at three Zone C locations, Limerick Park Road, Newbridge and Celbridge(18,19). The NO_2 annual averages in 2010 for the sites ranged from 12 μg/m^3 in Celbridge to 17 μg/m^3 in Newbridge with no exceedances of the 1-hour limit value(18,19). Hence, the long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40 μg/m^3. Based on the above information and baseline monitoring data, a conservative estimate of the 2012 background NO_2 concentration in the region of the proposed development is 17 μg/m^3.

The results of CO monitoring carried out in Newbridge and Celbridge in 2010 (Zone C) showed no exceedences of the 8-hour limit value (16,18), with average annual mean levels of 0.5 mg/m^3 and 0.3 mg/m^3 respectively(16,18). Based on the above information, a conservative estimate of the background CO concentration for the region of the proposed development in 2012 is 0.5 mg/m^3 as an annual mean.

With regard to benzene, continuous monitoring was carried out at Emo Court (Zone D) and Old Station Road (Zone B) in 2010, with long-term averages of 0.4 μg/m^3 and 1.1 μg/m^3 respectively (16,18). Based on the above information a conservative estimate of the background benzene concentration for the region of the proposed development in 2012 is 1.1 μg/m^3.

Long-term PM_{10} monitoring was carried out at five Zone C locations in 2010(16,18). The average concentrations measured ranged from 13 μg/m^3 in Bray to 27 μg/m^3 in Ennis. Data from the Phoenix Park in Dublin also provides a good indication of urban background levels, with an annual average in 2010 of 11 μg/m^3(16,18). Based on the above information a conservative estimate of the 2012 background PM_{10} concentration for the region of the proposed development in 2012 is 20 μg/m^3.

The results of $PM_{2.5}$ monitoring at Station Road in Cork City (Zone B) in 2010 (16,18) indicated an average $PM_{2.5}/PM_{10}$ ratio of 0.68. The results of $PM_{2.5}$ monitoring at Ennis (Zone C) in 2010 (16,18) indicated an average $PM_{2.5}/PM_{10}$ ratio of 0.59. Based on this information, a conservative ratio of 0.68 was used to generate a background $PM_{2.5}$ concentration in 2012 of 13.6 µg/m^3.

In summary, existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene based on extensive long-term data from the EPA are expected to be below the EU ambient air quality limit values in the vicinity of the proposed development. A summary of the background concentrations is detailed in Table 8.

3.4 Stack Monitoring Data

Annual monitoring is carried out for all existing stacks at the facility and the results are published in the Annual Environmental Report. The monitoring results from 2006 – 2011 have been reviewed as part of this assessment. Monitoring results for 2006, 2007, 2009 and 2011 show that the concentrations of all pollutants were in compliance with the emission limit values (ELV) as stipulated in the IPPC Licence for the facility(23). There was one exceedance of the ELV for NO_x at Boiler A1-1 in June 2008. However, the boiler had not reached a sufficient temperature at the time of the monitoring. A retest in July 2008 with the boiler under normal operating conditions gave results which were below the ELV stipulated in the IPPC Licence(23). There were two exceedances recorded during stack monitoring in 2010. There was one exceedance of the ELV for NO_x at Boiler A1-1 in November 2010. The other exceedance was at the dust extraction point A2-3 where the concentration for total dust exceeded the ELV in November 2010. Both emission points A1-1 and A2-3 were retested in February 2011 and gave results which were below the ELV stipulated in the IPPC Licence(23). Tables 9 – 11 summarise some of the most recent stack monitoring results at the facility.

4.0 PREDICTED IMPACTS OF THE SCHEME

4.1 Construction Phase: Air Quality

The greatest potential impact on air quality during the construction phase is from construction dust emissions and the potential for nuisance dust. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Provided the dust minimisation measures outlined in the plan (see Appendix 2) are adhered to, the air quality impacts during the construction phase will be not be significant.

4.2 Construction Phase: Climate

Due to the size and nature of the construction activities, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

4.3 Operational Phase: Local Air Quality Assessment

Detailed traffic flow information was obtained from the traffic consultant for the project and has been used to model pollutant levels under various traffic scenarios and under sufficient spatial resolution to assess whether any significant air quality impact on sensitive receptors may occur. The traffic data corresponded to the opening year of 2013.

Cumulative effects have been assessed, as recommended in the EU Directive on EIA (Council Directive 97/11/EC) and using the methodology of the UK DEFRA(11-12). Firstly, background concentrations(13) have been included in the modelling study, for both "do nothing" and "do something" scenarios. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern(11). Appropriate background levels were selected based on the available monitoring data provided by the EPA (18-21) (see above and Table 8).

Once appropriate background concentrations were established, the existing situation, including background levels, was assessed in the absence of the development for the opening year (2013). The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (Version 1.03c)[13], the NO_x to NO_2 Conversion Spreadsheet[22] and following guidance issued by the UK DEFRA[11-17]. Ambient concentrations of CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for the opening year (2013) were predicted at the nearest sensitive receptors to the development. "Do nothing" and "do something" modelling was carried out at the building façade of the worst-case receptors for 2013. This assessment allows the significance of the development, with respect to both relative and absolute impact, to be determined.

4.4 Operational Phase: Local Air Quality - Receptor Locations

Two receptors were modelled near the development; 1) a worst-case receptor located to the south of the site on the N16 Barroe Road and 2) a worst-case residential receptor situated to the north-east of the site, on the N16 North. The receptor locations are shown in Figure 2. Results are reported assuming both average daily speeds and worst-case rush hour speeds. The discussion below is based on the average speeds for PM_{10}, CO, benzene, NO_2 and $PM_{2.5}$. The effect of reducing speeds from typical to worst case is discussed separately. Modelling results are compared to the EU Air Quality Standards 2011 which are based on EU Directive 2008/50/EC. The EU Air Quality Standards are outlined in Table 1.

4.5 "Do Nothing" Modelling Assessment

PM_{10}, CO and Benzene

The results of the "do nothing" modelling assessment for PM_{10}, CO and benzene in the opening year are shown in Tables 12 - 13. Concentrations are well within the EU limit values under all scenarios at all worst-case receptors. Levels of all three pollutants range from 22 – 52% of the respective EU limit values in 2013.

NO_2

The results of the "do nothing" assessment for NO_2 in the opening year are shown in Tables 12 - 13. Concentrations are below the annual EU limit value under all scenarios at all locations. "Do nothing" annual average levels of NO_2 range from 50 – 53% of the annual EU limit value in 2013.

The EU limit value for the maximum one-hour standard for NO_2 is based on a one-hour mean not to be exceeded more than 18 times a year (99.8th%ile). "Do nothing" levels in 2013 are below this limit value, with levels at the worst-case receptor 53% of the EU limit value.

$PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ in the opening year are shown in Tables 12 - 13. The annual average $PM_{2.5}$ concentration peaks at 14.2 µg/m^3 in 2013. Hence levels are predicted to reach at most 57% of the $PM_{2.5}$ EU limit value of 25 µg/m^3 which will come into force in 2015.

4.6 Modelled Impact of the Development Once Operational ("Do Something")

PM_{10}, CO and Benzene

The results of the modelled impact of the development for PM_{10}, CO and benzene in the opening year are shown in Tables 12 - 13. The cumulative impact of both "do nothing" traffic levels and additional traffic due to the development are presented. Concentrations are below the EU ambient air quality standards under all scenarios. Levels of all three pollutants range from 22 – 52% of the respective limit values in 2013.

The impact of the development can be assessed for existing receptors relative to "do nothing" levels in the opening year (see Tables 12 - 13). For PM_{10}, CO and benzene, relative to "do nothing" levels, the impact of the development will lead to a slight increase in pollutant levels as a result of the development. As a worst-case, levels will increase by only 0.4% of the respective EU limit values.

Thus, using the assessment criteria outlined in Tables 5 - 7, the impact of the development in terms of PM_{10}, CO and benzene is negligible.

NO_2

The result of the assessment of the impact of the development for NO_2 in the opening year is shown in Tables 12 - 13. The annual average concentration is within the EU annual limit value for all scenarios. Levels of NO_2 range from 53 – 55% of the EU annual limit value in 2013.

Maximum one-hour NO_2 levels in 2013 (as a 99.8th%ile), with the development in place, will be significantly below the EU limit value, with levels at the worst-case receptor 55% of the limit value.

The impact of the development on maximum one-hour NO_2 levels can be assessed relative to "do nothing" levels in the opening year (see Tables 12 - 13). Levels are only slightly increased with the development in place, with an increase of at most 2.6% of the EU limit value.

Thus, using the assessment criteria outlined in Tables 5 - 7, the impact of the development in terms of NO_2 is negligible.

$PM_{2.5}$

The result of the assessment of the impact of the development for $PM_{2.5}$ in the opening year is shown in Tables 12 - 13. The annual average $PM_{2.5}$ concentration peaks at 14.4 µg/m^3 in 2013. Hence, levels are predicted to reach at most 58% of the $PM_{2.5}$ EU limit value of 25 µg/m^3 which will come into force in 2015.

The impact of the development on annual average $PM_{2.5}$ levels can be assessed relative to "do nothing" levels in the opening year (see Tables 12 - 13). Levels are slightly increased with the development in place, with an increase of at most 0.7% of the $PM_{2.5}$ EU limit value which will come into force in 2015.

Thus, using the assessment criteria outlined in Tables 5 - 7, the impact of the development in terms of $PM_{2.5}$ is negligible

Worst-case Traffic Speed Scenario

An assessment of the effect of changing the traffic speeds (for the entire assessment year) from average speeds to worst case peak hour speeds has also been carried out for all pollutants (see Tables 12 - 13). The results indicate that pollutant levels are increased at the worst-case traffic speed with levels ranging from 24 – 66% of the respective EU limit values for all five pollutants. Nevertheless, pollutant levels are still below the relevant EU limit values for PM_{10}, NO_2, CO and benzene and the proposed EU limit value for $PM_{2.5}$.

4.7 Climate

EPA guidance states that a development may have an influence on global climate where it represents "a significant proportion of the national contribution to greenhouse gases"[10]. Greenhouse gas emissions as a result of this development will be insignificant in terms of national CO_2 emissions and Ireland's agreed limit under the Kyoto Protocol[2,3]. Thus the impact of the proposed development on climate will be insignificant.

5.0 MEASURES TO MITIGATE SIGNIFICANT IMPACTS

5.1 Construction Phase: Air Quality

A dust minimisation plan has been formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions (see Appendix 2).

5.2 Construction Phase: Climate

No mitigation measures are necessary.

5.3 Operational Phase: Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (REGULATION (EC) No 715/2007) for passenger cars to be complied with in 2009 (Euro 5) and 2014 (Euro 6). With regard to heavy duty vehicles, EU Directive 2005/78/EC defines the emission standard currently in force, Euro IV, as well as the next stage (Euro V) which entered into force in October 2009. In addition, it defines a non-binding standard called Enhanced Environmentally-friendly Vehicle (EEV). In relation to fuel quality, SI No. 407 of 1999 and SI No. 72 of 2000 have introduced significant reductions in both sulphur and benzene content of fuels.

5.4 Operational Phase: Climate

CO_2 emissions for the average new car fleet will be reduced to 120 g/km by 2012 through EU legislation on improvements in vehicle motor technology and by an increased use of biofuels. This measure will reduce CO_2 emissions from new cars by an average of 25% in the period from 1995 to 2008/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone[24].

Additional measures included in the National Climate Change Strategy[25,26] include: (1) VRT and Motor Tax rebalancing to favour the purchases more fuel-efficient vehicles with lower CO_2 emissions; (2) continuing the Mineral Oils Tax Relief (MOTR) II Scheme and introduction of a biofuels obligation scheme; (3) implementation of a national efficient driving awareness campaign, to promote smooth and safe driving at lower engine revolutions; and (4) enhancing the existing mandatory vehicle labelling system to provide more information on CO_2 emission levels and on fuel economy.

6.0 RESIDUAL IMPACTS

The results of the air dispersion modelling study show that the residual impacts of the proposed development on air quality and climate will be insignificant.

7.0 CONCLUSION

The impact of the proposed development on air quality and climate will be insignificant.

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Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 μg/m^3 NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 μg/m^3 NO_2
		Annual limit for protection of vegetation	None	30 μg/m^3 NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	100% Note 2	0.5 μg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 μg/m^3	350 μg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 μg/m^3
		Annual & Winter limit for the protection of ecosystems	None	20 μg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 μg/m^3 PM_{10}
		Annual limit for protection of human health	20%	40 μg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 μg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)	-	Annual limit for protection of human health	None	20 μg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 μg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - '*Limit value to be met only by 1 January 2010 in the immediate vicinity of the specific industrial sources situated on sites contaminated by decades of industrial activities. In such cases the limit value will be 1.0 μg/m^3. The area in which higher limit values apply must not extend further than 1000 m from such specific sources*'

Table 1 EU Air Quality Standards 2011 (based on EU Council Directive 2008/50/EC)

Pollutant	Regulation	Type	Period	Value
Nitrogen Dioxide	85/203/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	200 µg/m^3
		Guide Value		135 µg/m^3
		Guide Value	50th percentile of yearly mean hourly concentrations	50 µg/m^3
Lead	82/884/EEC	Limit Value	Annual mean	2 µg/m^3
Sulphur dioxide	80/779/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	250-350[Note 1] µg/m^3
		Limit Value	Winter (medium of daily values)	130 or 180[Note 1] µg/m^3
		Limit Value	One year (medium of daily values)	80 or 120[Note 1] µg/m^3
		Guide Value	98th percentile of yearly mean hourly concentrations	135 µg/m^3
		Guide Value	50th percentile of 1-hour means	50 µg/m^3
Smoke	80/779/EEC	Limit Value	One year (medium of daily values)	80 µg/m^3
		Limit Value	Winter (medium of daily values)	130 µg/m^3
		Limit Value	98th percentile of daily values	250 µg/m^3

Note 1 The lower daily values refer to the situation with corresponding high levels of black smoke

Table 2 Previous European Union Air Standards

Pollutant	**Averaging Period**	**Primary & Secondary Standard Note 1 (µg/m³)**	**PSD Increment Class II Note 2 (µg/m³)**
PM_{10}	Annual - Average over 3 years	50	17
	24-Hour - as a 99th%ile over 3 years	150	30
NO_2	Annual Mean	100	25
	Maximum 1-hr - 3-year average of the 98th%ile of the daily maximum 1-hour	206	50
CO	8-Hour - 3-year average of annual 4th highest daily maximum 8-hour conc.	10,000	-
	1-Hour - not to be exceeded more than 3 times in 3 consecutive years	40,000	-
Hydrocarbon (Benzene)	3 Hours (6-9 AM) (corrected for methane)	160	-

Note 1 Primary standards to protect public health whilst secondary standards are set to protect public welfare
Note 2 Class I areas are national parks and similar areas. Class II are all areas not originally classified as Class I.

Table 3 US National Ambient Air Quality Standards (NAAQS) & PSD Increments

Substances	**Time-weighted Average**	**Averaging Time**
Lead	0.5-1.0 µg/m³	1 year
Nitrogen dioxide	200 µg/m³ 40-50 µg/m³	1 hour annual
Carbon monoxide	100 µg/m³ 60 µg/m³ 30 µg/m³ 10 µg/m³	15 minutes 30 minutes 1 hour 8 hour
PM_{10}	50 µg/m³ 20 µg/m³	24-Hour mean (99th%ile) Annual mean
$PM_{2.5}$	25 µg/m³ 10 µg/m³	24-Hour mean (99th%ile) Annual mean

Table 4 WHO Air Quality Guidelines - Global Update 2005 (WHO, 2006)

Magnitude of Change	**Annual Mean NO_2 / PM_{10}**	**No. days with PM_{10} concentration > 50 µg/m³**	**Annual Mean $PM_{2.5}$**
Large	Increase / decrease ≥4 µg/m³	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m³
Medium	Increase / decrease 2 - <4 µg/m³	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m³
Small	Increase / decrease 0.4 - <2 µg/m³	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase / decrease <0.4 µg/m³	Increase / decrease <1 day	Increase / decrease <0.25 µg/m³

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2011)

Table 5 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration** [Note 1]		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 μg/m^3 of NO_2 or PM_{10}) (≥25 μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 μg/m^3 of NO_2 or PM_{10}) (22.5 - <25 μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 μg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 μg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 μg/m^3 of NO_2 or PM_{10}) (<18.75 μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 μg/m^3 of NO_2 or PM_{10}) (≥25 μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 μg/m^3 of NO_2 or PM_{10}) (22.5 - <25 μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 μg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 μg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 μg/m^3 of NO_2 or PM_{10}) (<18.75 μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2011)

Table 6 Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration Note 1		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes –* National Roads Authority (2011)

Table 7 Air Quality Impact Significance Criteria For Changes to Number of Days with PM_{10} Concentration Greater than 50 μg/m^3 at a Receptor

Background Values Note 1	**2012**	**2013**
Nitrogen Oxides (NO_x) (μg/m^3)	20.9	20.4
Nitrogen Dioxide (μg/m^3)	17.0	16.8
Benzene (μg/m^3)	1.10	1.09
Particulates (PM_{10}) (μg/m^3)	20.0	19.9
Particulates ($PM_{2.5}$) (μg/m^3) Note 2	13.6	13.5
Carbon Monoxide (mg/m^3)	0.50	0.49

Note 1 Reduction in future years using the Netcen background calculator (January 2006).
Note 2 A ratio of 0.68 has been used for the ratio of $PM_{2.5}$ / PM_{10}.

Table 8 Summary of Background Concentrations used in the Air Dispersion Model.

Parameter	Unit	A1-1			A1-2			IPPC Licence Emission Limit Value
		June 2010	Nov 2010	Feb 2011	June 2010	Nov 2010	June 2011	
Temperature	Deg. C	63	112	75	66.3	48.5	108.4	-
SO_2	mg/Nm^3	5.25	3.6	<3.6	7.35	<8.6	<8.0	70
NO_x	mg/Nm^3	180.7	202.4	110.5	168.7	172.2	149.9	180
Volume Flow	m^3/hr	862.3	797.8	364.3	884	684	209.6	13047

Table 9 Summary of Recent Boiler Emissions Monitoring

Parameter	Unit	A2-1(a)	IPPC Licence Emission Limit Value
		2010	
SO_2	kg	16.93	511.4
NO_x	kg	217.7	1461.2
CO	kg	8.3	2191.8
TOC	kg	0.47	146.1

Table 10 Summary of Recent Emissions Monitoring from the Thermal Oxidiser

Parameter	Unit	A2-3	A2-4	IPPC Licence Emission Limit Value
		Nov 2010	Nov 2010	
Total Dust	mg/m^3	2.4	0.9	1
Dust as Pharmaceutical Ingredients	mg/m^3	$<0.45 \times 10^{-2}$	$<0.46 \times 10^{-2}$	0.15
Volume Flow	m^3/hr	1212	1264	18,000 (A2-3) 7,020 (A2-4)

Table 11 Summary of Recent Emissions Monitoring from the Dust Extraction System

Scenario	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)		Particulates ($\mu g/m^3$)		
		Maximum 8-hour	Annual Average	99.8th%ile of Max. 1-Hr	Annual Average	PM_{10} Annual Average	PM_{10}: No. Days >50 $\mu g/m^3$	$PM_{2.5}$ Annual Average
2013 Do Nothing	10	2.8	1.15	114	22.8	21.2	5	14.8
	60	2.5	1.11	100	20.0	20.4	4	14.0
2013 Do Something	10	3.0	1.17	124	24.7	21.6	6	15.3
	60	2.6	1.12	105	21.1	20.6	4	14.2
Standards Note 1		10	5	200 Note 2	40	40	35 Note 3	25

Note 1 EU Council Directive 2008/50/EC (S.I. 180 of 2011)

Note 2 1-hr limit of 200 $\mu g/m^3$ not to be exceeded >18 times/year (99.8th%ile)

Note 3 24-Hr limit of 50 $\mu g/m^3$ not to be exceeded >35 times/year (90.4th%ile)

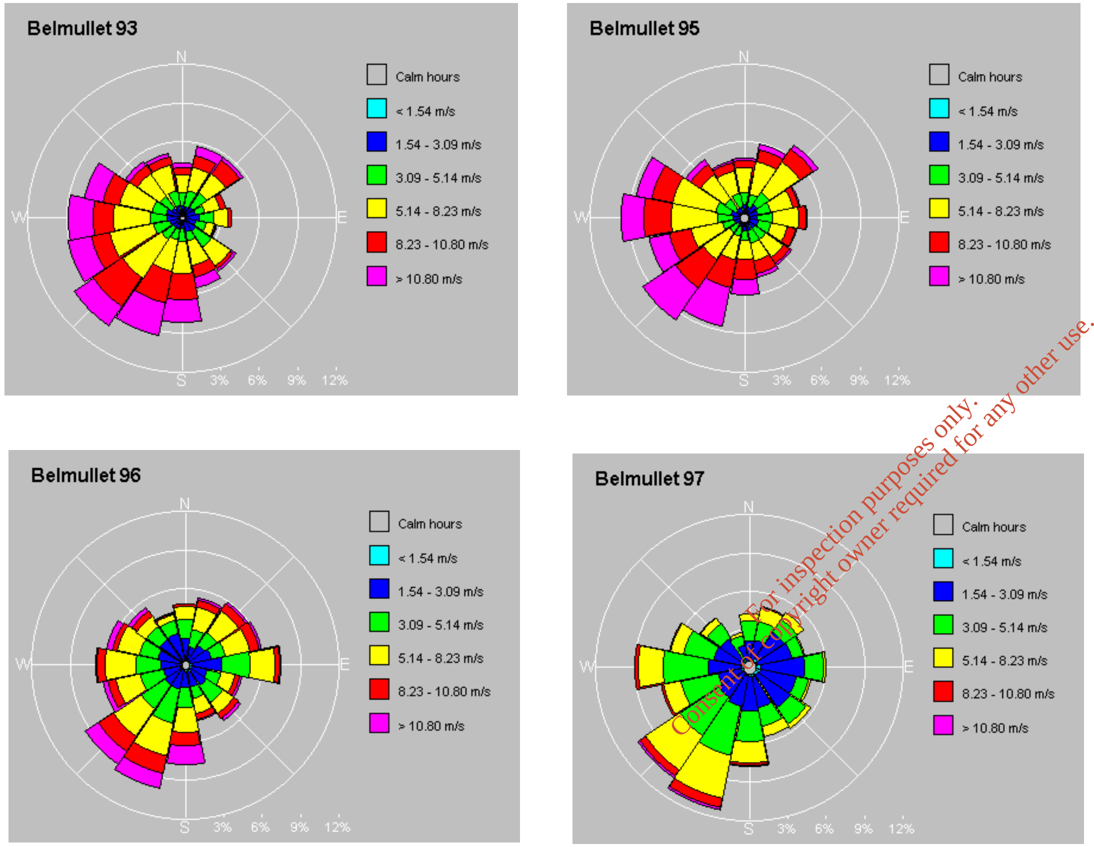
Note 4 1-hr limit of 200 $\mu g/m^3$ for NO_2 (not to be exceeded >18 times/year) applicable for worst-case peak hour impacts

Table 12 Air Quality Assessment of Proposed Macero Extension at the Abbott Facility in Manorhamilton. Summary of Predicted Air Quality at a Worst Case Residential Receptor along the N16 Barroe Road.

Scenario	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)	Benzene (µg/m^3)	Nitrogen Dioxide (µg/m^3)		Particulates (µg/m^3)		
		Maximum 8-hour	Annual Average	99.8th%ile of Max. 1-Hr	Annual Average	PM_{10} Annual Average	PM_{10}: No. Days >50 µg/m^3	$PM_{2.5}$ Annual Average
2013 Do Nothing	10	3.0	1.18	126	25.1	21.7	6	15.3
	60	2.6	1.12	106	21.3	20.6	4	14.2
2013 Do Something	10	3.1	1.20	133	26.6	22.0	6	15.7
	60	2.6	1.12	110	22.1	20.7	4	14.4
Standards Note 1		10	5	200 Note 2	40	40	35 Note 3	25

Note 1 EU Council Directive 2008/50/EC (S.I. 180 of 2011)
Note 2 1-hr limit of 200 µg/m^3 not to be exceeded >18 times/year (99.8th%ile)
Note 3 24-Hr limit of 50 µg/m^3 not to be exceeded >35 times/year (90.4th%ile)
Note 4 1-hr limit of 200 µg/m^3 for NO_2 (not to be exceeded >18 times/year) applicable for worst case peak hour impacts

Table 13 Air Quality Assessment of Proposed Macero Extension at the Abbott Facility in Manorhamilton. Summary of Predicted Air Quality at a Worst Case Residential Receptor along the N16 North.

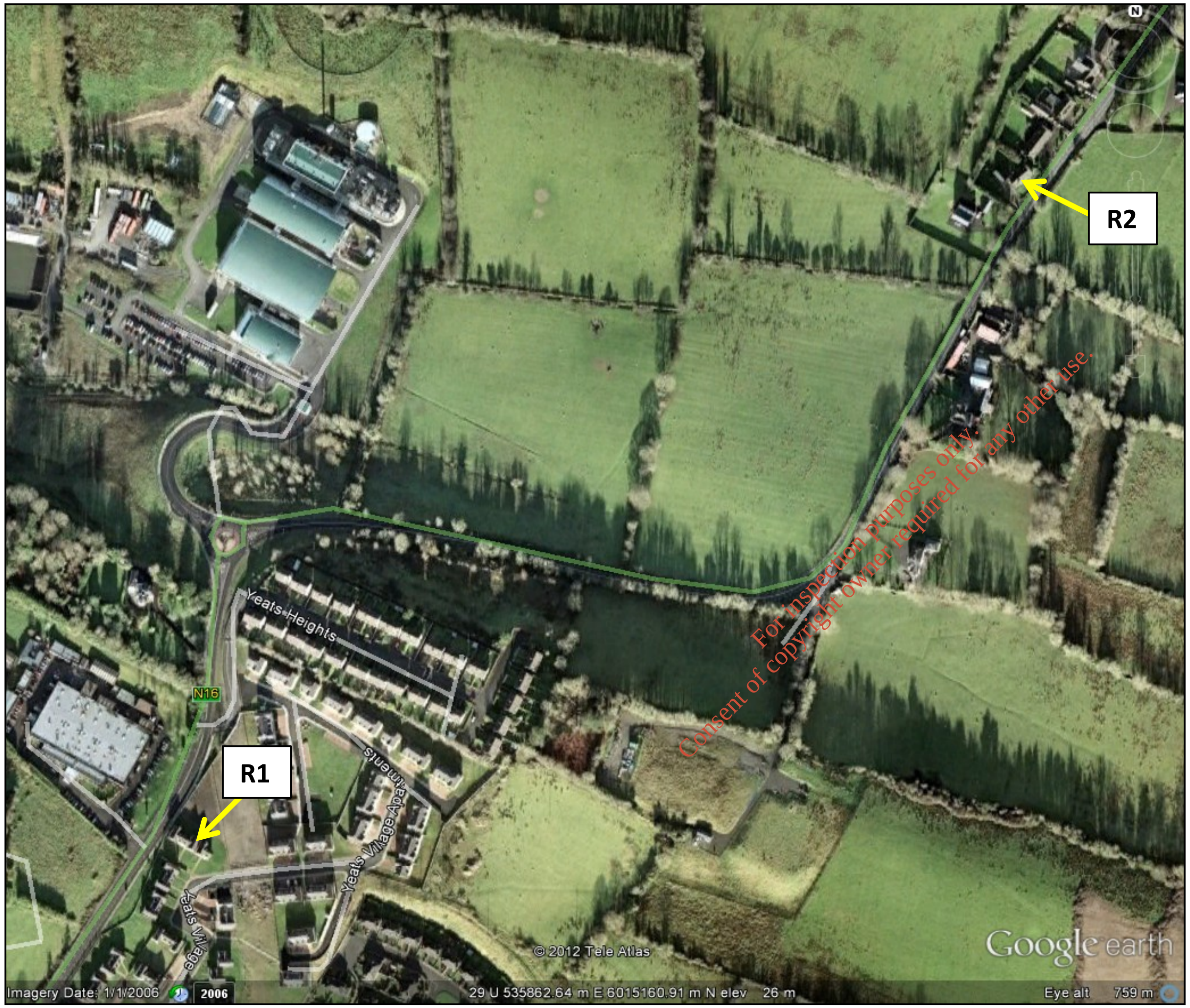


Project
Abbott Manorhamilton Extension EIS

Reference
CL/11/5727AR01

Figure 1
Belmullet Windrose 1993, 1995 - 1997

awnconsulting
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



Project
Abbott Manorhamilton Extension EIS

Reference
CL/11/5727AR01

Figure 2
Locations of Receptors modelled using DMRB

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APPENDIX 1

Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Tables 1 - 2). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. Council Directive 1999/30/EC, as relating to limit values for sulphur dioxide, nitrogen dioxide, lead and particulate matter, is detailed in Table 9.1. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and will start to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has recently published limit values for both carbon monoxide and benzene in ambient air as set out in Table 9.2. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives as outlined in Table 1. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ is to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3. Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020.

Additionally, an exposure concentration obligation of 20 µg/m^3 has been set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 21 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations[(A1)]. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise[(A2)] as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_x, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations[(A2)].

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_x showing that the over-prediction is due to NO_x calculations rather than the NO_x:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict $PM_{10.}$ Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable[(A2)].

REFERENCES

(A1) UK DEFRA (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 - HA207/07 (Document & Calculation Spreadsheet)
(A2) UK DEFRA (2001) DMRB Model Validation for the Purposes of Review and Assessment

APPENDIX 2

Dust Minimisation Plan

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within two hundred metres of the construction area.

In order to ensure mitigation of the effects of dust nuisance, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speeds restricted where there is a potential for dust generation. Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented to rectify the problem.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

NOISE ASSESSMENT

FOR

ALTERATIONS & EXTENSIONS AT THE EXISTING ABBOTT IRELAND PHARMACEUTICAL CAMPUS, MANORHAMILTON ROAD, SLIGO

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EXECUTIVE SUMMARY

Abbott Ireland proposes to apply to Sligo County Council for permission for a site extension at their facility on the outskirts of Sligo town. The proposed expansion of the site is to consider the following:

- The existing Admin. Building (Building 10) which is to be expanded to the east for canteen facilities and offices and to the west for 3 storey laboratories.
- The existing Tableting Building (Building 20) which is to be expanded for more tableting operations.
- The existing Manufacturing Building (Building 40) which is to be expanded for integrated site warehouse operations.
- A new Link structure which is currently in planning, Ref. No. 11/411.
- Ancillary site works such as rerouting roads and underground parking.

This document examines in detail the potential noise impacts of these works on the surrounding area. Abbott's operations are governed by its Integrated Pollution Prevention and Control (IPPC) Licence, which sets noise criteria at noise-sensitive locations around the site.

A review of annual noise monitoring carried out for the site has been completed in order to characterize the receiving environment in the area. It is concluded that site noise emissions do not have a significant impact at existing noise sensitive locations. Ambient and background noise levels are typically dictated by the road network.

Based on noise sources already in existence on the site, calculations have been prepared to reflect the proposals in this planning application. Predictions of the noise levels with the development in place have been carried out. The noise levels at noise-sensitive locations in the vicinity in the site are predicted to remain essentially unchanged in terms of the day to day operations of the site and the associated noise impact is not significant.

Noise calculations have also been prepared to predict expected construction noise levels at nearby noise sensitive locations. The predicted levels are below significant construction noise thresholds derived using guidance contained within British Standard BS 5228 – 1: 2009: *Code of practice for noise and vibration control on construction and open sites – Noise*.

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CONTENTS

1.0 INTRODUCTION

Abbott Ireland have an integrated pharmaceutical campus to the north of Sligo manufacturing both primary medicines and finished tableting products. A proposed expansion of the site is to consider the following:

- The existing Admin. Building (Building 10) which is to be expanded to the east for canteen facilities and offices and to the west for 3 storey laboratories.
- The existing Tableting Building (Building 20) which is to be expanded for more tableting operations.
- The existing Manufacturing Building (Building 40) which is to be expanded for integrated site warehouse operations.
- A new Link structure which is currently in planning, Ref. No. 11/411.
- Ancillary site works such as rerouting roads and underground parking

The site operates under an Integrated Pollution Prevention and Control Licence (IPPC) as issued by the Environmental Protection Agency (EPA).

AWN Consulting have been commissioned to assess the potential noise impact of the proposed developments. Figure 1 illustrates the site in question in the context of the surrounding area.

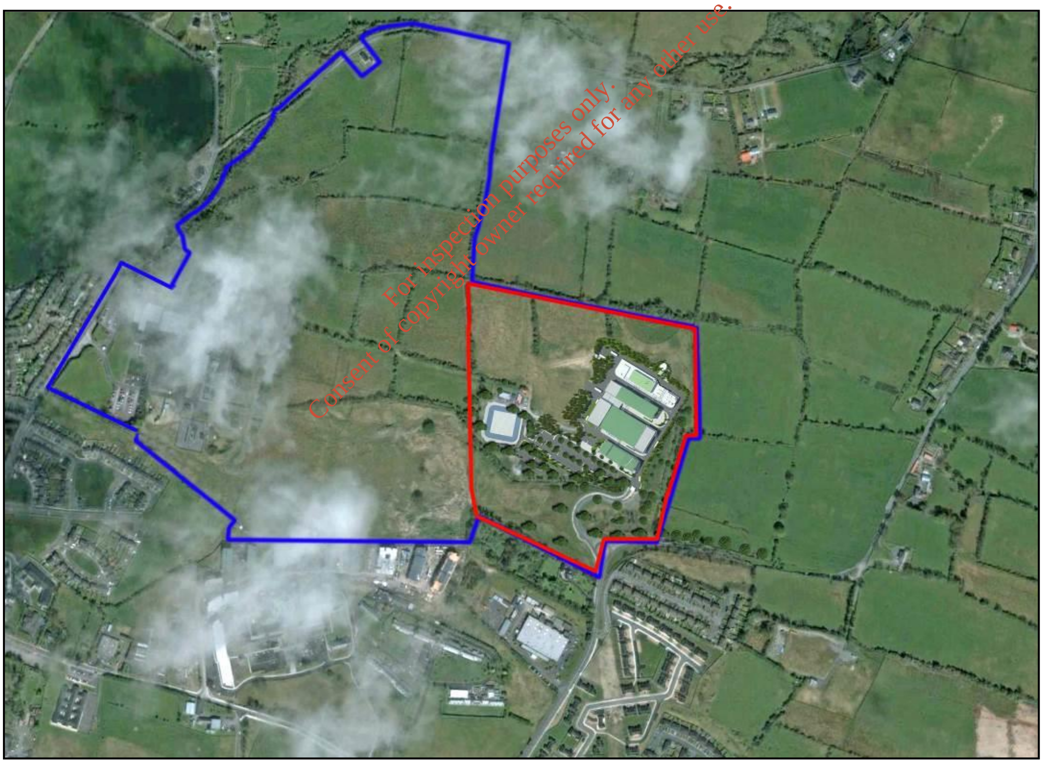

Figure 1 Site Location & Context[1]

The methodology adopted for this noise and vibration assessment is as follows:

- Characterisation of the receiving environment;
- Characterisation of the proposed development;
- Prediction of the noise impact associated with the proposed development;
- Evaluation of noise impacts.

A glossary of the acoustic terminology used in this report is presented in Appendix A.

[1] Subject site shown by red line and Abbott Ireland land holding by blue line

2.0 FUNDAMENTALS OF ACOUSTICS

In order to provide a broader understanding of some of the technical discussion in this report, this section provides a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment.

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. In order to take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates, and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the 'A-weighting' system has been found to provide one of the best correlations with perceived loudness. SPL's measured using 'A-weighting' are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) scale is presented in Figure 2.

The 'A' subscript denotes that the sound levels have been A-weighted. The established prediction and measurement techniques for this parameter are well developed and widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text[2].

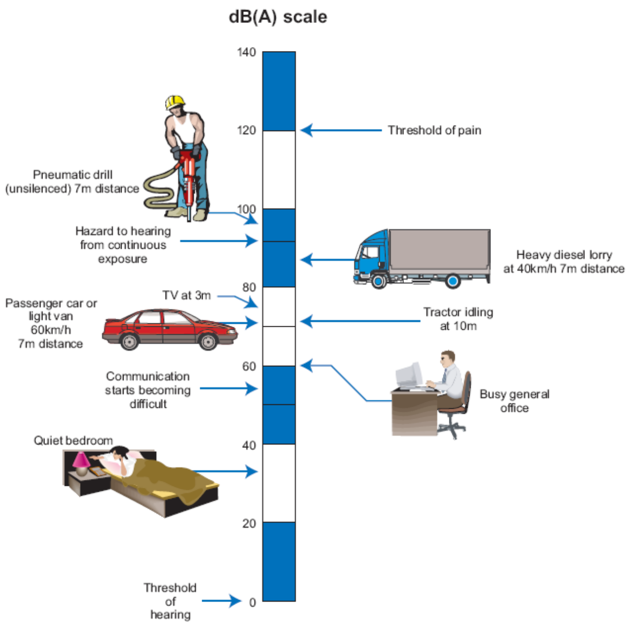

Figure 2 The level of typical common sounds on the dB(A) scale – (*NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004*)

2 For example, *Woods Practical Guide to Noise Control* by Ian Sharland.

3.0 RELEVANT NOISE CRITERIA AND ASSESSMENT LOCATIONS

3.1 Construction Phase

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228 – 1: 2009: *Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded, indicates a significant noise impact is associated with the construction activities.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 1 sets out values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by BS 5228 – 1. These are cumulative levels, i.e. the sum of ambient & construction noise levels.

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings & Weekends [D]	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Table 1 Example Threshold of Significant Effect at Dwellings

Note A: Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B: Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C: Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D: 19:00 – 23:00 weekdays , 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties. For the appropriate construction periods (i.e. daytime) the ambient noise level is determined and rounded to the nearest 5dB. Baseline monitoring carried out as in relation to the site[3] would indicate that the categories detailed in Table 2 are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

Period	Location	Measured Baseline Noise Level L_{Aeq} (dB)	Rounded Baseline Noise Level L_{Aeq} (dB)	Category	Threshold value, in decibels (dB)
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	NSL1	51	50	A	65
	NSL2	45	45	A	65
	NSL3	54	55	A	65

Table 2 Rounded Baseline Noise Levels and Associated Categories

[3] See Section 4.0.

Therefore in instances when construction noise along with baseline noise levels (i.e. cumulative levels) exceed 65dB $L_{Aeq(1hr)}$ at nearby sensitive locations a significant constriction noise impact is deemed to have occurred.

3.2 Operational Phase

It is a requirement of the Integrated Pollution & Prevention Control (IPPC) Licence held by Abbott Ireland (Register Number 755) that environmental noise levels in the vicinity of the site are monitored on an annual basis. Condition 6.9 of the Licence sets out the following requirements in relation to noise:

Condition 6.9 Noise

6.9.1 The licensee shall carry out a noise survey of the site operations annually. The survey programme shall be undertaken in accordance with the methodology specified in the 'Environmental Noise Survey Guidance Document' as published by the Agency.

6.9.2 There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location.

Schedule B4 pertains to noise and specifies the following limits:

B.4. Noise Emissions

Daytime dB(A) $L_{Aeq\ (30\ minutes)}$	Night-time dB(A) $L_{Aeq\ (30\ minutes)}$
55 Note 1	45 Note 1

Note 1: There shall be no clearly audible tonal or impulsive component in the noise emission from the site at any noise sensitive location[4]

Paragraph 4.5 of the Interpretation section of the licence also applies to noise:

4.5 Noise from the installation shall not give rise to sound pressure levels (Leq, 30 min) measured at noise sensitive locations of the installation which exceed the limit value(s).

Noise monitoring and predictions have been conducted at six positions, a number of these being located on the site boundary with the remainder located at noise-sensitive locations. These positions are the same as the noise monitoring locations stipulated in the current IPPC Licence for the site. These locations are described below and shown on Figure 3.

NSL1 Bottom of Yeats Heights, adjacent to the last house. Located to the south of the site.

NSL2 End of cul-de-sac, No. 31 Yeats Heights. Located to the south east of the site.

NSL3 Entrance to the driveway for a number of private residences along the N16 to the east of the site.

Noise monitoring is also carried out on the east, north east and north west boundaries of the site.

[4] Noise sensitive location is defined as – *"Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other installation or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels"*.

Figure 3 Noise Measurement Locations

Assessment of Significance

The assessment of significance of impact involves the assessment of the baseline data and the use of professional judgment. The relationship between the magnitude of increase in noise level and typical perceived impact is shown in Table 3. It shows that small changes in noise levels are not normally noticeable, whereas an increase of 10dB would be described as a doubling of loudness.

Change in Sound Level (dB)	Subjective Reaction	Magnitude of Impact	EPA Glossary of Impacts[5]
0	None	No Change	No Change
0.1 – 2.9	Imperceptible	Negligible	Imperceptible Impact
3 – 4.9	Perceptible	Minor	Slight Impact
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate Impact
10 – 14.9	Over a doubling of loudness	Major	Significant Impact
>15	Over a doubling of loudness	Profound	Profound Impact

Table 3 Significance of Change in Noise Level

5 Environmental Protection Agency – *Guidelines on the information to be contained in Environmental Impact Statements* (Section 5), 2002

4.0 RECEIVING ENVIRONMENT

The content of the annual noise surveys that have been carried out for the site over previous years has been reviewed. Specific details of the various annual noise surveys are contained in the relevant reports as submitted to the EPA. The following table reviews ambient (i.e. L_{Aeq}) and background (i.e. L_{A90}) noise levels indicative of the noise monitoring locations and surrounding areas.

Location	Year	Period	Measured Noise Levels (dB re. 2x10^{-5} Pa)		Comment
			L_{Aeq}	L_{A90}	
NSL1	2011	Day	56	44	Traffic noise is the dominant source at this location. Higher traffic volumes during daytime periods results in higher ambient levels. No significant noise audible from site operations. No tonal or impulsive noise emissions audible from the site.
	2010		54	43	
	2009		56	46	
	2008		51	46	
	2011	Night	52	39	
	2010		56	44	
	2009		49	41	
	2008		53	40	
NSL2	2011	Day	48	39	Traffic noise is the dominant source at this location. Higher traffic volumes during daytime periods results in higher ambient levels. No significant noise audible from site operations. No tonal or impulsive noise emissions audible from the site.
	2010		45	40	
	2009		56	46	
	2008		50	43	
	2011	Night	53	35	
	2010		43	38	
	2009		54	40	
	2008		48	36	
NSL3	2011	Day	63	41	Traffic noise is the dominant source at this location. Higher traffic volumes during daytime periods results in higher ambient levels. No significant noise audible from site operations. No tonal or impulsive noise emissions audible from the site.
	2010		63	44	
	2009		71	45	
	2008		69	40	
	2011	Night	58	33	
	2010		54	37	
	2009		66	34	
	2008		68	34	
BL1	2011	Day	51	48	Plant noise audible (external tank farm pumps, extraction fans, compressed air of pneumatic lines). A level of traffic noise from N16 was also noted during the daytime period.
	2010		53	52	
	2009		52	51	
	2008		53	51	
	2011	Night	49	47	
	2010		52	52	
	2009		52	52	
	2008		--	--	
BL2	2011	Day	48	46	Plant noise audible (cooling towers and utility building, air compressors and boilers). A level of traffic noise from N16 was also noted during the daytime period
	2010		59	57	
	2009		44	42	
	2008		61	51	
	2011	Night	48	46	
	2010		52	51	
	2009		48	47	
	2008		--	--	

Location	Year	Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		Comment
			L_{Aeq}	L_{A90}	
BL3	2011	Day	49	41	Traffic noise from the N16 was a significant source at this location. Distant plant noise audible. Aircraft movement overhead also noted.
	2010		45	43	
	2009		48	45	
	2008		61	51	
	2011	Night	48	41	
	2010		49	48	
	2009		45	42	
	2008		--	--	

Table 4 Review of Annual Noise Monitoring Results

Due to the nature of emissions from the site (i.e. typically continuous and broadband in nature) it is considered that the L_{A90} parameter offers a more accurate reflection of the magnitude of noise emissions at site boundaries and beyond and noise sensitive locations. The arithmetic average of background noise levels measured between 2008 and 2011 is considered to be a worst case assessment of emissions from the site to date. It is noted that at noise sensitive locations plant noise is noted to be inaudible in recent surveys. Therefore actual site noise emissions at NSL1, NSL2 and NSL3 are expected to be a minimum 5dB below the levels detailed in Table 5. The following table outlines the estimated plant noise emissions at noise sensitive and boundary locations.

Location	Period	Estimated Plant Noise Emissions $L_{Aeq,T}$ (dB)
NSL1	Day	~40
	Night	~36
NSL2	Day	~37
	Night	~32
NSL3	Day	~38
	Night	~30
BL1	Day	51
	Night	50
BL2	Day	49
	Night	48
BL3	Day	45
	Night	44

Table 5 Estimated Site Noise Emissions

5.0 PROPOSED DEVELOPMENT

The extent of the proposed extension is detailed in Figure 4. Note detailed descriptions of the proposed works are presented in accompanying reports that form part of the overall planning application. Figure 4 also identifies the approximate locations of significant noise sources associated with the operational phase of the development.

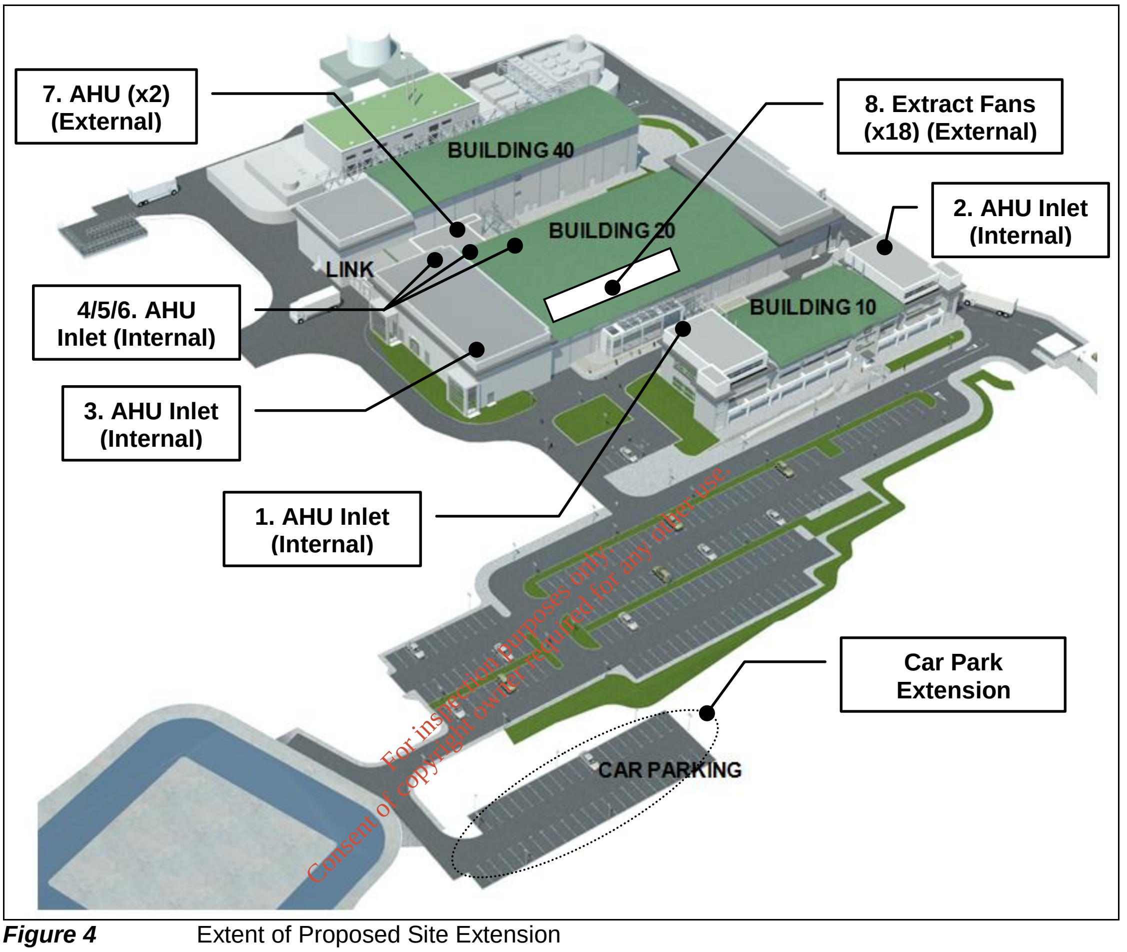

Figure 4 Extent of Proposed Site Extension

The following noise data has been supplied in relation to the items of plant detailed in Figure 4.

1. AHU Inlet (Internal) – L_w at inlet of 75dB(A);
2. AHU Inlet (Internal) – L_w at inlet of 75dB(A);
3. AHU Inlet (Internal) – L_w at inlet of 83dB(A);
4. AHU Inlet (Internal) – L_w at inlet of 84dB(A);
5. AHU Inlet (Internal) – L_w at inlet of 79dB(A);
6. AHU Inlet (Internal) – L_w at inlet of 83dB(A);
7. 2 No. AHU Inlet (External) – L_w breakout of 68dB(A);
8. 18 No. External Extract Fans – L_p at 1m of 65dB(A).

The following assumptions have been made:

- AHU noise emissions typically are detailed in terms of breakout, outlet and inlet levels. Where only one is supplied for a particular unit it is assumed that the quoted level applies to all aspects of noise emission (e.g. if an level of 75dB(A) L_w is stated an outlet level of 75dB(A) L_w and breakout level of 75dB(A) L_w is assumed.

- Standard noise spectra for AHU and extract fans have been obtained from similar plant items contained in the AWN database.
- In terms of AHU's a 3m duct run is assumed between inlet and outlet fans and there intake/outtake emission points.
- In terms of louvred areas a standard single bank acoustic louvres offering a minimum performance as detailed in Table 6 is assumed.

Item	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Louvre	5	4	5	6	9	13	14	13

Table 6 Sound insulation performance requirements, SRI (dB) of Louvres

An additional area of car parking providing some 42 new spaces is also proposed.

6.0 ASSESSMENT OF NOISE EMISSIONS

6.1 Construction Noise Assessment

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as mobile crane, steel cutters, excavators, lifting equipment, dumper trucks, compressors and generators.

Due to the nature of the activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works and lorry movements on uneven road surfaces. Due to the proximity of sensitive locations to potential site access points, the more significant of these is likely to be uneven road surfaces. However, there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings.

Due to the fact that the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, Table 7 indicates typical noise levels that would be expected from the proposed construction site during the various phases of the construction project.

For the purposes of the assessment we have assumed that standard good practice measures for the control of noise from construction sites will be implemented. These issues are commented upon in further detail in the mitigation section of this report.

Description	A-weighted Sound Power Level re 10^{-12} W at Octave Band Centre Frequency (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Crane	82	91	92	99	101	103	93	82	106
Steel Cutting	74	84	88	97	101	101	100	98	107
Dump Truck	70	81	82	92	99	107	92	76	108
Excavator	72	87	93	101	104	101	98	92	108
Front End Loader	83	97	98	104	105	104	97	86	110
Generator	92	95	96	93	86	82	77	70	94

Table 7 Typical Noise Levels Associated with Construction Plant Items

Table 8 presents the predicted noise levels from an indicative construction period on site. Note construction noise sources are assumed to be running 66% of the time.

Location	Measured Baseline Noise Level L_{Aeq} (dB)	Predicted Construction Noise Level L_{Aeq} (dB)	Cumulative Noise Level L_{Aeq} (dB)	Threshold value, in decibels (dB)	Complies?
NM01	51	55	56	65	✓
NM02	45	50	51	65	✓
NM03	54	41	54	65	✓

Table 8 Assessment of Predicted Construction Noise Emissions

There are no items of construction plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the threshold levels outlined in Table 2.

Figure 5 presents a construction noise contour for the indicative construction scenario outlined previously.

Figure 5 Construction Noise Contour

The impact on the noise environment due to construction activities will be transient in nature and mitigation measures will be implemented to minimise the impact of construction activities on the noise environment.

6.2 Operational Noise Assessment

Building Services & Mechanical Plant

A noise calculation model for computing noise levels in the vicinity of the site has been prepared. Calculations are based on *ISO9613-2:1996 Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation*. This method has the scope to take into account a range of factors affecting the sound propagation, including:

- the magnitude of the noise source in terms of sound power;
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- attenuation due to atmospheric absorption;
- meteorological effects such as wind gradient, temperature gradient, humidity (these have significant impact at distances greater than approximately 400m).

Calculations have been performed in octave bands from 63Hz to 8kHz as well as in overall dB(A) terms.

In terms of the calculation, a ground attenuation factor (general method) of 1.0 and no metrological correction were assumed for all calculations. The following atmospheric attenuation was assumed for all calculations.

Temp (^oC)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	80	0.11	0.37	1.02	1.96	3.57	8.79	28.97	104.57

Table 9 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Based on the noise data and assumptions detailed in Section 5.0, along with the information detailed above, the noise levels associated with the proposed plant items have been predicted and are presented in Table 10. Noise levels have been presented to the nearest noise sensitive location at Yeats Heights (i.e. NSL1). The noise levels associated with the new plant items at other noise sensitive locations in the area would be expected to be at worst equivalent to those stated for NSL1 and in most instances be lower due to additional distance, screening and other attenuation factors.

Item	Sound Pressure Level re 10^{-5} Pa at Octave Band Centre Frequency (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
1. AHU (Internal)	4.8	11.2	8.4	5.5	--	--	--	--	14
2. AHU (Internal)	4.8	11.2	8.4	5.5	--	--	--	--	14
3. AHU (Internal)	10.2	16.7	13.7	10.8	4.2	0.2	--	--	20
4. AHU (Internal)	11.2	17.7	14.7	11.8	5.2	1.2	--	--	21
5. AHU (Internal)	6.2	12.7	9.7	6.8	0.2	--	--	--	16
6. AHU (Internal)	10.2	21.7	18.7	15.8	9.2	5.2	--	--	24
7. AHU (External)	5.8	11.2	9.3	7.3	3.6	3.3	--	--	15
8. Extract Fans (External)	--	11.0	24.8	29.0	28.3	26.2	7.6	--	34
Total	16.9	25.1	26.6	29.4	28.4	26.3	7.6	--	34.9

Table 10 Predicted Plant Noise Levels at NSL1

A worst case assessment of all the additional plant items operational at the nearest noise sensitive location yields a level of 34.9dB L_{Aeq}. The exercise has been repeated for NSL2 and NSL3 as detailed in Table 11.

Location	Predicted $L_{Aeq,T}$ (dB)
NSL1	34.9
NSL2	29.8
NSL3	26

Table 11 Predicted Noise Levels Associated with New Plant Items

The predicted noise levels associated with the new plant items can then be added to those associated with the existing site operations (see Table 5) in order to estimate overall site emissions following the works. The results of this exercise are presented in Table 12.

Location	Period	Estimated $L_{Aeq,T}$ (dB)	Predicted New Plant $L_{Aeq,T}$ (dB)	Combined Level $L_{Aeq,T}$ (dB)	Relevant Criterion $L_{Aeq,30min}$ (dB)	Complies
NSL1	Day	~40	34.9	41	55	✓
	Night	~36		38	45	✓
NSL2	Day	~37	29.8	38	55	✓
	Night	~32		34	45	✓
NSL3	Day	~38	26	38	55	✓
	Night	~30		31	45	✓

Table 12 Estimated Combined Site Noise Emissions

The review of the combined specific noise emissions from existing and new plant items concludes that they are within the relevant day and night time noise criteria that are applicable to the site.

The final stage of this assessment review the expected change in overall noise levels in the vicinity of the nearest noise sensitive locations. Tables 13 and 14 review the results of this exercise. Expected increases in terms of overall ambient noise levels (i.e. L_{Aeq}) and background levels (i.e. L_{A90}) have been presented. Note that this is a worst case assessment assuming all new plant items are running simultaneously.

Location	Period	Existing $L_{Aeq,T}$ (dB)[6]	Predicted $L_{Aeq,T}$ (dB)	Change in Level (dB)	Impact
NSL1	Day	54.7	54.7	0.0	No Change
	Night	53.2	53.3	0.1	Imperceptible
NSL2	Day	51.7	51.7	0.0	No Change
	Night	51.3	51.3	0.0	No Change
NSL3	Day	67.9	67.9	0.0	No Change
	Night	64.5	64.5	0.0	No Change

Table 13 Predicted Change in Ambient Noise Levels ($L_{Aeq,T}$)

Location	Period	Existing $L_{A90,T}$ (dB)[7]	Predicted $L_{A90,T}$ (dB)	Change in Level (dB)	Impact
NSL1	Day	44.8	45.2	0.4	Imperceptible
	Night	41.0	42.0	1.0	Imperceptible
NSL2	Day	42.0	42.3	0.3	Imperceptible
	Night	37.3	38.0	0.7	Imperceptible
NSL3	Day	42.5	42.6	0.1	Imperceptible
	Night	34.5	35.1	0.6	Imperceptible

Table 14 Predicted Change in Background Noise Levels ($L_{Aeq,T}$)

Review of the predicted changes in noise level concludes that ambient noise levels will be unchanged and that any predicted increases in background noise levels at noise sensitive locations will be imperceptible. The associated noise impact of the proposed extension, in terms of plant noise is not significant.

<u>Car Park Extension</u>

A car parking extension is proposed to cater for some additional 42 spaces. The location of this car park is shown in Figure 4. A car park of this scale is equivalent to those associated with medium sized retail development. Noise level measurements have previously been conducted by AWN Consulting in the vicinity of car parks in

6 Average L_{Aeq} levels obtained from IPPC noise monitoring (See Section 4.0).
7 Average L_{A90} levels obtained from IPPC noise monitoring (See Section 4.0).

support of other planning applications. The typical noise level 10m beyond the boundary of these car parks during busy daytime periods has been found to be of the order 48dB $L_{Aeq,1hr}$.

Taking into account the attenuation due to distance (e.g. 220m to from the edge of the car park to the nearest noise sensitive location to the south), the predicted noise levels at the nearest noise sensitive locations beyond the southern boundary (i.e. Yeats Heights) of the proposed car park is the order of 20dB $L_{Aeq,1hr}$. Therefore it would be expected that car park activities would be inaudible at these and other locations further distance, and no significant noise impact would be associated with its operations.

Traffic on Public Roads

In terms of the additional traffic on local roads that will be generated as a result of this development the following comment is presented. Some additional truck movements and staff movements will be added to the local road network over a typical working day. Considering that in order to increase traffic noise levels by 1dB traffic volumes would need to increase by the order of 25% it is considered that additional traffic introduced onto the local road network due to this development will not result in a significant noise impact.

7.0 CONCLUSIONS

Abbott Ireland proposes to apply to Sligo County Council for permission for a site extension at their facility on the outskirts of Sligo town. The proposed expansion of the site is to consider the following:

- The existing Admin. Building (Building 10) which is to be expanded to the east for canteen facilities and offices and to the west for 3 storey laboratories.
- The existing Tableting Building (Building 20) which is to be expanded for more tableting operations.
- The existing Manufacturing Building (Building 40) which is to be expanded for integrated site warehouse operations.
- A new Link structure which is currently in planning, Ref. No. 11/411.
- Ancillary site works such as rerouting roads and underground parking

This document examines in detail the potential noise impacts of these works on the surrounding area. Abbott's operations are governed by its Integrated Pollution Prevention and Control (IPPC) Licence, which sets noise criteria at noise-sensitive locations around the site.

A review of annual noise monitoring carried out for the site has been completed in order to characterise the receiving environment in the area. It is concluded that site noise emissions do not have a significant impact at existing noise sensitive locations. Ambient and background noise levels are typically dictated by the road network.

Based on noise sources already in existence on the site, calculations have been prepared to reflect the proposals in this planning application. Predictions of the noise levels with the development in place have been carried out. The noise levels at noise-sensitive locations in the vicinity in the site are predicted to remain essentially unchanged in terms of the day to day operations of the site and the associated noise impact is not significant.

Noise calculations have also been prepared to predict expected construction noise levels at nearby noise sensitive locations. The predicted levels are below significant construction noise thresholds derived using guidance contained within British Standard BS 5228 – 1: 2009: *Code of practice for noise and vibration control on construction and open sites – Noise*.

APPENDIX A
GLOSSARY OF TERMINOLOGY

The noise survey results are presented in terms of the following parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. This parameter is representative of the specific noise from plant when plant is the dominant noise source, i.e. there is no extraneous noise from sources such as traffic.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise. This parameter is representative of the specific noise from plant when there is extraneous noise from intermittent noise sources such as intermittent traffic.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

Another parameter that will be commented upon in this report is the L_{ArT}.

$L_{Ar\,T}$ The L_{Aeq} during a specified time interval, plus specified adjustments for tonal character and impulsiveness of the sound.

It should be noted for this assessment it has been assumed that detailed design of any development that was proposed for the site would be carried out in order that there would be not tonal or impulsive noise emissions associated with the development. Therefore, in this instance L_{Aeq} is equal to $L_{Ar\,T}$.

L_w (sound power level) The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m^2 where:

$$Lw = 10 Log \frac{P}{P_0} \text{ dB}$$

Where: p is the rms value of sound pressure in pascals;
P_0 is 1 pW.

L_p (sound pressure level) The sound pressure level at a point is defined as:

$$Lp = 20 Log \frac{P}{P_0} \text{ dB}$$

Where: P is the sound pressure;
P_o is a reference pressure for propagation of sound in air and has a value of 2×10^{-5}Pa.

SOILS, GEOLOGY AND HYDROGEOLOGY ASSESSMENT

FOR

ALTERATIONS & EXTENSIONS AT THE EXISTNG ABBOTT PHARMACEUTICAL CAMPUS, MANORHAMILTON ROAD, SLIGO

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EXECUTIVE SUMMARY

AWN Consulting Limited (AWN) were commissioned by Environmental Impact Services (EIS) Limited to assess the impact of a proposed alterations and extensions to the existing Abbott Ireland Pharmaceutical Operations (AIPO) manufacturing plant at Manorhamilton Road, Sligo on the surrounding soils, geology and hydrogeology environment. The subject site comprises an existing pharmaceutical manufacturing plant and ancillary facilities.

Baseline soil, geology and hydrogeology data was compiled through an inspection of Geological Survey of Ireland (GSI) geological and groundwater maps and records for the area and a review of borehole logs from previous site investigations for the existing AIPO facility and IPPC and Annual Environmental Report (AER) documents for the existing facility.

The subject site is underlain by a Locally Important Bedrock Aquifer (LI), which is described by the GSI as bedrock that is moderately productive only in local zones. The Carboniferous Limestone (Glencar Formation) underlies the site. Based on borehole logs, the depth to bedrock varies across the site from 2.7m to 6.2m below ground level (BGL). The bedrock encountered was described as grey limestone with some weathered/broken and fissured stratum.

The subsoils and soil beneath the site comprise primarily shales and sandstone tills. The subsoil information from the borehole logs of boreholes drilled on site in 2003 describes the subsoils on the site as loose sandy Clay ranging in thickness from 0.5m to 5m.

The bedrock aquifer beneath the subject site has been classed as *High* with a small strip classified as *Extreme*. There are no karst features on the site. Borehole logs indicate that water was encountered in the bedrock at approximately 5.6m BGL. Based on water level monitoring conducted at the site, the ground water flow across the site is expected to be south-westerly in direction, towards the coast. The quality of the groundwater is assessed bi-annually as part AIPO IPPC licence compliance requirements. A review of the groundwater quality results from the last three years (as detailed in the AIPO AER's) show that the groundwater quality is generally in compliance with the EPA Interim Guideline Values and Drinking Water Regulations (S.I. No. 278 of 2007) with the exception of elevated concentrations of electrical conductivity, COD, ammonia, chloride, sulphate, orthophosphate and manganese which are also elevated in the well up-gradient of the site, indicating that the source is off-site.

According to the GSI National Draft Gravel Aquifer Map for the region, the subject site is not underlain by a gravel aquifer.

Excavations of the soils and subsoils will be required to facilitate construction of foundations, underground tanks, underground utilities and additional car parking areas. There will be no direct discharges to the soils and groundwater environment during the construction or operational phases of the development.

The potential impacts on the soils, geology and hydrogeology during the construction phase include the permanent removal of soils/subsoils, contamination of watercourses due to silt laden run-off, contamination of soils and groundwater due to concrete run-off and the spillage or leaks of fuels. The potential impacts during the operational phase include contamination of the soil and hydrogeology environment from fuel and/or chemical spills or leaks.

The mitigation measures for the construction phase include minimising disturbance of soils, carefully managing stockpiles of soil, assessing soil for signs of contamination, re-using soil on-site (where possible), controlling silt laden run-off, the use of bunded areas for storing fuel, oil, solvents, paints, refuelling only in designated areas, the use of spill kits, spill training, double skinned fuel tanks, concrete mixing off-site and adherence to the AIPO Environmental Management Plan (EMP).

The mitigation measures proposed to be put in place during the operational phase will include control of surface water runoff, the use and maintenance of hydrocarbon interceptors, bunded tanks/drum storage, adherence to the AIPO EMP, loading/unloading of chemicals in bunded areas and regular integrity testing of bunds, drains and lines and bi-annual groundwater monitoring.

The combined application of these measures will ensure that inputs to, and subsequent contamination of, the soil and hydrogeology environment do not occur during normal and/or emergency conditions and ensure that the impact of the proposed development on the soils, geological and hydrogeological environment will be **imperceptible**.

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CONTENTS

1.0 INTRODUCTION

AWN Consulting Limited (AWN) were commissioned by Environmental Impact Services (EIS) Limited to assess the impact of a proposed alterations and extensions to the existing Abbott Ireland Pharmaceutical Operations (AIPO) manufacturing plant at Manorhamilton Road, Sligo on the surrounding soils, geology and hydrogeology environment.

The existing pharmaceutical manufacturing plant was constructed in 2001 and prior to this the site was primarily used for agricultural, livestock grazing. It is propose to extend a number of the buildings on the existing site

The proposed extension will comprise the following:

- 2 no. 3 storey extensions to the existing Administration/ Laboratory Building approximately 1661m² in area, (height 15.6 metres) located to the east and west of this facility and alterations to the existing south façade;
- 2 no, single storey extensions approximately 2072m² in area, (height 13.5 metres) to the existing Production/Tableting Building with internal mezzanines, located to the east and west of this facility;
- An extension to the existing single storey high bay Warehouse (including relocated docks) to the west of the existing 3 storey Manufacturing Building approximately 380m² in area (height 16.6 metres);
- The proposed works also include an inter-building 2 storey Link approximately 787m² in area, (height 13.5m metres) directly located to the west of a proposed link currently subject to planning (planning reference number 11/411);
- Alterations to building facades to include roof mounted equipment, external stairs and miscellaneous single storey porches to all buildings; and
- Ancillary works include 42 no. additional car spaces and revisions to roads and services, including pipe bridges, bunded tanks with canopy over and revised landscaping.

The expansion of the site will require excavation works and they will be as follows;

- Foundations for new building extensions
- A new underground process water tank and pump
- Underground utilities (Fire Main, Foul Water, Surface Water, Process Water and LV Electrical Ducting) in the footprint of the new buildings will be diverted to allow for the construction of the new extensions.
- Expansion of car parking areas

The potential impacts and mitigation measures for soils, geology and hydrogeology for the construction and operational phase of the proposed development are set out in the following sections.

2.0 ASSESSMENT METHODOLOGY

The assessment of the potential impact of the proposed extension on the soil, geology and hydrogeology environment was carried out according to the methodology specified by the Environmental Protection Agency (EPA) [1, 2]. The Institute of Geology in Ireland (IGI) Guidelines on geology in EIS [3] were also followed in the preparation of this report.

The following sources of information were consulted to establish the baseline soil, geology and hydrogeology environment:

- The Geological Survey of Ireland (GSI) well card and groundwater records for the area were inspected, with reference to hydrogeology [4];
- Ordnance Survey of Ireland (OSI) Discovery Series 1:50,000 Map Series, No.25, Sligo Leitrim and Roscommon [5]
- GSI, Geology of Sligo - Leitrim, Sheet 7, 1:100,000.
- The Geological Heritage of Sligo: An Audit of County Geological Sites in Sligo. (McAteer, C and Parkes, M., 2004) [6]

From the GSI databases, the following information was reviewed:

- Soil Map;
- Bedrock Geology Maps;
- Quaternary (Subsoils) Maps;
- Well Card Database (Groundwater Wells);
- Historical Geological 6 inch:1 mile maps; and
- Database of Site Investigations/Surveys.

In addition, the following documents and logs were reviewed:

- AIPO IPPC Licence (Reg. P0643-02) [7]
- AIPO Annual Environmental Reports 2006 – 2010 [8];
- Borehole logs for boreholes drilled at the AIPO facility in 1997 and 2003.

3.0 RECEIVING ENVIRONMENT

The site is located in townlands of Ballytivnan and Rathbraughan, Co. Sligo and is accessed from the N16, Sligo to Manorhamilton Road, 2km north of Sligo Town. The overall site area is approximately 47 hectares (116 acres) comprising of a number of fields. The overall site has an "L" shape and the site topography is defined by 2 valleys oriented east-west separated by a central spine plateau area. The elevations range from a low of 8 m OD (ordnance datum) in the south-western end to a high of 40m OD at the north eastern end. This overall site bounds the existing Abbott Ireland, Ballytivnan plant to the west, private housing (Yeats Heights) to the south east, the Bellanurly Stream, a tributary of Willsborough Stream, approximately 0.5km to the north and west of the site and, the Clarion Hotel and the Sligo and Leitrim Mental Health Services building to the south west. The existing pharmaceutical manufacturing plant is situated to the east of this overall site and is approximately 12.5 ha (31 acres) in extent.

3.1 Bedrock Geology

Reference to the GSI Bedrock Geology Map for Sligo and Leitrim (Sheet 7) indicates that the subject site is underlain by Carboniferous limestones (Holkerian Stage) of the Glencar Limestone formation. This geological formation comprises argillaceous calcisiltite, very fine calcarenite limestone, interbedded with dark calcareous shale and is locally abundant. The GSI online database maps indicate that the site is underlain by Dinantian Upper Impure Limestones (DUIL). The Bedrock Geology Map for the site and surrounding area is included as Figure 1.

There are no geological faults indicated beneath the subject site on the GSI bedrock geology maps but a geological fault is indicated within circa 1.5km to the north of the

subject site (Figure 1). A geological fault is also indicated approximately 3km to the east of the subject site. Geological faults in the area would be expected to influence the local hydrogeological regime to some extent because they would facilitate groundwater flow. It should be noted, however, that the location of geological faults on bedrock maps by the GSI is indicative only.
As part of a site investigation for the planned development of the existing AIPO facility in 2003, 4 no. boreholes were drilled at the site. The borehole logs recorded the soil, subsoil and bedrock strata depths. These borehole logs indicate that the depth to bedrock varies across site from 2.7m to 6.2m below ground level (BGL). The bedrock encountered was described as grey limestone with some weathered/broken and fissured stratum encountered. This site specific information is consistent with the GSI bedrock mapping for the area.

3.2 Drift Geology

The Quaternary geological period extends from about 1.5 million years ago to the present day and can be sub-divided into the Pleistocene Epoch, which covers the Ice Age Period to 10,000 years ago, and the Holocene Epoch, which extends from 10,000 years ago to the present day.

As the ice travelled over the ground, it eroded the underlying bedrock, which resulted in the formation of sediment beneath and within the ice sheet. The particle size distribution of the sediment varied greatly and ranged from clay particles to large boulders. This material has been labelled glacial till or boulder clay and is the most widespread soil type in Ireland. If conditions were suitable, sediment was also deposited as distinct bands of sand, gravel, silt and clay. Glacial till can range in thickness from less than 1m thick to tens of metres in depth.

The EPA subsoil mapping indicates that the subsoils underlying the site primarily comprise shales and sandstone tills (See Figure 2). The Teagasc subsoil map of Ireland illustrates the soil covering the site to be predominantly Tills derived chiefly from Namurian rocks (TNSSs). The map also illustrates a narrow strip of Alluvium located in the southern area of the site.

3.3 Soils

The soils distribution across the study area is provided on the EPA/Teagasc Soils Map. The map identified podzolics, gleys and alluvium as the distinct soil types that exist in the general area. Figure 3 shows the soils map for the site and surrounding areas.

Podzolics (Acid Brown Earths Brown Podzolics)

This is a well drained, acid mineral soil which is derived from sandstone, shale or granite parent material. They are less depleted of nutrients than podzols and the surface layer contains organic material and is intimately mixed with mineral matter. Brown Podzolics are often extensively cultivated by cropping and pasture production. Their inherent low nutrient status can be overcome by addition of lime and fertiliser.

Gleys (Surface water Gleys, Ground water Gleys)

Gleys are soils in which the effects of drainage impedance dominate and which have developed under the influence of permanent or intermittent waterlogging. The impedance may be due to a high water table, to a 'perched' water table caused by the impervious nature of the soil itself, or to seepage of runoff from slopes. Most gleys have poor physical conditions, which make them unsuitable for cultivation or for intensive grassland farming. Their productive capacity is also affected by restricted growth in spring and autumn.

Alluvium

Alluvium is sediment that is usually deposited by flowing water.

In 2003, 4 no. boreholes were drilled at the site by Bord na Mona. The borehole logs describe the subsoils on the site as loose sandy Clay ranging in thickness from 0.5m to 5m.

In summary, the geological sequence underlying the site, based on the available baseline information is expected to be as follows:

- *Hardstanding (Tarmac/Paving)*
- *Topsoil (possibly)*
- *Made Ground (possibly)*
- *Glacial Tills*
- *Limestone*

3.4 Hydrogeology

3.4.1 Aquifer Classification

Reference to the GSI National Draft Bedrock Aquifer Map for the subject site (see Figure 4) indicates that the site is underlain by a Locally Important Bedrock Aquifer (LI), which is described by the GSI as bedrock that is moderately productive only in local zones. The primary characteristic of the bedrock aquifer beneath the subject site is that the Glencar limestone is not a uniform bed of limestone but has with shale beds running through the limestone beds which are unfavourable in the context of groundwater flow. This classification refers to the Glencar Limestone bedrock.

According to the GSI National Draft Gravel Aquifer Map for the region, the subject site is not underlain by a gravel aquifer.

The GSI mapping shows no karst features on the subject site but the mapping shows karst features approximately 4.5km east of the site in Magheraghanrush, Co. Sligo. These karst features are caves. Figure 5 illustrates the karst features.

The six-inch map for the site shows a well in the centre of the site but there is no further information available for this well.

3.4.2 Aquifer Vulnerability

Reference to the GSI Interim Vulnerability Groundwater Map (see Figure 6) indicates that the vulnerability of the majority of the bedrock aquifer beneath the subject site has been classed as *High* with a small strip classified as *Extreme*. This indicates the presence of between 3m and 10m of low permeable subsoils overlying the bedrock aquifer and a small area with 0 – 3m of low permeability subsoils overlying the bedrock aquifer. This is consistent with the ground conditions indicated by the borehole logs.

3.4.3 Groundwater Levels & Quality

The borehole logs show water was encountered in the bedrock at depths of approximately 5.6m BGL. These were slight ingresses of water in the weathered bedrock. The topographical gradient of the site is from northeast to southwest and it has been noted during monitoring of the wells that the groundwater flow appears to follow this gradient.

There are currently 4 no. monitoring wells on the site (MW-1, MW-2, MW-3 and MW-4). Based on the predicted direction of groundwater flow, MW-1 is located hydraulically upgradient of the site and MW-2, MW-3 and MW-4 are located hydraulically downgradient.

Biannual monitoring of the groundwater quality is carried out at the 4 no. monitoring wells on behalf of AIPO as part of their IPPC licence compliance monitoring.

Although these monitoring wells are not used as a potable drinking water supply, the results of monitoring are compared to the EPA's Interim Guideline Values (IGV's) for groundwater's and the limits set by the Drinking Water Regulations (S.I. No. 278 of 2007) for comparison purposes as there are no emission limits set for groundwater under the IPPC licence.

A review of the groundwater quality results from the last three years (as detailed in the AIPO AER's for 2010, 2009 and 2008) show that the groundwater quality is generally in compliance with the aforementioned criteria with the exception of elevated concentrations of electrical conductivity, COD, ammonia, chloride, sulphate, orthophosphate and manganese. The monitoring results from MW-1 monitoring well (upgradient of AIPO facility) show that these elevated concentrations of these parameters are already present in the baseline groundwater up-gradient of the site.

The AIPO is located in a rural agricultural area. The groundwater monitoring reports suggested that the elevated concentrations levels may all be related to agricultural activities upgradient of the site (e.g. fertilizer application, landspreading) and not from the AIPO site.

3.5 IPPC Compliance

The EPA conducts regular audits of the site in accordance with the IPPC licence. Based on a review of the EPA inspection reports over the last three years, AIPO have consistently been in compliance with the conditions of their IPPC licence relevant to soils and hydrogeology.

An incidents log is kept as part of IPPC licence and published in the AER. The logs for the last three years have been reviewed and there were no incidents reported in the log which could have impacted on the soils, geology and hydrogeology of the site and surrounding area.

4.0 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

As detailed in Section 1.0, the existing AIPO buildings are to be altered and extended. Excavations of the soils and subsoils will be required to facilitate construction of foundations, underground tanks, underground utilities and additional car parking areas.

During the construction and operational phase of the proposed extension there will be no direct discharges to the soils and groundwater environment.

5.0 POTENTIAL IMPACTS

The potential impacts of the construction and operation phases of the development in terms of the soils, geology and hydrogeology environment are detailed in this section.

5.1 Construction Phase

Construction of the proposed extension will involve excavations of soil/subsoil to facilitate the construction of foundations, the installation of underground services and construction of additional car park. Soil/subsoil excavated will be reused as fill material on other sections of the site where possible. Excess inert soils/subsoils excavated that are not required for use as fill on site will be disposed of or re-used offsite. The removal soils/subsoils will have a permanent impact on the soils, geology and hydrogeology environment. However, as the soil is of no particular interest or importance, the potential impact is not considered to be significant.

The nature of the construction activities will involve the stripping vegetation and soil and the stockpiling of topsoil and other excavated material. There is the potential that rain falling on such stockpiles may result in slippage and a washout of sediments, which may affect the water quality of nearby watercourses.

It is not envisaged that bedrock will be encountered during the excavations required to facilitate construction. The borehole logs for indicated that the bedrock is 2.7m – 6.2m BGL. This is below the anticipated maximum depth of the excavations required.

Concrete will be required on site to facilitate construction of the new build; therefore there is the potential for washout of this material to the soil and groundwater environment. Concrete (specifically, the cement component) is highly alkaline and any spillage could adversely impact on groundwater quality.

During the construction phase there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of oils, fuels and chemicals stored on site.
- Spillage or leakage of oils and fuels from construction machinery or site vehicles.
- Spillage of oil or fuel from refueling machinery on site.

Accidental spillages may result in contamination of the soil or groundwater environment.

In relation to the construction phase the potential impact on the soils, geology and hydrogeology is considered to be **slight-moderate**.

5.2 Operational Phase

There will be no direct discharges to the soil/groundwater environment during the operational phase.

There is a potential for leaks and spillages during operation and maintenance of the extension. Any accidental emissions of chemicals, oil, petrol or diesel leaks could cause contamination if they enter the soil and/or groundwater environment.

In relation to the operational phase the potential impact on the soils, geology and hydrogeology is considered to be **slight**.

6.0 MITIGATION MEASURES

In order to minimise the potential impacts from the development, the following mitigation measures will be implemented to ensure that contamination of soils and groundwater does not occur.

6.1 Construction Phase

Excavation of soils/subsoils will be required to facilitate construction of the foundations, car parking and rerouting and installation of underground services for the new build. The construction works are planned to be carried out with the least feasible disturbance of soils. Where soil stripping occurs the resulting excavated soil fractions will be separated into topsoil and subsoil stockpiles. Temporary storage of spoil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. If all soil excavated at the site is not to be re-used on the site it will be removed by a permitted/licensed waste contractor.

All excavated soils will be visually assessed for signs of possible contamination such as staining or strong odours, which may have occurred from leaks or spills from construction machinery or from historic activities at the site. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that contamination has not occurred. Should it be determined that any of the spoil excavated is contaminated, this will be dealt with appropriately as per the Waste Management Acts of 1996 – 2008 and associated Regulations.

To minimise any impact on the underlying subsurface strata from material spillages, all fuels, oils, solvents and paints used during construction will be stored within specially constructed, dedicated, temporary bunded areas or in bunded containers. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s).

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area of the site. Spill kits and hydrocarbon adsorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. Should it not be possible to bring a vehicle to the refuelling area, fuel shall be delivered using a double-skinned mobile tank. Refuelling operations will use drip trays to collect any minor leaks or spills. A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their Environmental Management Plan (EMP) and will be implemented during the construction phase of the proposed development.

Concrete will be mixed off–site and imported to the site. The pouring of concrete will take place within a designated area using a geosynthetic material to prevent concrete runoff to the soils, geology and hydrogeology environments. The wash down of concrete transporting vehicles will take place at concrete batching facilities with the appropriate infrastructure.

The removal soils/subsoils will have a permanent impact on the soils, geology and hydrogeology environment. However, as the soil is of no particular interest or importance, the potential impact is not considered to be significant. The combined application of these mitigation measures and the AIPO EMP will help ensure that inputs to, and subsequent contamination of, the soils, geology and hydrogeology environments do not occur during normal and/or emergency conditions and that the impact will be **imperceptible**.

6.2 Operational Phase

In order to prevent the potential contamination of soils, geology and hydrogeology by surface water runoff containing oil/solids from the car parking and service yard areas during the operational phase, an appropriately sized hydrocarbon interceptor will be used to contain any hydrocarbons.

A regular inspection and maintenance/desludging programme will be implemented whereby any oil/solids/debris trapped within the interceptor will be removed and disposed of by an appropriately licensed EPA approved waste disposal contractor.

The site use chemical substances which have the potential to cause ground pollution if not handled, stored and transported correctly. All tank and drum storage areas are bunded on-site. Any oil and chemical product, waste storage or transfer areas are locally bunded with the design of all bunds conforming to standard bunding specifications - BS8007-1987. All oil and fuel storage tanks will be stored in designated areas with an impervious base. These tanks will be areas which will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). As part of AIPO's EMP, all loading and unloading of chemicals, takes place in designated bunded areas and the integrity of these bunds are assessed annually. Foul drains and doubled contained lines will be appropriately maintained and checked for leaks every three years as part of AIPO's IPPC Licence compliance. A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their EMP and will be implemented as part of the operational phase of the proposed extension.

Groundwater monitoring will continue to be monitored bi-annually as part of the AIPO IPPC licence monitoring requirements. This will ensure that quality of the groundwater in the bedrock aquifer is continuously monitored.

Provided these mitigation measures are implemented, the impact on the soils, geology and hydrogeology of the site and surrounding area will be **imperceptible**.

7.0 RESIDUAL IMPACT

The proposed development will have an **imperceptible** residual impact on the soils, geology and hydrogeology environment provided the mitigation measures outlined in Section 6.0 and the AIPO's EMP are implemented during the construction and operational phases.

8.0 MONITORING

Monitoring of the groundwater quality in accordance with the IPPC licence compliance monitoring requirements will be carried out biannually.

All bunds, interceptors, retention pond, flow control device will be inspected regularly and in particular after heavy rainfall events to ensure that they are not blocked or overflowing.

A regular inspection and maintenance/desludging programme will be implemented whereby any oil/solids/debris trapped within the interceptor will be removed and disposed of by an appropriately licensed EPA approved waste disposal contractor.

A site-wide spill control programme including monitoring is in place on the AIPO site which is implemented as part of their EMP and will be implemented as part of the construction and operational phases of the proposed development.

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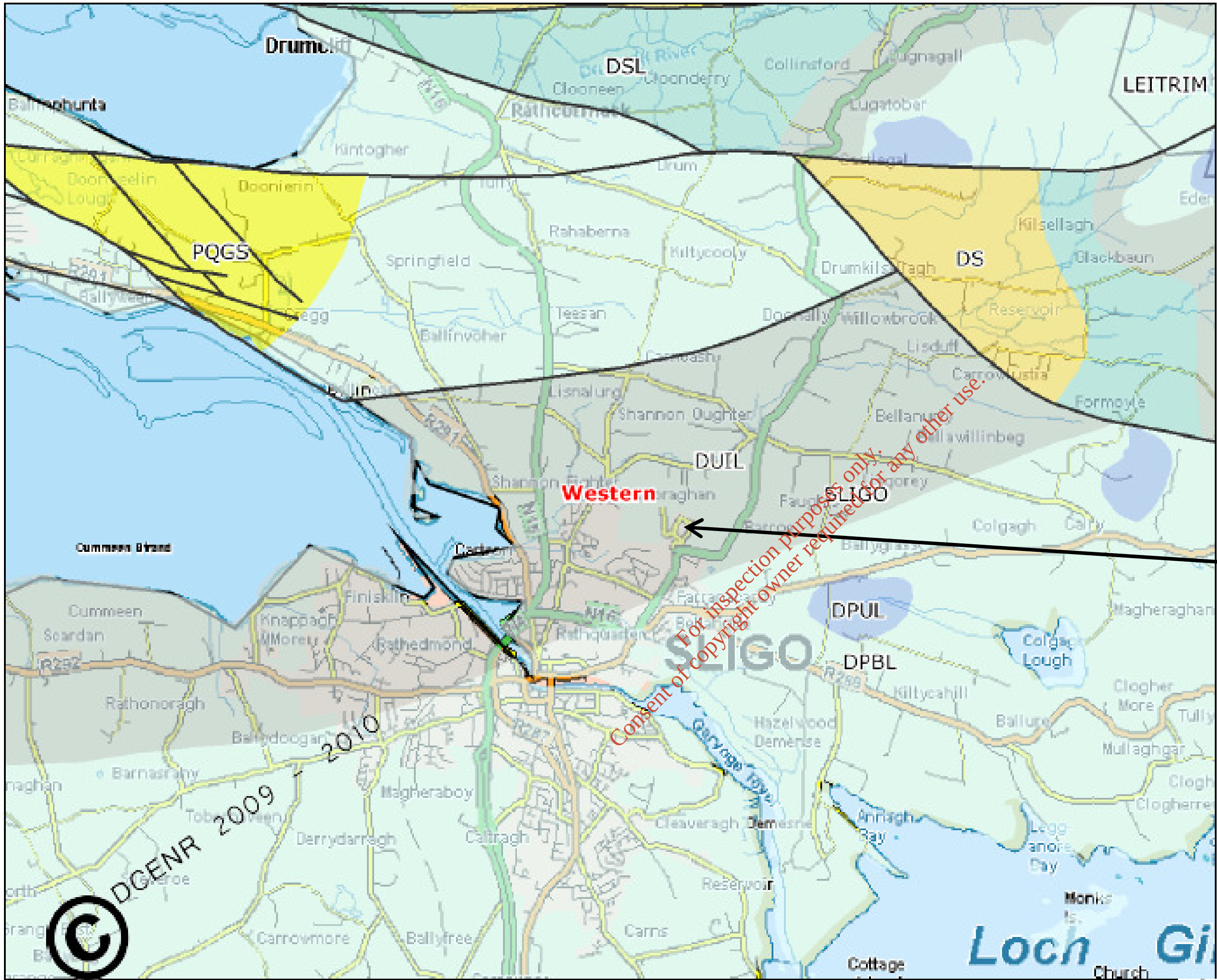
7. Integrated Pollution Prevention Control Licence (Reg. P0643-02) for Abbott Ireland Pharmaceutical Operations, Manorhamilton Road, Sligo.
8. Abbott Ireland Pharmaceutical Operations Annual Environmental Reports 2006 – 2010.



Legend

Bedrock Faults 100k

National Draft Generalised Bedrock Map

- BV - Basalts and other Volcanic rocks
- CM - Cambrian Metasediments
- DDL - Dinantian Dolomitised Limestones
- DESSL - Dinantian early Sandstones, Shales and Limestones
- DKS - Devonian Kiltorcan type Sandstones
- DLIL - Dinantian Lower Impure Limestones
- DMSC - Dinantian Mudstones and Sandstones Cork Group
- MSSL - Dinantian Mixed Sandstones, Shales and Limestones
- DORS - Devonian Old Red Sandstones
- DPBL - Dinantian Pure Bedded Limestones
- DPUL - Dinantian Pure Unbedded Limestones
- DS - Dinantian Sandstones
- DSL - Dinantian Shales and Limestones
- DUIL - Dinantian Upper Impure Limestones
- GII - Granites and other Igneous Intrusive rocks

Site Location

0 1.5 3 4.5 km.

Map center: 169905, 337758

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Project

AIPO Extension

Reference

KF/11/5727SR01

Figure 1

Draft Bedrock Geology Map

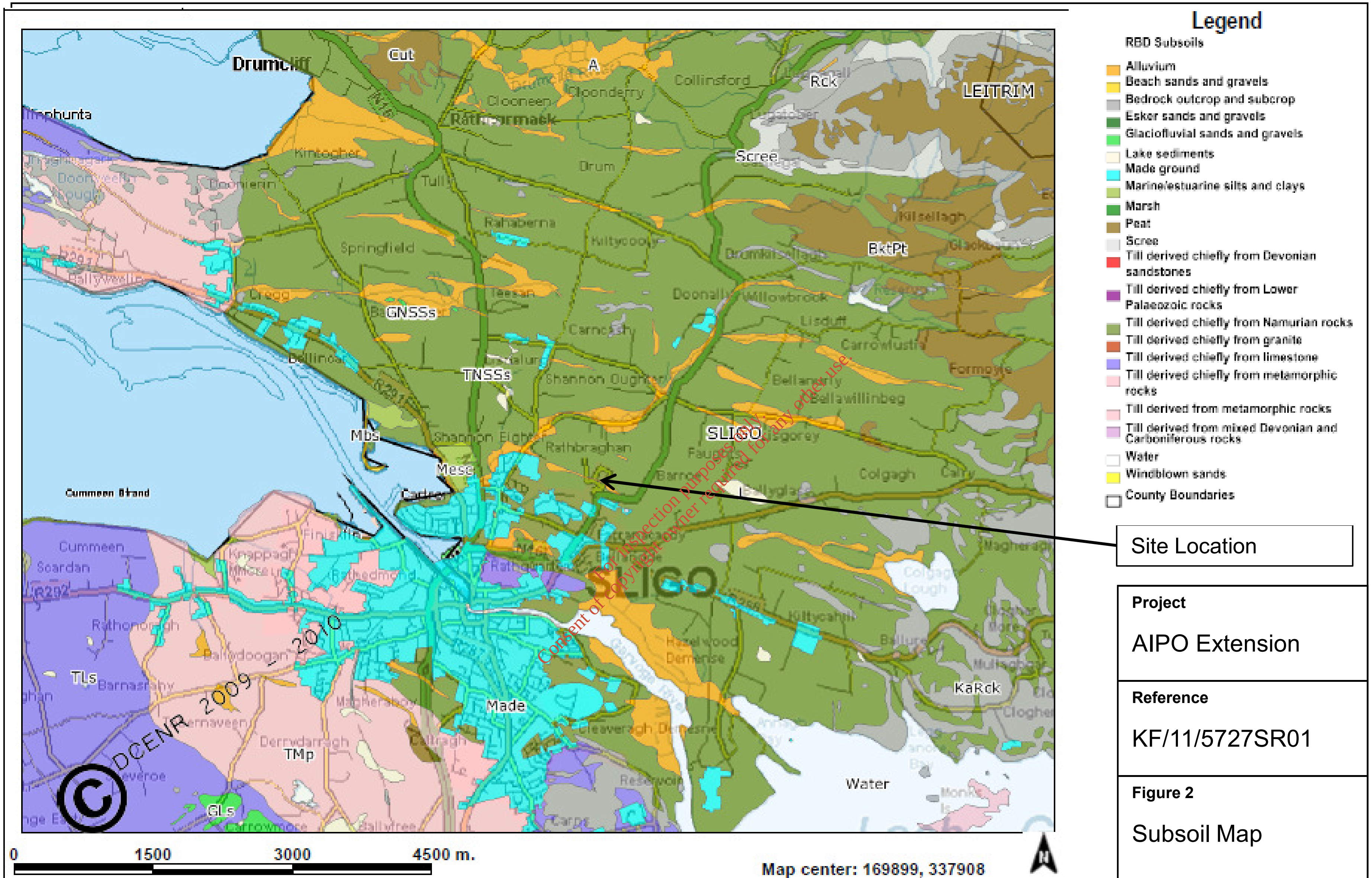

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Figure 2

Subsoil Map

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Soils

- AeoUND - Aeolian Undifferentiate-d
- AlluvMIN - Mineral alluvium
- AlluvMRL - Marl type soils
- AminDW - Acid Brown Earths / Brown Podzolics
- AminPD - Surface water Gleys / Ground water Gleys, Acidic
- AminPDPT - Peaty Gleys, Acidic

Site Location

Project

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Reference

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Figure 3

Soils Map

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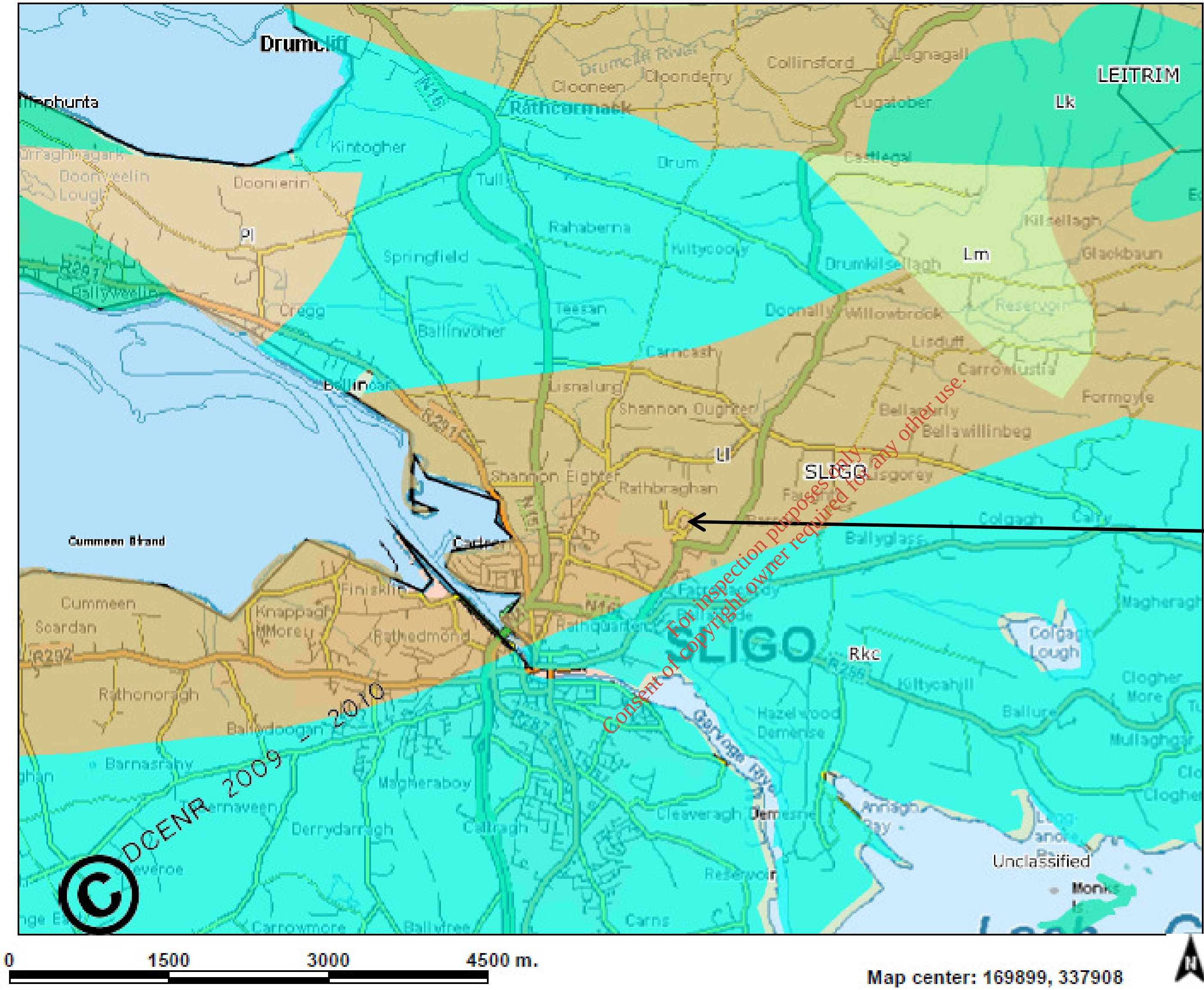

Project
AIPO Extension
Reference
KF/11/5727SR01
Figure 4
Aquifer Classification Map

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Legend

Karst Features

- Borehole
- Cave
- Dry Valley
- Enclosed Depression
- Estevelle
- Spring
- Superficial Solution Features
- Swallow Hole
- Turlough
- County Boundaries

Site Location

Project

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Figure 5

Karst Features Map

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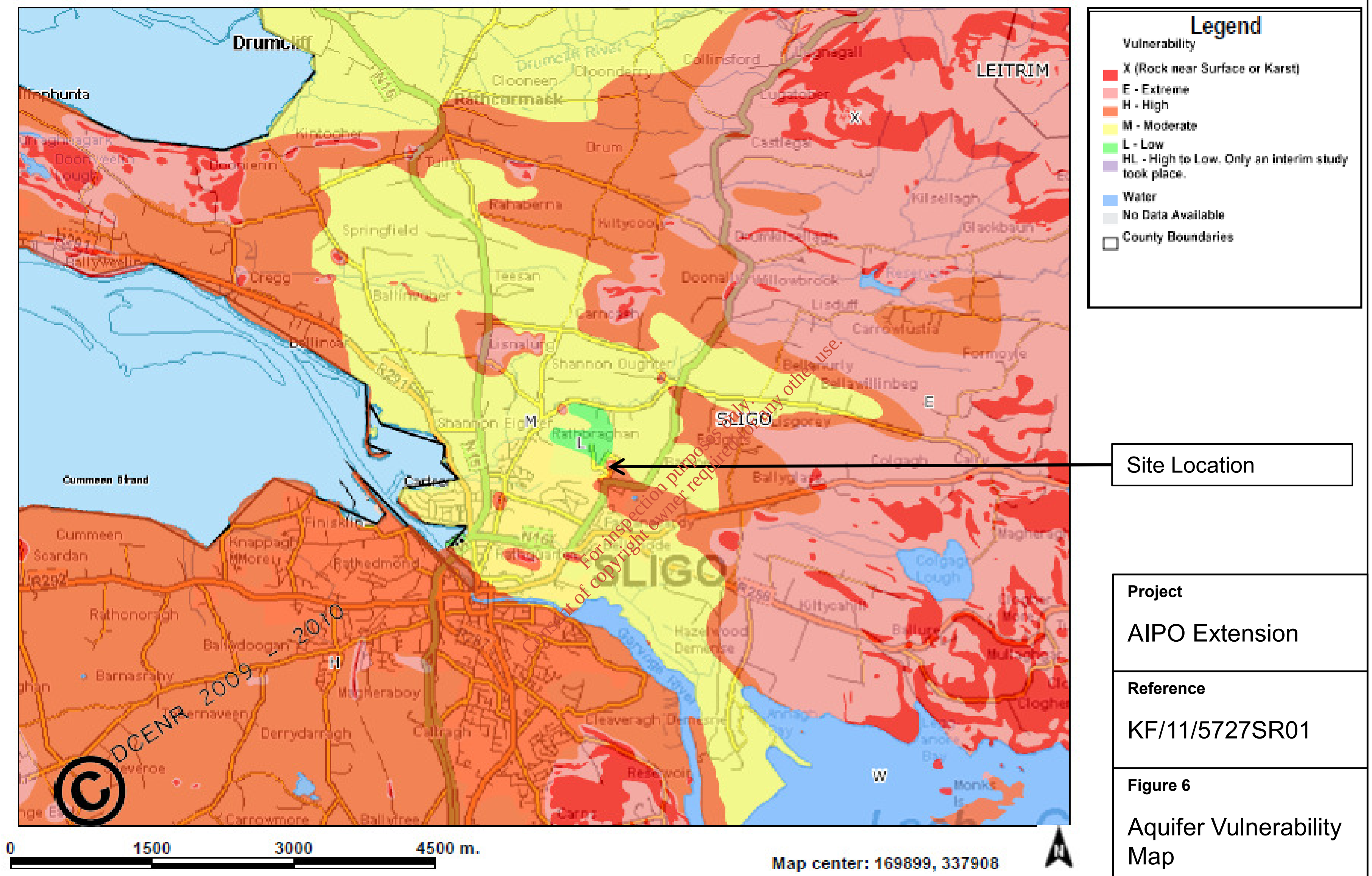

Project

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Reference

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Figure 6

Aquifer Vulnerability Map

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LANDSCAPE & VISUAL IMPACT ASSESSMENT

FOR PROPOSED

ALTERATIONS & EXTENSIONS OF

ABBOTT IRELAND PHARMACEUTICAL FACILITY

MANORHAMILTON ROAD, SLIGO

by:

Environmental Impact Services

2nd Floor
The Courtyard
25 Great Strand Street
Dublin 1

22 FEBRUARY 2012

Contents

1. Introduction

This section describes the likely impact on the landscape in accordance with the EIA Regulations. In practice (and according to the EPA Guidelines and Advice Notes) this topic covers changes to the appearance and character of the landscape. The appearance is dealt with as 'Visual Impacts' and is examined using a series of computer simulated views. Impacts on the character of the landscape refers to the way in which changes in landuse cause a series of environmental topics – such as noise, emissions, traffic, as well as visual impacts – to interact so as to alter the perception of the place.

2. Proposed Development

Abbott Ireland have an integrated pharmaceutical campus to the north of Sligo manufacturing both primary medicines and finished tabletting products.

The attributes of the project which are likely to give rise to landscape and visual effects are:-

The existing facility is on a site located in Ballytivnan, Co. Sligo which is accessed from the N16, Sligo to Manorhamilton Road. The site is aprox 47 ha. The elevations range from a low of 8 m OD (ordnance datum) in the south-western end to a high of 40m OD at the north Eastern end.

The current Abbott facility consists of 4 blocks, which represent the four primary Buildings:

The proposed expansions are as follows:

- The existing Admin. Building (Building 10) is to be expanded to the east for canteen facilities and offices and to the west for 2 storey laboratories.
- The existing Tableting Building (20) is to be expanded for more tableting operations.
- The existing Manufacturing Building (40) is to be expanded for integrated site warehouse operations.
- A new Link structure which is currently in planning.
- Ancillary site works such as rerouting roads and parking

These are illustrated in the diagram following;-

Fig 1 Schematic representation of principal elements of proposed development

3. Existing Environment

Context and Character

The landscape immediately north of Sligo consists of a series of shallow, steep sided, east to west oriented valley. These create a series of small, largely self contained landscape units which consist of small fields bounded by overgrown hedgerows of ash and hawthorn. Roads are generally oriented east to west and they support concentrations of private residences – in significant numbers in the immediate environs of Sligo.

The site of the proposed development is typical of these conditions, though modified by its close proximity to Sligo Town. The development site occupies the legal (i.e. County Council to Corporation) and land-use transition from the countryside to urban fabric. A mixture of health care institutional buildings and residences occupy the lands which overlook the development site from the south and south east. The existing Abbott Ireland industrial plant closes the valley to the west while the north and north-east are enclosed by steep slopes which are used for low intensity livestock production. The development site is overlooked from the south east by the N16 – a national primary route.

Significance of the Existing Environment

Sligo is an important tourism centre in the north west and the area north and east of the town (including Ben Bulben, Kings Mountain ,Glencar) contains some of its most important scenic resources.

The development site itself and its immediate natural environs are a type of landscape which is common in the area and is visually robust[1] on account of the number of small and visually self-contained valleys

In this area whenever topography and vegetation combine to provide open views from elevated stretches of road there are fine views of the adjacent mountain skylines. Therefore while the site and its environs are not themselves inherently significant – as amenities – their role in the maintenance of the wider visual amenity must not be underestimated.

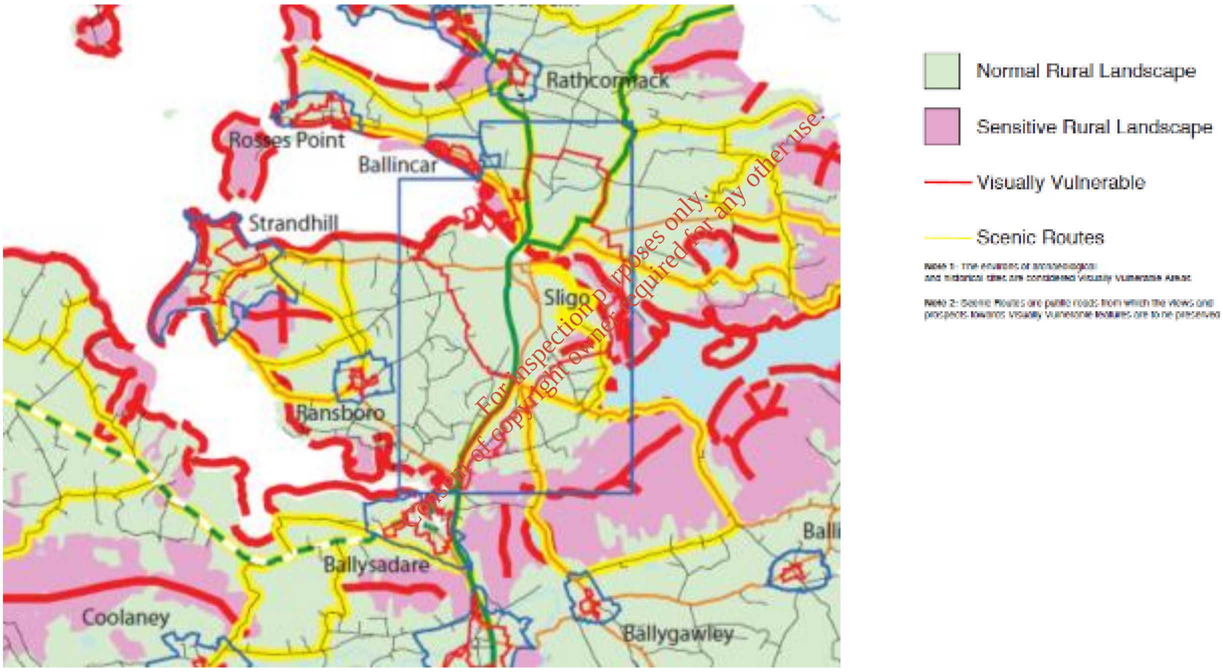


Fig 2 Extract from Landscape Characterisation map from the Sligo County Development Plan

Existing Designations

The N16 between Sligo and Manorhamilton has been recognised by County Development Plans and various tourist maps as a scenic route. The views from this road are valued on account of the panoramas both of Sligo Bay and Knockmorae to the west and south as well as views of the mountains skyline between Benbulben and Glencar.

[1] Visual robustness is a term used to indicate that a landscape has a capacity to absorb development without undergoing a significant change of character

Existing Landscape Sensitivities and Vulnerability

The views from the N16, which is likely to carry many tourists, and from the nearby residences to the south east are the principal groups (or 'receptors') who are likely to be sensitive to any significant adverse landscape or visual impacts.

The principal vulnerability is the threat to significantly intrude upon views of these distant upland landscapes and skylines.

4. Impacts and Mitigation Measures

Assessment Methodology

The designs for the proposed development were evaluated and the site and surrounding context were examined by a chartered landscape architect[2] who specialises in visual impact assessment. The evaluation was supported by photomontages, prepared under the direction of the landscape architect, that were prepared using the same data.

The development will give rise to impacts from two sources:-

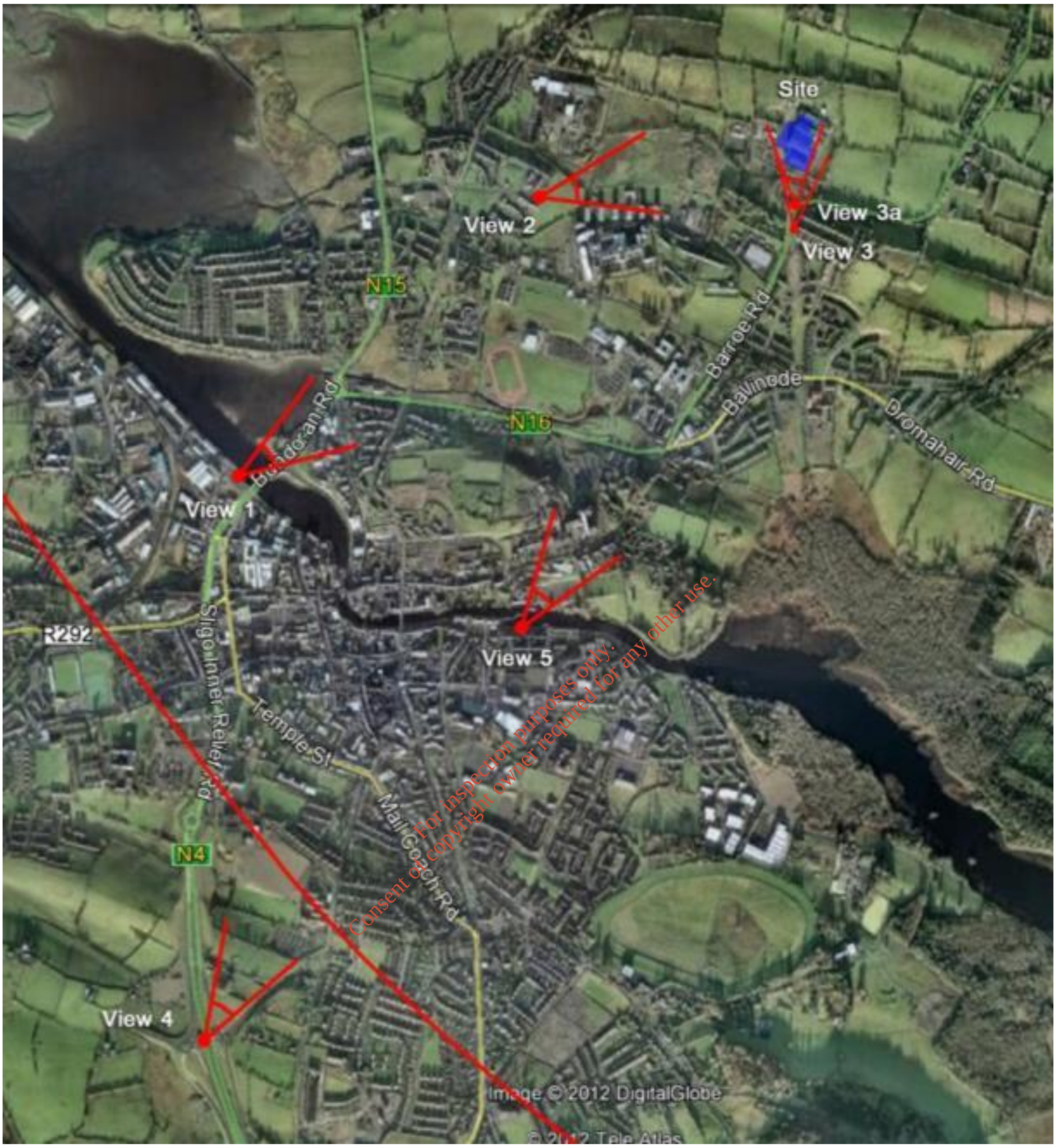
- Visual impacts caused by the visibility of the development
- Landscape impacts caused by the change in landuse from agriculture to industrial

Views of the Existing Proposed Development Site

The existing appearance of the development site is represented by six views which have been chosen to examine the potential for any likely significant visual impacts. The description of the views, along with the rationale for its inclusion, follows:

Number	Description	Rationale
View 1	View from Ballast Quay	View from nearest local amenity
View 2	View from glendallon/Elm Gardens	View from amenity area of nearest and most exposed residential area
View 3a	View from N16/Barroe	View from nearest public road that is a scenic route in the Development Plan.
View 3	View from access road to Yeats Height	View from most exposed part of access to nearest residential area
View 4	View from N4 Overpass at Caltragh	View from most elevated point on main approach road.
View 5	View from Riverside	View from Sligo's nearest public amenity

[2] Conor Skehan is a chartered landscape architect with over 25 years of experience. He is author of a number of standard works on EIA and Visual Impact Assessment in particular.



Visual Impacts on Selected Views

While the upper portion of the main process building will be visible above hedgerows and trees, it will not be visually obtrusive or dominant on account of it's colour, shape and limited profile at distance of over 1 km.

The following "proposed views" illustrate the effect of the proposed development on the views. These represent the significant views on account of two factors:-

- The selection of viewing points to represent the maximum degree of exposure.
- The illustration of views *without* the ameliorative screen planting.

It is important to note therefore that once the landscape proposals are implemented the actual visual impacts will be further reduced annually as the tree and screen planting matures.

View 1 Existing

View from Ballast Quay – looking east

View 1 Proposed

Views new development [red] obscured by intervening buildings, topography and vegetation

View 2 Existing

View from Glendallon/Elm Gardens looking east.

View 2 Proposed

New development right/centre of image

View 3a Existing

View from N16/Barroe Rd Looking North

View 3a Proposed

Extent of new buildings shown outlined in red. [see View 3a for fully rendered version]

View 3 Existing

View from access road to Yeats Heights looking north

View 3 Proposed

New development seen flanking each side of existing buildings.

View 4 Existing

View from N4 Overpass at Caltragh looking north east

View 4 Proposed

Views new development [red] obscured by intervening topography and vegetation

View 5 Existing

View from Riverside looking north north east

View 5 Proposed

Views new development [red] obscured by intervening buildings, topography and vegetation

Landscape Character Impacts

Notwithstanding the visual impacts of the development, there will be a change in how the character of the immediate local landscape will be perceived on account of intermittent visibility, additional traffic, the new entrance and other residual environmental impacts. The immediate local environment will be perceived as changing from agricultural and residential to agricultural, residential and industrial. The perception will be concentrated along and adjacent to a short section of the N16 in the vicinity of the development site entrance and the section of road to the east of that.

Mitigation of Visual Impacts (General)

Arising from the original project, a landscape mitigation strategy has been put in place consisting of screen planting and site layout to minimise visual impacts.

Significant mitigation of visual impacts was also achieved during the design stage by the consideration of alternatives for the following:-

- Location and layout within the holding
- Design and massing of the building form
- Configuration of new work in relation to existing structures
- Selection of colours and finishes

5. Conclusion

Landscape and visual impacts will be localised and will not create significant or adverse impacts. Effects will be concentrated on a short section of the N16 (which is a tourist route) but these will be largely mitigated by existing screen planting, site layout and the adherence to the established colour scheme.

Abbott Ireland

Sligo Site Expansion

Traffic Impact Assessment

February 2012

JACOBS

Document Control Sheet

BPP 04 F8
Version 7 April 2011

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Project:	Sligo Site Expansion		
Document Title:	Traffic Impact Assessment		
Ref. No:	TIA		

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DATE **10/02/12**	INITIALS **SD**	INITIALS	INITIALS	INITIALS
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Contents

1 Introduction

1.1 Introduction

Jacobs has been commissioned by Abbott Ireland to undertake a Traffic Impact Assessment (TIA) associated with the potential traffic impacts of a proposed expansion at their site in Sligo.

This report forms the output of the assessment.

1.2 Outline Methodology

The outline assessment methodology is as follows:

- *establish baseline conditions;*
- *determination and assignment of additional development related trips; and*
- *assessment of junction operation.*

2 Development Proposals

2.1 Site Location

The Abbot site is located to the northeast of Sligo, adjacent to the N16 (Barroe Road) as shown in Figure 1-A below. Access to the existing site is gained from a three arm roundabout on the N16.

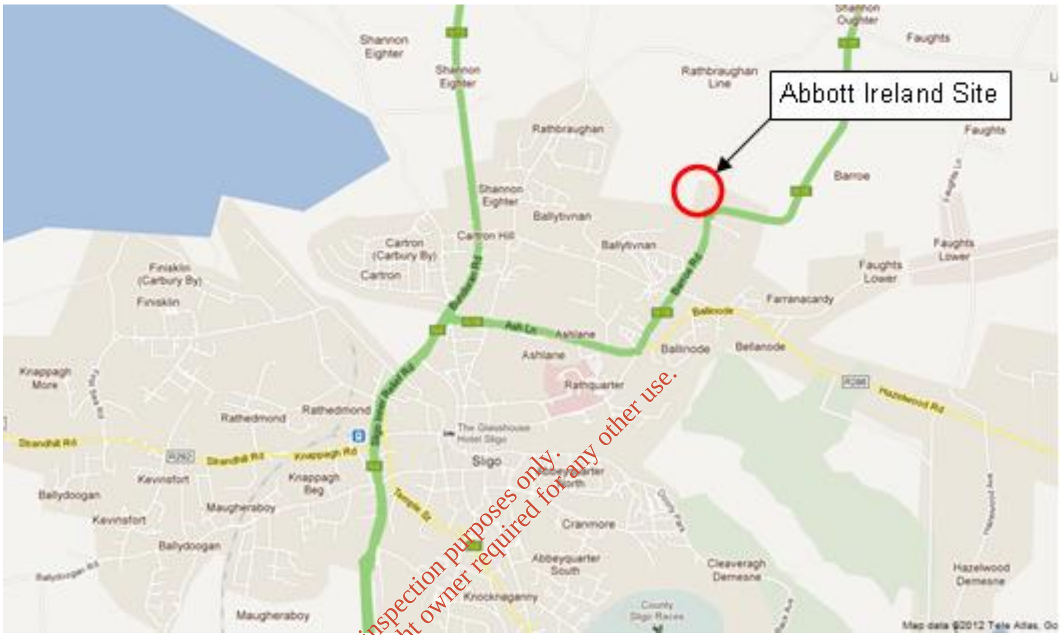


Figure 2-A Site Location

2.2 Development Proposals

This proposed development takes the form of an expansion of the existing Abbot site at Sligo.

The construction period for the expansion is expected to be between March 2012 and May 2013.

During this construction period, levels of construction staff required on site are expected to range from 20 to a peak of 180 persons.

It is forecast that this maximum construction staff demand (180) will be required for approximately 5 months between August 2012 and December 2012.

Following completion of the construction programme, an additional 75 staff (compared to current staffing levels) are forecast to work at the site.

Access to the development during and post construction will continue to be provided by the existing three arm roundabout on the N16.

3 Baseline Traffic Conditions

In order to evaluate the potential traffic impacts of the proposed development, the baseline traffic conditions were first established on the road network adjacent to the site.

Traffic surveys were undertaken by Jacobs at key junction locations on the local road network as follows:

- *Location A - N16 Barroe Road / Abbot Site Access / N16 North Roundabout; and*
- *Location B - N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode signal controlled junction.*

AM (06:30 hrs to 09:00 hrs) and PM (16:00 hrs to 18:30 hrs) peak period junction turning counts were undertaken and observations recorded relating to junction operation, level of queuing and signal timings.

The surveys were undertaken on Wednesday 1 February 2012 and Thursday 2 February 2012. Surveys results are therefore considered to reflect typical weekday traffic conditions.

The AM peak hour was identified as 08:00 hrs to 09:00 at both junction locations.

The PM peak hour was identified as 17:15 hrs to 18:15 hrs at the roundabout and 17:00 hrs to 18:00 hrs at the signalised crossroads.

A summary of the two way flows on the N16 on approach to both junction locations is summarised in Table 3-A below.

Peak Hour	Two Way Flow (vehicles)	
	Location A - N16 Barroe Road Approach	Location B – N16 North Approach
AM	328	596
PM	405	543

Table 3-A Baseline N16 Peak Hour Traffic Flows (Two Way)

The AM and PM Peak hour flows at these junctions are shown in the flow diagrams in Appendix A.

No forecast growth has been applied to these observed traffic levels to achieve a suitable baseline level as the periods of increased demand relating to the development are forecast to occur within the same year (2012).

4 Development Trip Generation and Distribution

4.1 Introduction

This section of the report discusses the anticipated additional vehicles trips in the AM and PM peak hours as a result of the expansion in both construction and operational phases.

4.2 Construction Phase

Construction of the expanded facility is expected to take place between March 2012 and May 2013. The level of on-site construction staff is expected to peak at 180 between August 2012 and December 2012. In order to test the potential worse case scenario, the assessment has been carried out based on this maximum level.

In order to provide a robust assessment of the surrounding road network, it is assumed that all staff will travel to the site by car. An occupancy level of 1.2 people per car is assumed to take account of car sharing. This is considered a conservative estimate as typically higher levels of car sharing would be expected by construction staff. The level of trips generated by construction staff to and from the site is therefore estimated as 150.

It is anticipated that construction staff shifts will start at 07:30 hrs and finish at 18:00 hrs. However this may change subject to demands on site and as such, to present a worst case assessment, it has been assumed that all construction personnel arrive at the site during the AM peak hour and depart from the site during the PM peak hour. It has also been assumed that the construction arrival and departure profile during the peak hours will be similar to the existing level, observed during the traffic survey. This is considered a robust method.

In reality, the level of car sharing is likely to be higher and some people may access the site by walking, cycling or using public transport. In addition, a greater spread of trip arrivals and departures could be expected and therefore the actual impact in the peak hours is likely to be lower than tested.

There is not expected to be a significant level of off peak traffic movements during the construction phase and therefore only peak traffic movements are considered within this assessment.

4.3 Operational Phase

It is expected that an additional 75 staff (compared to existing levels) will work on site following completion of the construction phase. This level of additional staff is significantly lower than the additional staff numbers (and trip demand) expected on site during the construction phase. Therefore the traffic impacts of the operational phase have not been assessed further.

4.4 Trip Distribution

Development (construction phase) trips have been distributed on the network according to the existing trip patterns observed at each junction during the traffic surveys. This trip distribution is detailed in Appendix B.

The baseline trip distribution was used to assign the development related trips for the construction phase (see Appendix C).

These construction trips were then added to the baseline traffic flows to reflect the forecast traffic flow levels during the development construction phase (Appendix D).

A summary of the increased flows on approach to both junctions on the N16 is presented in Table 4-A and in Appendix D.

Peak Hour	Two Way Flows (vehicles)			
	Baseline	Baseline + Construction	Numerical Change	% Change
Location A - N16 Barroe Road Approach				
AM	328	439	+111	+34%
PM	405	541	+136	+34%
Location B – N16 North Approach				
AM	596	707	+111	+19%
PM	543	679	+136	+25%

Table 4-A Changes in Peak Hour Flows (N16)

The percentage change of flows on the N16 during the identified peak hours during the construction phase of the development demonstrates the requirement to assess the potential traffic impacts on the junctions identified.

The level of impact of these increased flows on junction operation is discussed within Section 5.

5 Operational Analysis

5.1 Introduction

To assess the traffic impacts of the additional development related trips, traffic models of the identified junctions reflecting both the AM peak and PM peak were developed using the standard industry wide analysis software:

- *ARCADY6* *Analysis of roundabouts; and*
- *LINSIG v3.1* *Analysis of signalised junctions.*

5.2 Baseline Operation

The baseline operation at both junctions was first assessed using the traffic models. A comparison of the model output was checked against queue length observations made during the traffic surveys to validate the suitability of the model at reflecting local junction operation.

5.2.1 N16 Barroe Road / Abbot Site Access Roundabout

Observations taken during the traffic surveys indicated minimal queuing during both peak periods, with maximum queue lengths of up to 4 vehicles on each approach.

This queuing was noted to at no stage be sustained and was observed to be primarily a result of platoons of vehicles arriving at one time. Such queues were observed to clear almost immediately after forming.

The traffic model predicted a maximum Ratio of Flow to Capacity (RFC) value of 0.165 on the N16 North approach in the AM peak hour, and a maximum of 0.184 on the N16 Barroe Road approach in the PM peak hour. RFC values of this level indicate operation comfortably within the junction capacity – a roundabout of this type is typically considered to operate within capacity with an RFC value of less than 0.85. Maximum queue lengths were predicted to be less than 1 vehicle on all arms during both peak periods.

The traffic model indicates minimal queuing and that the junction has no operational issues, which is comparable with on-site observations. The model is there considered to suitably reflect traffic operation at this junction.

The output from the baseline traffic model is summarised is Appendix E.

5.2.2 N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode

On-site observations indicated maximum queue lengths ranging from 4 vehicles to 8 vehicles are also predicted by the optimised traffic model, considering all junction approaches and both time periods. Delays appeared minimal and the junction appeared to be operating within capacity.

When assessing traffic signals, the Degree of Saturation' is the key factor in assessing the level of operation. The traffic model predicted a maximum value for

Degree of Saturation of 69.6% with an associated queue of 6 vehicles in the AM peak and a maximum value for Degree of Saturation of 60.4%.

Degrees of Saturation at these levels indicate operation comfortably within the junction capacity – a junction of this type is generally accepted to operate within capacity if it has a Degree of Saturation of less than 90%.

This closely matches observations taken during the traffic surveys with maximum queue lengths on each approach of around 7 vehicles. The traffic model can therefore be considered to suitably reflect local junction operation.

The output from the traffic model is summarised is Appendix E.

5.3 Operation during Construction Period

The traffic operation at both junctions was subsequently assessed considering the increased traffic demand forecasts during the development construction period (See Appendix D).

5.3.1 N16 Barroe Road / Abbot Site Access / N16 North Roundabout

The traffic model predicted a similar level of performance as in the baseline scenario, with minimal queuing and delay.

The maximum RFC value is forecast to be 0.194 on the N16 North during the AM peak, and 0.184 on the N16 Barroe Road during the PM peak. It is also predicted that queuing will be of a similar level to as currently observed.

The junction testing has therefore demonstrated that the traffic operation at this location is forecast to remain broadly similar to as currently observed, and comfortably within capacity throughout the proposed development construction period.

The output from the traffic model is summarised is Appendix E.

5.3.2 N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode

The optimised traffic model forecasts that the N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode will have a maximum Degree of Saturation of 76.4% with an associated queue of 7 vehicles in the AM peak and a maximum value for Degree of Saturation of 70.4% with an associated queue of 7 vehicles in the PM peak during the period of maximum construction demand. This level of operation is only marginally lower than the existing situation during both peak periods. The junction is therefore forecast to continue to operate within desirable levels of capacity.

The maximum values in the AM and PM peaks are expected to occur on the N16 Barroe Road approach.

The assessment of this junction, using the Linsig software includes a pedestrian stage actuated on every cycle. In reality the frequency of the pedestrian stage would be far lower and therefore the actual operational performance of this junction is expected to be better.

The output from the traffic model is summarised is Appendix E.

5.4 Operation Post Construction Period

It has been demonstrated that both junctions are expected to operate within capacity, during the period of maximum construction demand, when up to an additional 150 staff are expected to work on the site.

It is therefore expected that the proposed additional 75 staff members working on site following completion of the development construction will have no material impact on the operation and safety of the road network adjacent to the site.

6 Non Motorised User (NMU) Considerations

Pedestrian links are available from the Abbot Site towards the main settlement areas of Sligo via the footway network on the N16.

Cycle lanes are provided on the footway adjacent to the N16 starting at Yeats Heights (to the south of the Abbot site) and continuing for around 1.5 km to the roundabout at the N16 Ash Lane / Holborn Hill / Ballytivnan Road.

There are no bus stops or local bus services in the vicinity of the Abbot site on the N16.

The development proposals are not expected to affect pedestrian and cycle provision. It is therefore considered that the existing provision will continue to provide safe access for pedestrians and cyclists both 'during' and 'after construction' of the proposed site development.

7 Summary and Conclusions

A Traffic Impact Assessment has been undertaken to evaluate the potential traffic impacts of the proposed Abbott Ireland development in Sligo.

To facilitate the development, it is expected that up to 180 construction staff per day will be required on site. Post construction, staff levels at the Abbott Ireland site are expected to increase by around 75 persons (compared to existing levels). These post construction site demands are not forecast to impact on operation or safety on the road network adjacent to the site.

Junction testing has been undertaken at two key junctions adjacent to the site to assess the potential impact on traffic operation and safety resulting from the additional demand from construction staff.

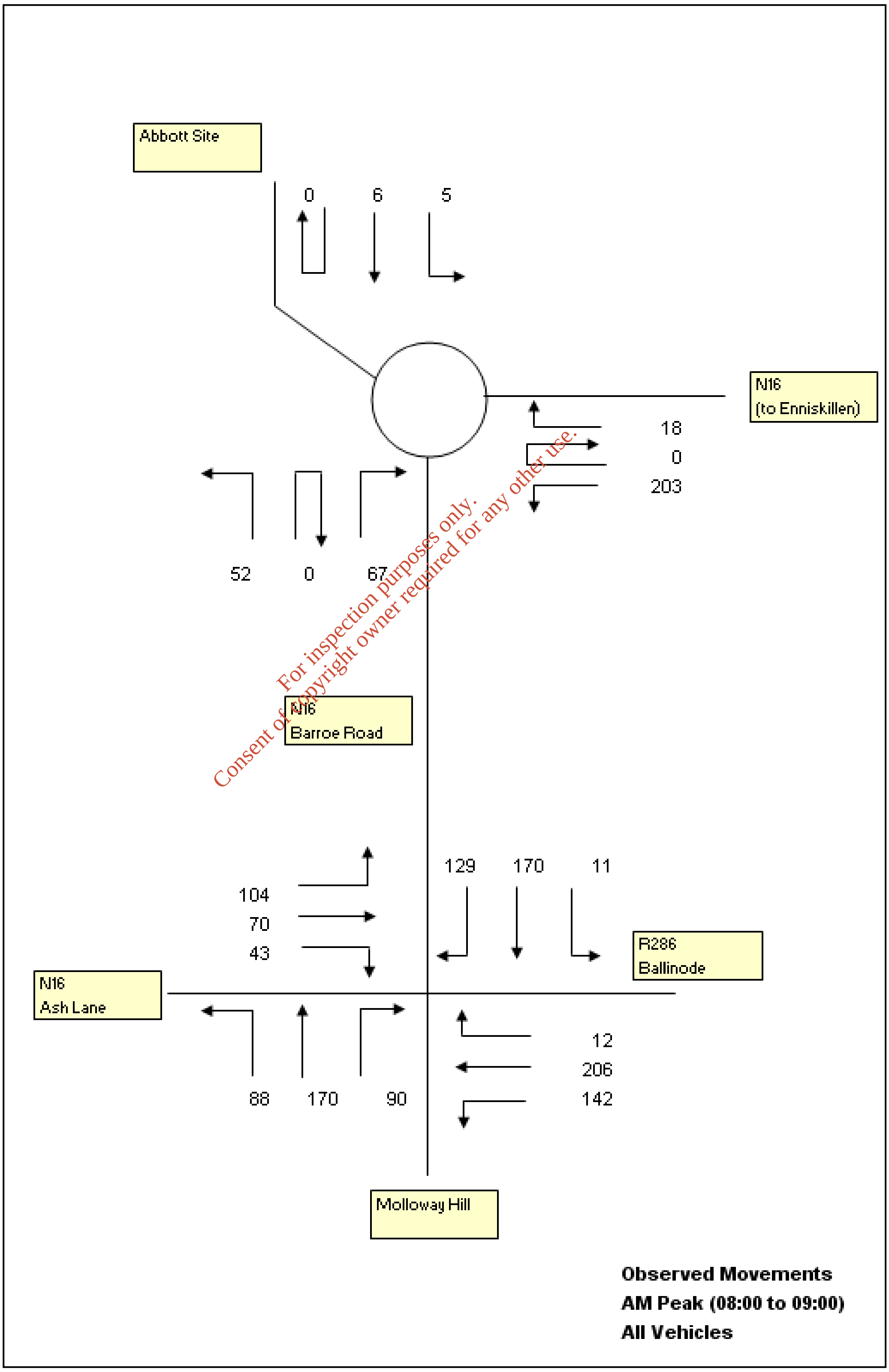
The baseline assessment, demonstrates that both junctions currently operate within capacity. The point of highest construction trip demand is expected to increase traffic levels during the peak hour periods by up to 150 vehicles. However this increase is not expected to materially impact on junction operation at the N16 Barroe Road / Abbott Ireland Access / N16 North Roundabout or at the N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode signal controlled junction.

This assessment has demonstrated that both junctions are forecast to continue to operate safely and within capacity throughout the construction period.

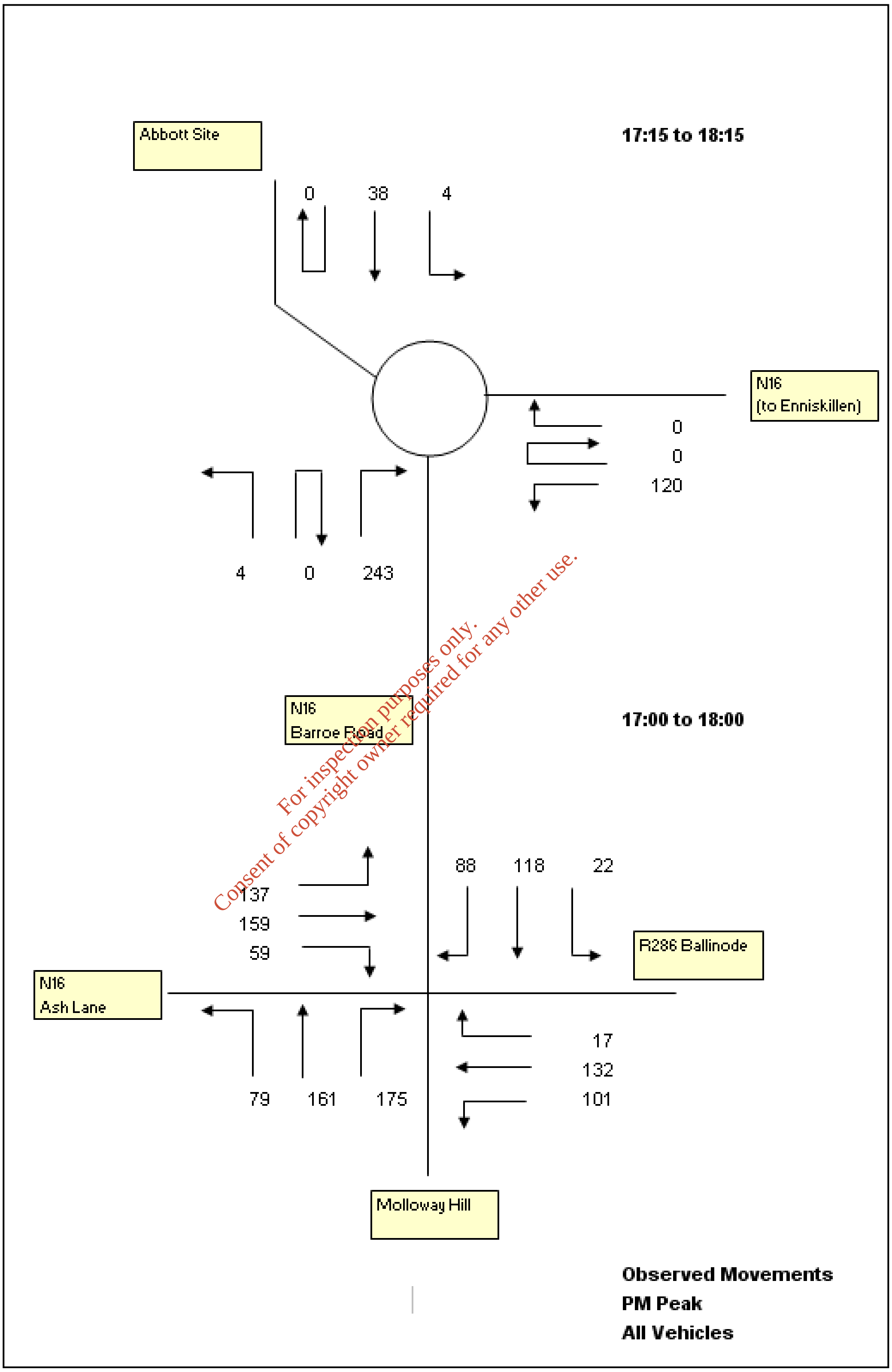
The development is not expected to affect existing pedestrian and cycle provision in the area adjacent to the site.

Appendix A AM and PM Peak Hour Observed Flows

AM Peak Hour



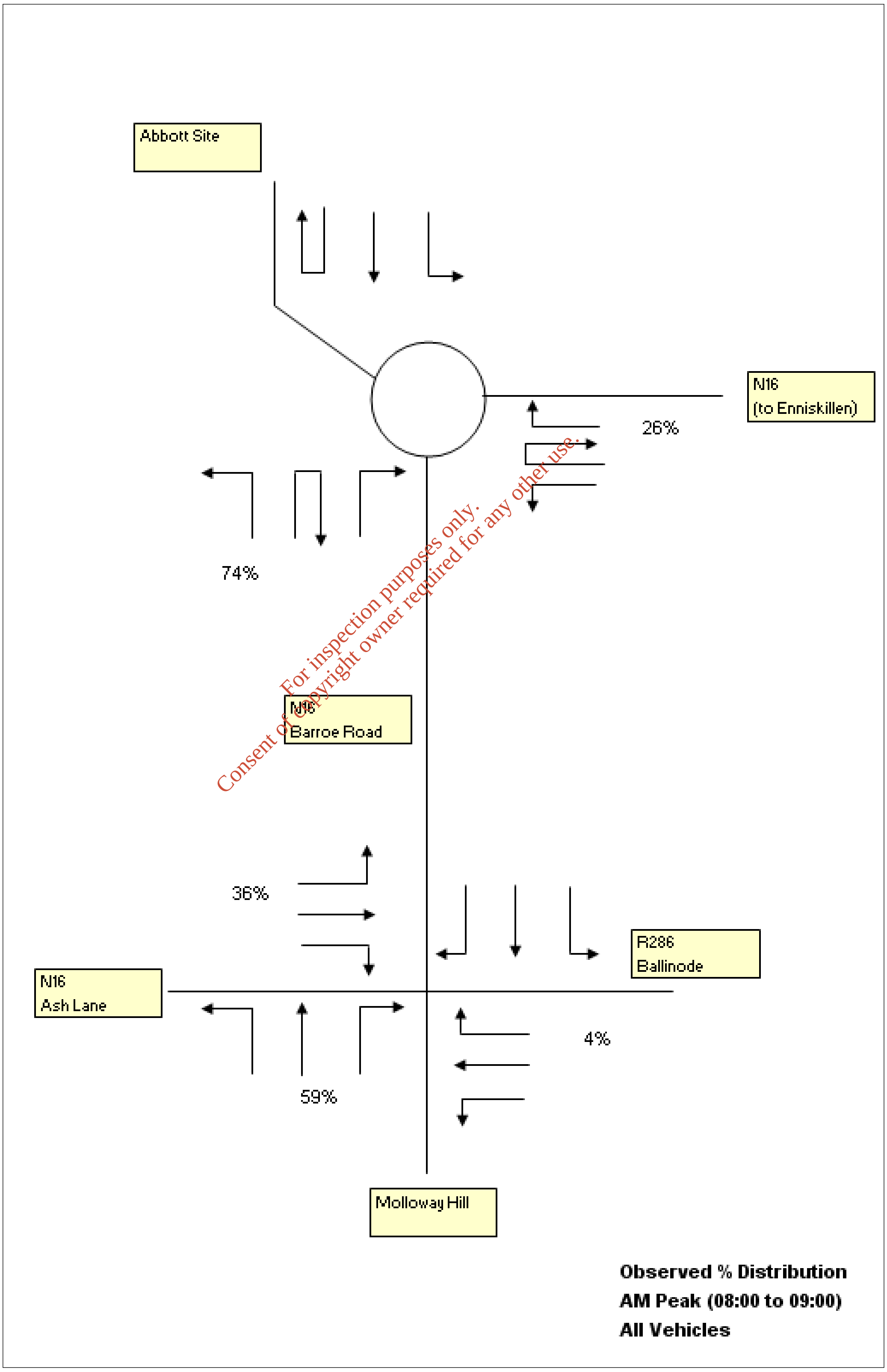
PM Peak Hour



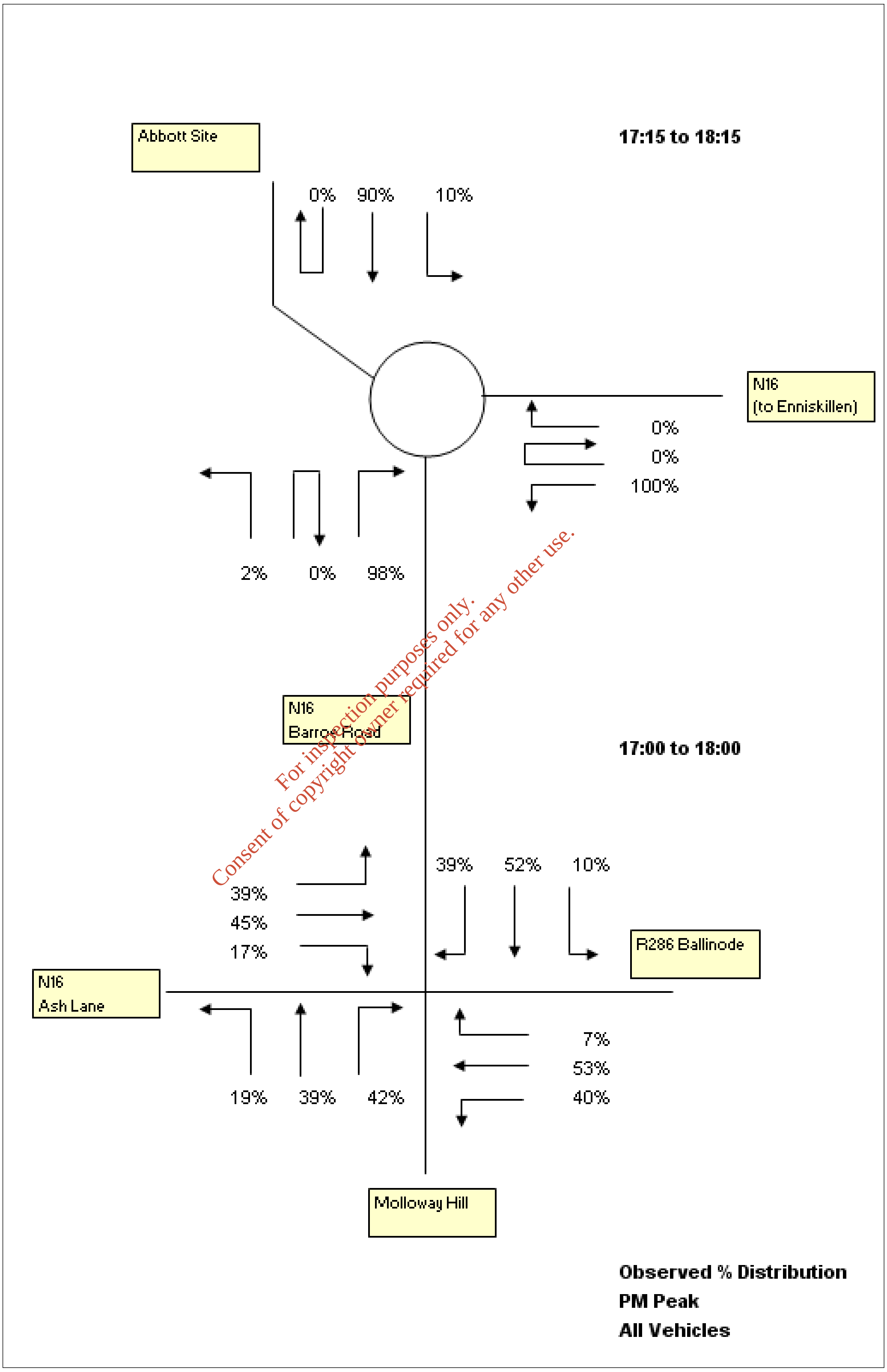
Abbott Site
17:15 to 18:15
0
38
4
N16
(to Enniskillen)
0
0
120
4
0
243
N16
Barroe Road
17:00 to 18:00
88
118
22
137
159
59
R286 Ballinode
N16
Ash Lane
17
132
101
79
161
175
Molloway Hill
Observed Movements
PM Peak
All Vehicles

Appendix B Trip Distribution

AM Peak Hour



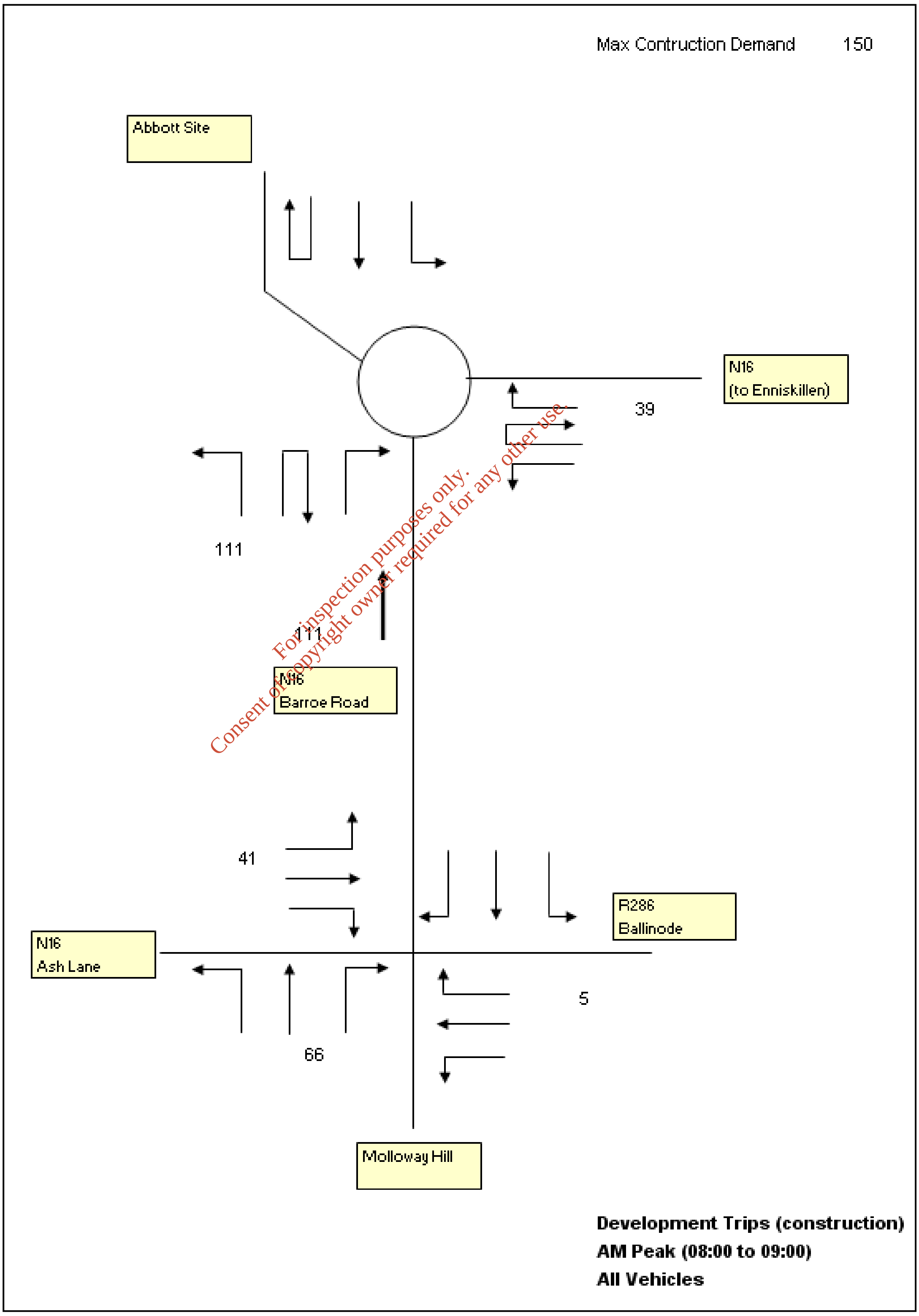
PM Peak Hour



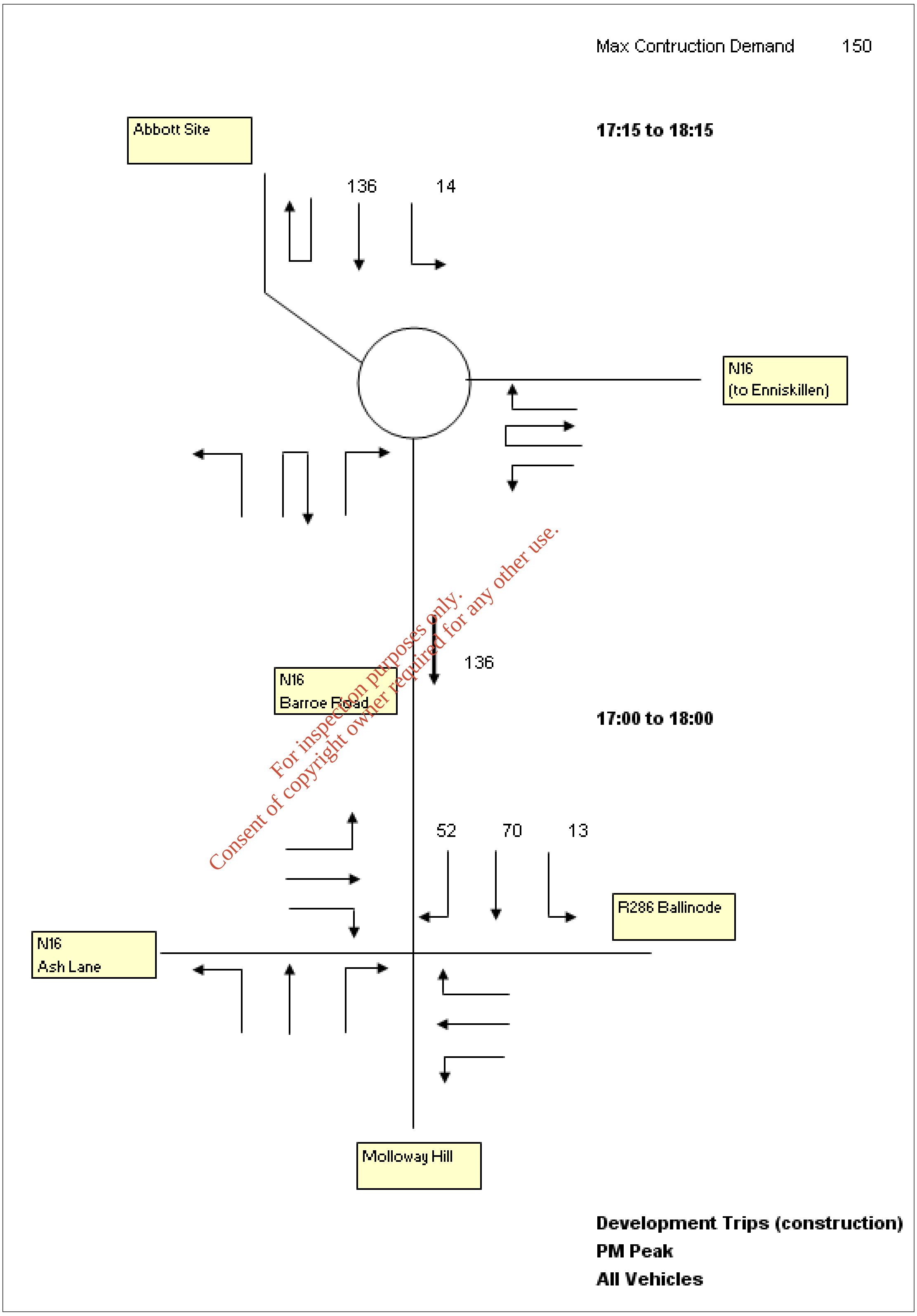
Abbott Site
17:15 to 18:15
0%
90%
10%
N16
(to Enniskillen)
0%
0%
100%
2%
0%
98%
N16
Barrack Road
17:00 to 18:00
39%
52%
10%
39%
45%
17%
R286 Ballinode
N16
Ash Lane
7%
53%
40%
19%
39%
42%
Molloway Hill
Observed % Distribution
PM Peak
All Vehicles

Appendix C Construction Staff Trips

AM Peak Hour



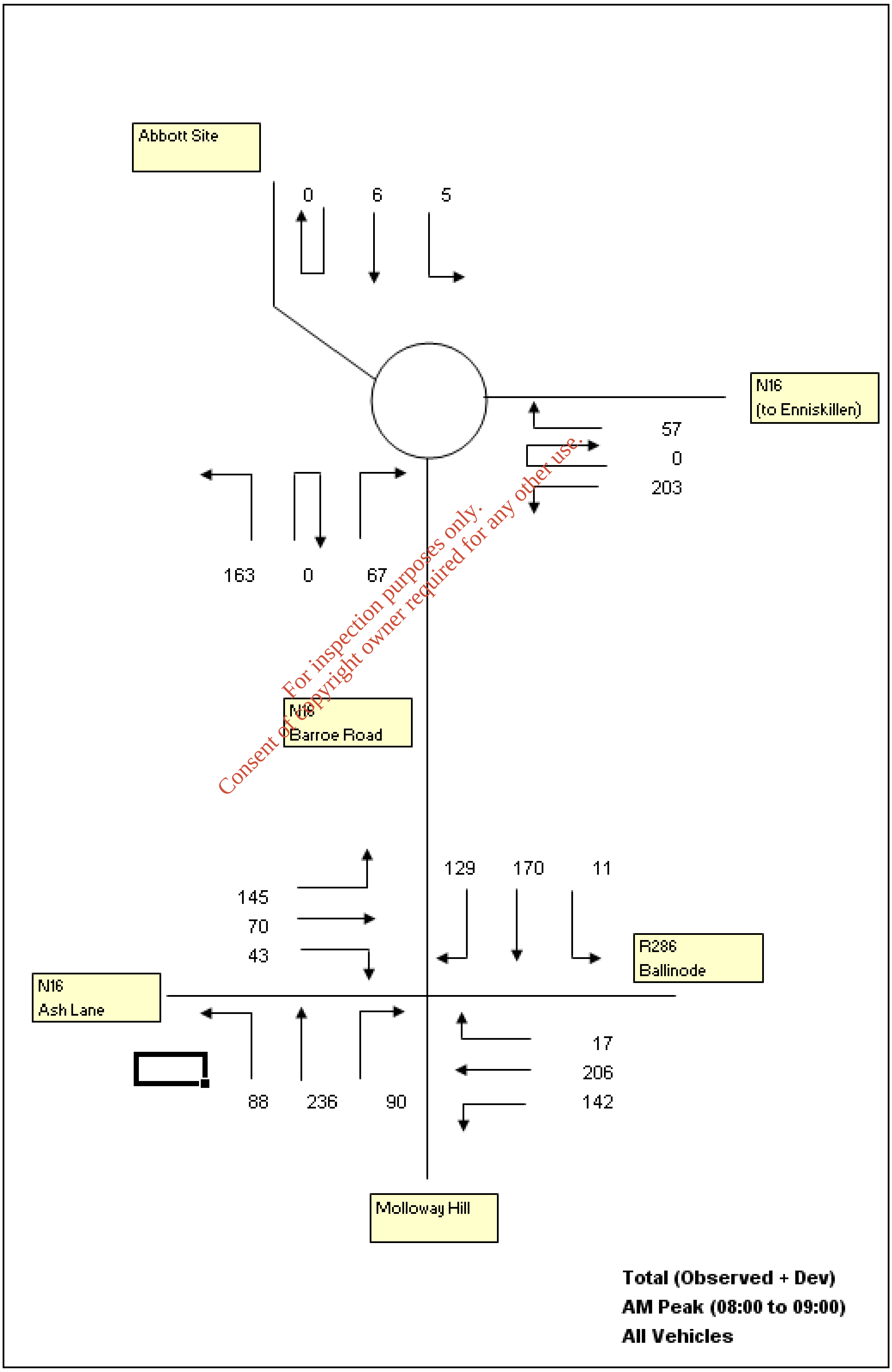
PM Peak Hour



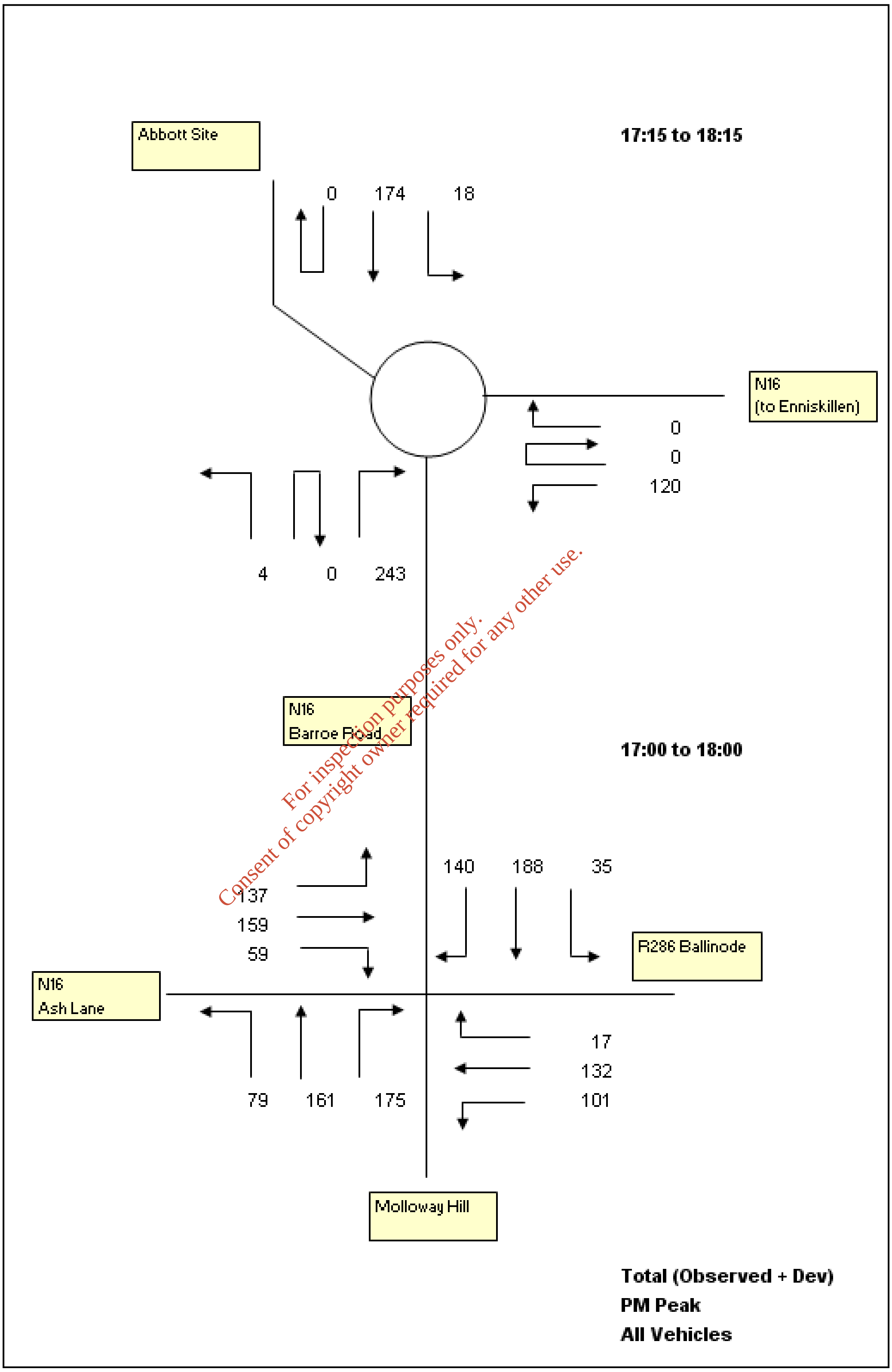
Max Contruction Demand 150
Abbott Site
17:15 to 18:15
136
14
N16
(to Enniskillen)
136
N16
Barroe Road
17:00 to 18:00
52
70
13
R286 Ballinode
N16
Ash Lane
Molloway Hill
Development Trips (construction)
PM Peak
All Vehicles

Appendix D Observed + Construction Staff trips

AM Peak Hour



PM Peak Hour


Abbott Site
17:15 to 18:15
0
174
18
N16
(to Enniskillen)
0
0
120
4
0
243
N16
Barroe Road
17:00 to 18:00
140
188
35
137
159
59
R286 Ballinode
N16
Ash Lane
17
132
101
79
161
175
Molloway Hill
Total (Observed + Dev)
PM Peak
All Vehicles

Appendix E Summary of Junction Operation

N16 Barroe Road / Abbott Site Access / N16 North Roundabout

Traffic Scenario	Approach	RFC	End Queue	Av. Delay (veh mins)
AM Peak Baseline	N16 Barroe Rd	0.090	0.1	0.05
	Abbot Site	0.007	0.0	0.04
	N16 North	0.165	0.2	0.05
PM Peak Baseline	N16 Barroe Rd	0.184	0.2	0.05
	Abbot Site	0.030	0.0	0.04
	N16 North	0.091	0.1	0.05
AM Peak Baseline + Construction Staff Trips	N16 Barroe Rd	0.177	0.2	0.05
	Abbot Site	0.007	0.0	0.04
	N16 North	0.194	0.2	0.05
PM Peak Baseline + Construction Staff Trips	N16 Barroe Rd	0.184	0.2	0.05
	Abbot Site	0.139	0.2	0.05
	N16 North	0.098	0.1	0.05

N16 Barroe Road / N16 Ash Lane / Molloway Hill / R286 Ballinode Signalised Crossroad

Traffic Scenario	Approach	Max Degree of Saturation (%)	Mean Maximum Queue (vehs)	Average Delay per vehicle (secs / pcu)
AM Peak Baseline	N16 Ash Lane	37.5	3.7	31.6
	N16 Barroe Road	69.6	6.0	45.0
	R286 Ballinode	69.2	9.0	39.5
	Molloway Hill	67.3	4.9	37.5
PM Peak Baseline	N16 Ash Lane	60.4	7.1	34.5
	N16 Barroe Road	57.7	3.9	43.3
	R286 Ballinode	46.3	5.5	31.9
	Molloway Hill	60.3	4.4	34.3
AM Peak Baseline + Construction Staff Trips	N16 Ash Lane	48.9	4.9	35.3
	N16 Barroe Road	76.4	6.7	52.1
	R286 Ballinode	76.0	9.9	45.6
	Molloway Hill	74.6	7.1	40.1
PM Peak Baseline + Construction Staff Trips	N16 Ash Lane	69.9	7.8	42.0
	N16 Barroe Road	70.4	7.4	41.1
	R286 Ballinode	54.3	5.9	37.6
	Molloway Hill	67.0	4.8	39.3