Corrib
natural gas

Corrib Gas Field Development Environmental Impact Statement

Prepared in respect of the proposed Bellanaboy Bridge Gas Terminal and associated Srahmore Peat Deposition Site.

Non-technical Summary Volume 1:

Proposed Bellanaboy Bridge Gas Terminal
Bellanaboy Bridge
Bellagelly South
Co. Mayo

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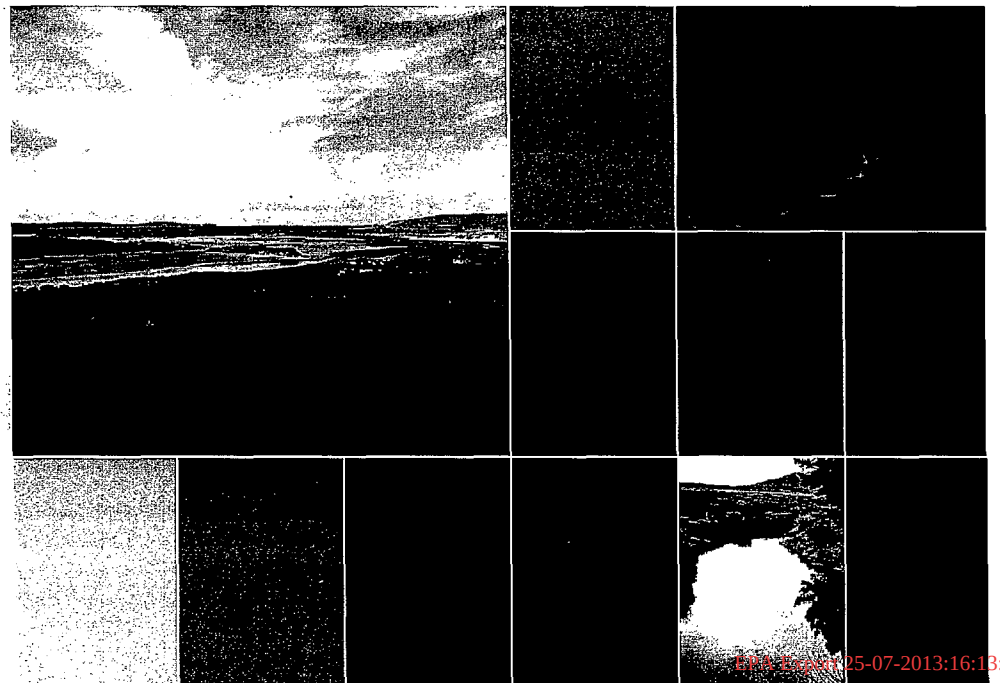


December 2003

NON TECHNICAL SUMMARY

Introduction

Shell E&P Ireland Limited (Shell), formerly Enterprise Energy Ireland Limited (Enterprise), propose to develop the Corrib natural gas field (the Corrib field) off the coast of County Mayo with its co-venturers Statoil Exploration (Ireland) Limited and Marathon International Petroleum Hibernia Ltd. This project will bring gas infrastructure to the north-west region, which currently has no access to the national natural gas network. While very important for Ireland, the Corrib discovery is relatively small by international standards. However, the proposed development entails significant inward investment for County Mayo, and will enhance continued security of indigenous gas supply.

The Corrib field is an accumulation of natural gas located below the seabed in the northeast Atlantic Ocean. It is located approximately 65 kilometres from the nearest significant landmass, the islands off the Mullet peninsula and Achill Head, on Achill Island. The natural gas is contained in a porous rock formation (reservoir) that lies at a depth of about 3,500 metres below the seabed.

This document is a non-technical summary of the Environmental Impact Statement (EIS) prepared as part of Shell's application for permission to develop a gas reception terminal at Bellanaboy Bridge, near Glenamoy and associated peat deposition site at Srahmore Near Bangor, Erris, in north west County Mayo (see Figure 1).

The gas in the Corrib field is composed mainly of methane, which has significant environmental benefits when compared to other fossil fuels. It is similar to the natural gas that has been produced from the Kinsale Head gas field off the coast of County Cork since 1978. When developed, the Corrib field will produce gas over a period of 15 to 20 years.

The natural gas will be produced from a number of wells drilled from the seabed into the gas reservoir. Equipment located on the seabed will control the flow of the gas from the wells into a pipeline. The pipeline will come ashore at Dooncarton in Broadhaven Bay, County Mayo. Buried throughout its length onshore, the pipeline will take the gas to an onshore reception terminal. It is proposed that the terminal is located near Bellanaboy Bridge in the townland of Bellagelly South. There the gas will be prepared for onward distribution and sale to domestic and commercial users through Bord Gáis Éireann's (BGE) network of gas distribution pipelines.

In order to construct the terminal approximately 450,000m^3 peat will have to excavated from the terminal footprint. This peat will be transported to an area of cutover peatland at Srahmore near Bangor-Erris, where it will be placed and allowed to vegetate naturally. This is described in the Peat Deposition Site volume of this EIS.

The purpose of the terminal is to control the operation of all of the facilities associated with the Corrib field, and to remove liquids from the Corrib gas so that it meets the transmission specification required by BGE. The operation of the terminal will be subject to the terms of an Integrated Pollution Prevention and Control Licence (IPPC Licence) from the Environmental Protection Agency (EPA).

When the gas enters the terminal, it will be dried by removing small volumes of condensate (a hydrocarbon liquid that condenses from the gas) and water. It will then be exported from the terminal via a pipeline. This pipeline is to be built, owned and operated by BGE with capital and operating costs recovered from the Corrib co-venturers via a tariff agreement. The pipeline will tie into the national grid at Craughwell near Galway.

The Developer

Shell E&P Ireland Limited is a wholly owned subsidiary of the Royal Dutch/Shell Group of Companies. The companies in the group are engaged in the business of Exploration and Production, Gas and Power, Oil Products, Chemicals and Renewables as well as other activities. The group operates in over 145 countries and employs more than 115,000 people.

Shell set up its first headquarters in Ireland in 1908, and built the country's first bulk terminal at Foynes, Co. Limerick. An office was opened in Belfast in 1922. Shell in Ireland has businesses in Oil Products and Chemicals (Irish Shell Limited) and Exploration and Production (Shell E&P Ireland Limited).

Shell E&P Ireland Limited is part of Shell's EP Europe organisation, which has extensive experience in operating subsea developments and has safely operated major onshore and offshore gas fields in Europe since the 1960's. The Royal Dutch ? Group of Companies acquired Enterprise Oil in 2002, including what was then Enterprise Energy Ireland Limited.

Figure 1: Terminal Location Plan

About sixty people are now employed in Ireland working on the Corrib development and related projects. This includes an office in Bangor-Erris with two full time staff. The number of jobs will rise to about 500 at peak during construction. A further circa 50 people will be recruited for the long term operation of the terminal facility at Bellanaboy.

The Corrib Licence Co-venturers

Shells co-venturers in the Corrib development have considerable experience in the development and production of hydrocarbon facilities. Marathon, a subsidiary of Marathon Oil (US based) developed the Kinsale Head gas field offshore Cork in the mid seventies, and has operated in Ireland ever since. Statoil, with its head office in Norway, is the largest oil producer in the North Sea. Statoil operates gas and oil terminals, refineries and pipeline transport systems, and has had a presence in Ireland, both in exploration and in the marketing and distribution of petroleum products, since the early nineties.

The Corrib joint venture thus brings together extensive experience in subsea oil and gas developments, offshore and onshore pipelines and in the construction and operation of oil and gas terminals.

The Consents Process

Authorisations required to allow the development of the Corrib field to proceed include:

Licence/Consent	Status
The grant of a Petroleum Lease by the (then) Minister for Marine and Natural Resources	Granted 15/11/01
Approval of a Plan of Development for the Corrib Field by the (then) Minister for Marine and Natural Resources.	Granted 15/04/02
A Foreshore Licence for the pipeline, umbilical and outfall	Granted 17/05/02
Consent under the Continental Shelf Act 1968	Granted 2001
Pipeline Consent (Section 40 Gas Act)	Granted 15/04/02
Export Pipeline (Terminal to Craughwell) Section 8 Gas Act	Granted 28/02/02
Planning Permission for the future Bellanaboy Bridge Terminal and associated peat deposition site	
Waste Licence for the future Peat Deposition Site at Srahmore	
IPPC Licence for the future Bellanaboy Bridge Terminal	

The Continental Shelf Act

The Continental Shelf Act (1968) makes provision in relation to the exploration and exploitation of the continental shelf whereby an operator of a hydrocarbon prospect has to apply for Consent to exploit and extract the reserve.

Petroleum Lease

The Minister for Communication, Marine and Natural Resources regulates all exploration activities in Irish waters. Shell and its co-venturers have carried out exploration in the Corrib field in accordance with the terms set out in an exploration licence. As the joint venture proposed to develop the field, they applied for a Petroleum Lease, which, when granted, set out the conditions for production operations.

Plan of Development Approval

When a Petroleum Lease has been granted, the Licence Operator must apply for formal approval of its Plan of Development. In the autumn of 2001 Shell submitted a Plan of Development for the Corrib field development to the (then) Minister for Marine and Natural Resources.

Offshore Pipeline Consents

Shell also submitted an application for Pipeline Consent under the Gas Act 1976 (as amended) to construct the pipeline from the subsea installation to the terminal. The application was accompanied by an EIS.

In addition, a separate application was submitted to the Minister for a Foreshore Licence to lay pipelines across the foreshore.

Export Pipeline Approval

A consent to construct the export pipeline from the proposed Bellanaboy Bridge Terminal to the Bord Gáis Éireann network (at Craughwell) is required under Section 8 of the Gas Act. An application, accompanied by an EIS, was made to the (then) Minister of the Department of Public Enterprise in 2001.

Consent Approvals

The Minister for the Marine and Natural Resources requested the Marine Licence Vetting Committee (MLVC) to examine all environmental aspects of the Corrib gas field development proposed by Shell. The terms of reference given to the MLVC were as follows:

"The MLVC will assess all environmental issues relating to the Plan of Development, Petroleum Lease Application and Foreshore Licence Application. This will include the pipeline and umbilical from the wellhead to the landfall and on to the terminal and the terminal itself and will include all outfalls."

On the basis of its consideration the MLVC recommended that the project be given the relevant statutory permissions subject to a number of conditions.

The Minister approved the Corrib Plan of Development and authorised the construction of the pipeline between the Corrib field and the proposed terminal on 15th April 2002. He granted a Foreshore Licence on 17th May 2002.

The Bord Gáis Éireann export pipeline from the Bellanaboy Bridge Terminal to the Bord Gáis Éireann network (at Craughwell) was granted Pipeline Consent by the (then) Minister of the Department of Public Enterprise in 2002.

Approvals required for the Bellanaboy Terminal and associated peat deposition site

The development of the terminal and the associated peat deposition site requires Planning Permission from the local authority. Because of the energy requirements at the terminal, arising from the need to pressurise the export gas, it will also need an Integrated Pollution Prevention and Control Licence (IPPC) from the Environmental Protection Agency before operations can commence. This licence will set out the detailed limits for all emissions from the terminal, and will specify the monitoring and reporting regime to be put in place to ensure and demonstrate that these limits are adhered to.

Planning Permission and a Waste Licence will be required for the proposed peat deposition site at Srahmore which will be operated by Bord na Mona.

Figure 2 shows the various consents required for the proposed Corrib development.

Consultation

Each of these permissions and licences involves a high degree of consultation, particularly through the environmental impact assessment process. This process provides opportunities for authorities and agencies with specific environmental responsibilities, as well as the public and other interested parties, to have input into the development process. To date there have been over 10 public exhibitions, a number of public meetings and extensive written and oral consultation with the people of Erris and other interested parties both statutory and non statutory.

Environmental Impact Assessment

Environmental Impact Assessment may be defined as a systematic and integrated evaluation of both the positive and negative impacts of a project on the natural and socio-economic environment. The aim is to identify and predict any impacts of consequence, to describe the means and extent by which the impacts can be reduced or ameliorated and to interpret and communicate information about the impacts.

The proposed development comprises three distinct elements. Separate Environmental Impact Statements (EISs) were prepared for each of these elements in accordance with relevant legislation, as follows:

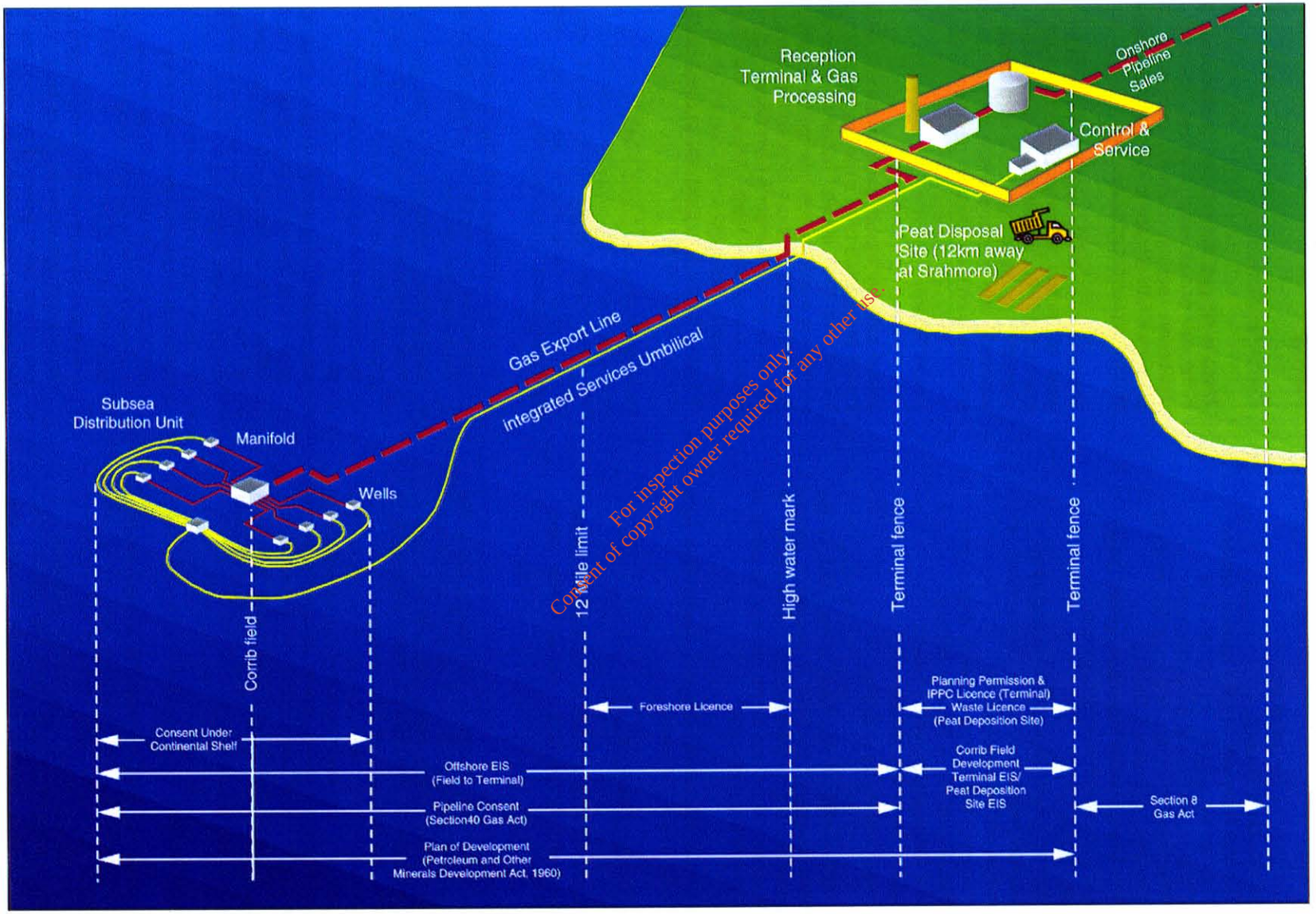
- the Offshore (field to terminal) EIS, was published in November 2001 with the application to the Minister for Communications, Marine and Natural Resources, referenced above. This addressed the offshore parts of the development, including the wells, subsea equipment, the offshore portion of the gas pipeline and the landfall at Dooncarton where the offshore gas pipeline will come ashore. It also included the gas pipeline between the landfall and the terminal;
- the EIS for the Bellanaboy Bridge Terminal and associated peat deposition site addresses the terminal at Bellanaboy Bridge and the associated Srahmore peat disposal site; and
- the EIS for the gas pipeline from the terminal to Craughwell was prepared and submitted by BGE, with the application for consent to construct the pipeline between the terminal and the tie-in at Craughwell.

Each of these documents dealt addresses the cumulative impacts that might arise as a result of other significant developments in the vicinity.

The Terminal Volume of the EIS

- The Terminal Volume if the EIS has been prepared on behalf of Shell by RSK ENSR Environment Ltd. A combination of field surveys, desktop surveys and modelling techniques were used to assess the potential impacts of the terminal and associated facilities.

Figure 2: Legislation Requirements for Corrib



A number of agencies were consulted during the assessment. These included:

- Government Departments;
- Mayo County Council;
- National Parks and Wildlife Service, and the National Monuments and Architectural Protection Service of the Department Environment Heritage and Local Government (DoEH&LG), (formerly Dúchas;
- The Environmental Protection Agency (EPA);
- Local community/residents groups;
- An Taisce;
- North-Western Regional Fisheries Board;
- Tourism Industry;
- National Museum of Ireland;
- Department of Communications, Marine and Natural Resources / Marine Institute;
- The Geological Survey of Ireland;
- Mayo County Fire Brigade; and
- Health and Safety Authority.

This Non-Technical Summary forms part of the Terminal Volume of the EIS. It provides a general overview of the proposed terminal development. A list of abbreviations and simple glossary is provided at the end of this document.

A separate volume of this EIS covers the peat deposition site at Srahmore.

Need for the Development

The Corrib Field is of national strategic importance. In this respect, the following points should be noted.

Sources of Natural Gas

Currently, the only source of Irish natural gas is the Kinsale Head/Ballycotton gas field area off the coast of Cork. The Kinsale Head gas field has been in production since 1978 and has contributed greatly to the Irish gas supply. The balance (currently 80%) is provided by imports from abroad. Production from this gas field has been declining for several years and within the next few years is expected to cease entirely. However during 2003, the Seven Heads gas field has been developed and will start producing through the Kinsale Head gas field facilities in the winter of 2003.

Demand for Gas

The demand for gas in Ireland is growing rapidly, due principally to its increasing use for power generation to meet rising demand for electricity. Demand for gas powered electricity generation is expected to continue to grow as other less environmentally acceptable fuels are phased out. This is in order to achieve Ireland's reduction targets for greenhouse gases emissions under the Kyoto Protocol.

Current Infrastructure

There is no gas transmission or distribution system in the west or north-west of Ireland. The north –south distribution system currently stops at Belfast, although a new pipeline to Derry is in the final stages of planning.current infrastructure

The present electricity supply to the west and north-west of Ireland is subject to occasional supply interruption. For industrial users this issue is not conducive to attracting inward investment. This is especially true of modern high tech industries that rely heavily on clean reliable energy sources.

Future Supply

Ireland currently imports gas from the UK. However, the UK is expected to be a net gas importer by 2005. Ireland will thus shortly become dependent on imports via a country which is itself a net importer of gas. This could give rise to price increases, as the UK will depend on imports from Norway, the former Soviet Union and North Africa. The European Commission has expressed concern about security of supply for Europe, given the political instability of some of these areas.

Development of the Corrib Field

The development of the Corrib field will resolve or partly resolve many of the issues and problems highlighted above. In particular it will:

- provide a significant and reliable additional indigenous gas supply, increasing Ireland's overall security of supply;
- support the construction of an Irish gas ring main system and the provision of a major gas pipeline in the west of Ireland and encourage the development of regional power generation projects;
- reduce the cost of and therefore facilitate the provision of fibre optics infrastructure (a fibre optics cable can be laid with the gas pipeline);
- aid the development of an improved electricity supply system in the west of Ireland;
- create a large number of jobs during the construction phase of the development; temporary local employment, as well as increased demand for accommodation, transport and catering services;
- create a significant number of skilled jobs at the terminal throughout the life of the field; and
- through the development of gas and fibre optics infrastructure, stimulate the development of

existing and new local businesses and generally benefit the Mayo/Galway area, helping to redress regional economic imbalance (an objective of the current National Development Plan).

Alternatives considered

How to develop the Corrib Gas Field

The offshore area where the Corrib field is located is characterised by deep water and a harsh marine environment, being directly exposed to long distance influences (the large Atlantic swell) and to more local influences created by approaching Atlantic weather fronts (strong winds and large waves). There is currently no hydrocarbon production infrastructure offshore or on the coast of the west of Ireland.

When the gas field was discovered, a number of development concepts were studied, which were considered possible ways of bringing the gas to shore. At that time, little was known about the size or extent of the field, other than the fact that it contained gas. These development studies were carried out in parallel with the 'appraisal' programme of the Corrib field, which consisted of drilling several wells into the structure to better determine its size and production characteristics.

The studies resulted in a better understanding of the Corrib field and the technical and economic implications of its possible development. This allowed Shell and its partners to carry out detailed screening exercises in order to arrive at a preferred development concept.

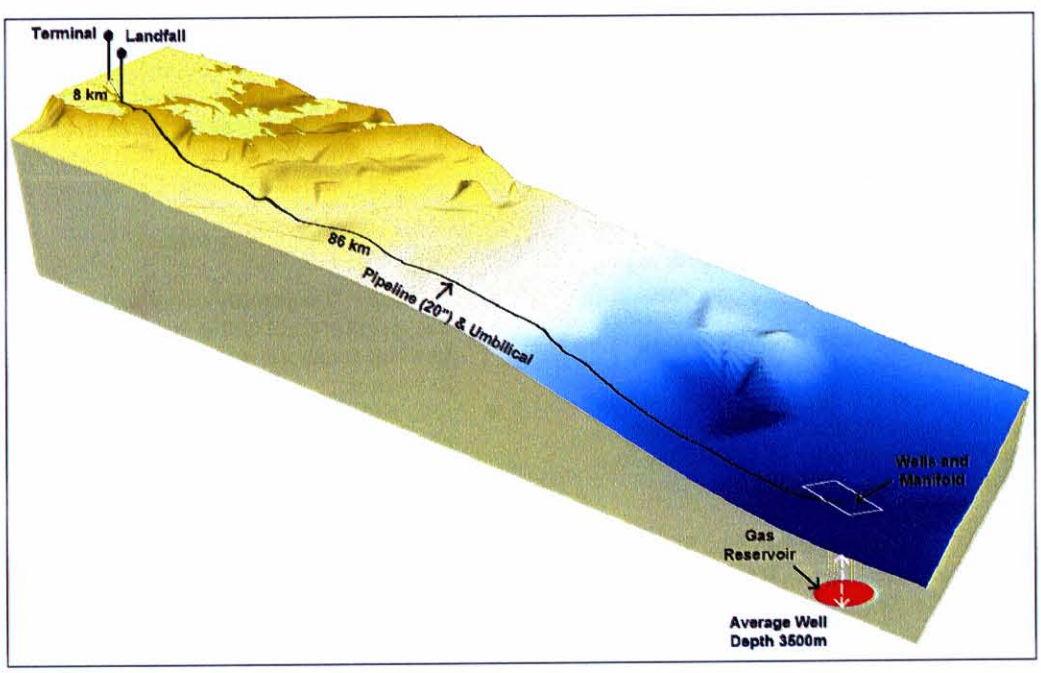
The principal alternatives considered were:

- a deepwater platform standing on the sea bed, with processing, drilling and accommodation facilities;
- a "shallow" water (<100m depth) fixed steel platform located between the Corrib field and the shore with minimum facilities, together with the installation of associated subsea infrastructure (feeding gas from Corrib);
- various types of floating production system; and
- a sub-sea gas gathering system, tied back to an onshore gas reception terminal.

The first three options would require offshore processing and accommodation facilities. All would require a gas pipeline to transport the gas to shore and all would require an onshore reception facility.

As a result of the screening studies, it was concluded that the preferred development scenario for the Corrib field was a subsea system tied back to a processing terminal onshore. This method of development represents the best solution in terms of safety, the environment and economics, and it is in line with the most up-to-date industry best practice in the North Sea (see Figure 3).

Figure 3 Corrib Development



The main reasons for this choice were:

- the relatively dry nature of the Corrib gas (although there is water in the produced gas, Corrib is unusually dry in terms of liquid hydrocarbons or 'condensate') and the high reservoir productivity permits the practical adoption of subsea production technology;
- all the options involving an offshore manned facility (whether fixed or floating) have increased adverse safety implications, particularly with respect to offshore transfer of personnel and result in high operational expenditure compared to an onshore tie back;
- the combination of deep water (350m) and hostile environment at the Corrib field do not favour the use of a fixed steel jacket or guyed tower; and
- floating production concepts are untried solutions for high reliability gas exports in the harsh offshore conditions encountered in the north eastern Atlantic region.

Even if they had been technically attractive, the high capital cost of all the floating or fixed platform options, combined with the requirement for extensive offshore and onshore gas transportation and reception infrastructure, rendered all these options sub-economic.

Landfall and Terminal Site Selection

In parallel with the screening studies described above, studies were carried out to identify the best route for transporting the gas from the Corrib field to the market. This would identify the most suitable location for the landfall and gas reception terminal.

Several possible tie-ins with the Irish gas network were considered, as were possible direct off-take points for the gas. Possible offshore pipeline routes from the field were studied. Surveys were carried out on routes from as far south as the mouth of the Shannon, north-east to County Sligo. These route surveys showed extensive areas of rock outcrops on the seabed in many areas. This severely limited the number of locations that would be suitable for laying a pipe ashore.

From the screening study many potential landfalls were rejected due to the proximity of protected areas in the coastal region and the associated hinterland. This latter issue is a key constraint in the routeing of the export pipeline away form the terminal. Only four potentially suitable areas were identified:

- Killala Bay area, in Counties Mayo and Sligo;
- the eastern side of Broadhaven Bay and Blacksod Bay in Co. Mayo;
- the Emlagh Point area, to the west of Westport in Co. Mayo; and
- Liscannor Bay and Doughmore Bay in central Co. Clare.

These areas were then considered in more detail in terms of:

- environmental constraints;
- offshore pipeline route;
- engineering feasibility and costs;
- pipeline shore approach and landfall construction issues;
- possible onshore terminal locations; and
- onshore pipeline routing and construction considerations.

Following this, a number of landfall locations and associated terminal sites were identified for more detailed feasibility studies. These were in four general areas:

- between Lenadoon Point and Rathlee Head, on the east side of Killala Bay in Co. Sligo, with the reception terminal at the landfall;
- Ross Point on the south side of Killala Bay in Co. Mayo, with two possible reception terminal sites, one at the landfall and the other some distance inland;
- Bunatrahir Bay, in Co. Mayo, with the reception terminal within 0.5km of the landfall; and
- Broadhaven Bay, either north or south of the Sruwaddacon inlet, with the reception terminal located inland at Bellanaboy Bridge.

The optimum terminal site was then identified for each of these landfalls. The main criteria used were:

- minimise the distance from landfall to terminal;
- keep visual impact to a minimum; and
- avoid environmentally sensitive areas such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

Brief conclusions were as follows:

- Rathlee. The primary constraint identified was the visual impact of the terminal. All possible terminal locations were highly visible and difficult to screen.
- Killala Bay. Several landfall locations were considered around the bay. One suitable landfall location was a designated SAC and National Heritage Area (NHA), another was a recreational beach area. The areas to the west of the bay were found to offer the best landfall locations, but are designated as being of special scenic importance. No suitable terminal location could be identified within a suitable distance.

The Asahi site, whilst already having undergone industrial development, was too far from the Corrib field in respect of operability issues for the pipeline and umbilical.

- Bunatrahir Bay. The beach area is a designated area of special recreational importance. In addition, the presence of sandstone bedrock could cause problems in the construction of the landfall. The nearby beach of Portnahally was considered but potential terminal sites were highly visible, particularly from the R314 around Ballycastle village. The land is flat and exposed.
- Broadhaven Bay. It was difficult to identify a suitable site in close proximity to the landfall, but a good terminal location was found within farmed forestry further inland. Screening could be maintained where possible from the existing plantation. Broadhaven Bay is a candidate marine SAC. The ground conditions of the foreshore and approach are predominantly sand and ideal for landfall construction, allowing rapid natural regeneration. A suitable pipeline route from the landfall to the terminal could be identified, avoiding protected areas.

Plate 1: The Landfall Area and Sruwaddacon Bay

Alternative terminal locations were considered around Broadhaven Bay, but none were as suitable as that near Bellanaboy Bridge. In particular the visual impact of the alternative terminal locations would have been much greater. Another important factor was that the site at Bellanaboy was already ecologically altered from its original state by its use as a peatland research station in the 1950s.

On the basis of all the above studies, it was decided that the best option was to come ashore (landfall) at the Sruwaddacon inlet, in Broadhaven Bay and build the terminal within the forestry plantation area near Bellanaboy Bridge.

Plate 2: Track Through Immature Plantation

In summary, the preferred landfall and terminal locations offer the following advantages:

- the approach to the landfall is largely rock free, allowing the pipeline to be installed without significant environmental impact;
- the pipeline can be installed at the landfall by conventional means with minimal environmental impact in the short term;
- installation of the onshore part of the pipeline mainly along the north side of Sruwaddacon Bay is relatively straightforward and can be achieved with minimal to moderate environmental impact in the short term;
- the terminal site is partly wooded, greatly reducing the visual environmental impact of the terminal; and
- the peat at the terminal site has already been disturbed as a Coillte peatland experimental site.

In parallel with the terminal site selection, engineering feasibility studies progressed, and more detailed knowledge of the gas composition and design parameters were developed. As a result of this the length of the subsea pipeline became a technical constraint on the site selection; i.e. the longer the pipeline from the field became, the larger and more complex facilities were required, and the ultimate gas recovery reduced. The engineering conclusions therefore also favoured the Broadhaven Bay / Bellanaboy option.

In order to construct the terminal at the Bellanaboy Bridge site, earthworks will need to be carried out to prepare a flat, stable surface on which to found the termianl facility. The site is covered at present by between approximately 1 and 4m of peat and it will be necessary to excavate this along with some of the underlying mineral soils. Various alternatives have been considered to deal with the excavated materials. These include storing the peat on site

(rejected by An Bord Pleanala), consolidating the peat by surcharging, treating it by lime stabilisation, removing it from site by road or rail and pumping it to a disposal site or to a sea going barge for diposal elswhere.

The favoured option from this assessment is to remove the peat from site to a cut over bog owned by Bord na Mona at Srahmore near Bangor Erris. The method of transport would be by wagon and the route would be along the L1214 which will be upgraded by Mayo County Council. The cost of the upgrade will be funded by Shell.

The Bellanaboy Bridge Terminal

Purpose

The purpose of the Bellanaboy Bridge Terminal is to:

- control the operation of the entire Corrib field facilities; and
- remove liquids from the Corrib gas so that it meets the gas network transmission specification required by Bord Gáis Éireann.

Main Processes

The main steps involved in achieving the above are as follows:

- remote control of the operation of the Corrib subsea equipment and wells such that gas production meets gas demand;
- monitoring of essential safety systems;
- reception of the fluids produced from Corrib and separation of gas from liquid (condensate and water/methanol); and
- gas treatment to meet Bord Gáis Éireann's specification. Export of gas to the Bord Gáis Éireann gas distribution system.

Other processes involved are:

- hydrocarbon liquid (condensate) recovery and storage for use as a fuel;
- injection of methanol and other chemicals to the subsea system and subsequent recovery; and
- treatment and disposal of produced water.

A plan of the terminal with all plant identified is provided in Figure 4.

Control

The subsea facilities, and in particular the flow of gas from each of the Corrib wells, will be controlled and monitored from a control room in the terminal. The remote control system consists of a buried composite cable (the umbilical) which contains electrical, hydraulic, and chemical injection fluids systems. This cable runs between the terminal and the Corrib wells.

Injection of Methanol and Other Chemicals

Methanol, together with corrosion and scale inhibitor (if required), are pumped from the terminal through the umbilical to the subsea equipment. The purpose of each of these is as follows:

- methanol - to prevent freezing within the subsea facilities (i.e. the wells, subsea system, gas pipeline and the terminal). In essence, the methanol acts as an anti-freeze;
- corrosion inhibitor - to prevent corrosion in the field facilities; and
- scale inhibitor - to prevent the possible precipitation of natural mineral salts such as calcium carbonate and barium sulphate within the field facilities.

Fluids Arriving at the Bellanaboy Bridge Terminal

The fluids from the Corrib field received at the terminal will be mainly gas, but some liquid will also be present. This liquid will primarily consist of

- water of condensation (water that condenses from the gas as its temperature and pressure fall); and
- methanol (injected from the terminal).

The liquid will also include small volumes of:

- condensate (liquid hydrocarbons that condense from the gas as its temperature and pressure fall); and
- corrosion inhibitor and scale inhibitor (both injected from the terminal).

Formation water (water present in liquid form within the Corrib reservoir) may also be produced.

Figure 4: Plan of the Terminal Facilities

Fluid Reception

The liquid produced with the gas does not arrive at the terminal in a uniform manner, but rather arrives in varying quantities or 'slugs'. On entry to the terminal, the incoming gas and the accompanying slugs of liquid are passed through a 'slugcatcher'. This is an arrangement of large pipes in which the incoming fluid is calmed by substantially reducing its velocity and the two liquid phases are separated from the gas by gravity. The condensate (liquid hydrocarbon phase) and water/methanol (water phase) that separate out from the gas in the slugcatcher pass to the condensate recovery and methanol regeneration systems respectively.

Treatment and Export of Gas

Because Corrib gas is so pure, no treatment other than the removal of any remaining liquid is required to satisfy Bord Gáis Éireann's export gas specification. Gas from the slugcatcher flows to the 'inlet separator', which separates finer droplets of liquid from the gas. The gas passes through a mercury removal unit to ensure that any traces of mercury, if present, are removed. The gas is then fed to a pressure valve where it is allowed to expand. This expansion cools the gas and condenses out any remaining traces of condensate, methanol and water, resulting in gas that meets Bord Gáis Éireann's specification.

The gas is finally compressed (so it leaves the terminal at the pressure required for the export pipeline) and an odorant is added (to assist leak detection in the gas distribution network). The volume of gas is metered as it leaves the terminal.

Methanol Recovery

The methanol recovered from the gas has a (high) water content. The methanol is separated from the water by distillation. The methanol is then recycled for use in the offshore system.

Condensate Stabilisation and Storage

Condensate received and separated as described above is stabilised by a series of pressure reductions and heating processes. It is then cooled and transferred to storage tanks. Produced condensate will be used as fuel in the terminal. Small quantities of gas released from the condensate during stabilisation will be recovered and reinjected into the main gas system.

Treatment of Water Prior to Disposal

The water recovered from the methanol distillation column is treated in the water treatment plant to meet the terms of the Integrated Pollution Prevention and Control Licence from the Environmental Protection Agency (EPA). It is then discharged to sea through an outfall pipeline.

Ancillary Equipment

Various ancillary equipment is required to support the above processes. This includes power generation, fire fighting and emergency equipment.

Buildings

There will be a number of buildings on the terminal site. These include:

- administration and control room buildings;
- maintenance warehouse;
- compressor housing;
- power generating buildings; and
- local equipment room.

Plate 3: Image of Proposed Courtyard Area

Design of the Bellanaboy Bridge Terminal

Great care has been taken in the design of the terminal to minimise its environmental impact. Key mitigation measures include:

- maximum use of existing vegetation cover to conceal the terminal and provision of additional screening. The site layout has been designed to make best use of the existing vegetation whilst ensuring an efficient layout in terms of process function and safety;
- the height of terminal structures will be kept to the minimum possible;
- the flare system has been designed so that there will be no unnecessary burning of gas. This means the flare will only be used in emergencies or abnormal operating conditions;

- maintenance flaring will be via a ground flare, as this minimises noise and visual disturbance;
- light emissions will be minimised;
- appropriate materials and paint schemes will be used;
- noise levels from equipment will be minimised through strict specification and selection of equipment in combination with sound insulation where required;
- emissions to air will be minimised by the use of 'clean burn' fuel efficient burners; and
- waste water will be treated to Environmental Quality Standards.

Construction of the Terminal

Site Set-Up

Site set-up will commence with the erection of a perimeter fence. Trees and shrubs on the terminal footprint will then be cleared and access roads constructed.

Initial site drainage for the whole site will then be installed

The temporary construction facility, containing cabins, skips and fuel storage etc, will be set up.

Peat Removal

The site is overlain by between approximately 1 and 4m of peat, which overlies sand and gravel with some clay. This passes down into a layer of weathered bedrock.

Relatively little bedrock will need to be disturbed but it will be necessary to remove the peat within the area of the terminal itself to provide a firm foundation on which the terminal equipment can be sited. The peat removal and levelling of the soil and rock formations, creating a flat bench, will effectively lower the terminal foot print by up to 10 m. This will significantly reduce the environmental impact of the terminal; in particular with regard to its visual impact.

The peat removed from the terminal area will be taken to a new peat deposition site located at Srahmore, approximately 11km south of the terminal site. During the removal of the peat water that will drain from the disturbed peat will be controlled on site and silt removed using silt ponds prior to discharge to local watercourses.

Following peat removal, side slopes around the site will be topsoiled and seeded to prevent erosion.

Structural Works

Once the peat has been cleared, structural and civils works will begin with piling and foundation works.

Structural steel work will then be added and the site buildings constructed

Installation of Equipment

Equipment, prefabricated where possible, will then be installed and finally the plant will be tested and commissioned.

Construction Timescale

Terminal construction activities will last about two years. During this time there will be an increase in traffic as a result of the removal of the peat offsite, delivery of construction materials and equipment and from construction workers travelling to and from the site. The issues of traffic, noise and dust are addressed in later sections.

Benefits Of The Terminal

The Corrib field development will bring considerable cumulative direct and indirect socio-economic benefits to the region of Erris, County Mayo, west of Ireland and Ireland in general.

Direct

Manpower requirements will vary during the construction and operation phases of the terminal. During construction, manning levels are expected to peak at around 500. Construction of the BGE owned and operated pipeline from the terminal to Galway will provide a similar number of additional jobs.

The total manning level at the terminal during normal operation is expected to be around 50 divided into four shifts.

Indirect

By increasing the attractiveness of the area for inward investment, the existence of the terminal will help reduce the outflow of population from rural areas and help to consolidate and strengthen existing urban areas. Increased economic activity and productivity will also help increase the general affluence of the area and contribute to further regional development.

The development will also provide more localised benefits for the duration of the construction period. These include increased trade in local shops, service industries and accommodation providers, as well as indirect employment.

Shell also intends to establish a "Corrib Community Fund" which will be managed by a committee consisting of a number of local people, and representatives of the company, chaired by a locally recognised independent figure. This body will consider applications for funding for socially beneficial activities in the Erris area. It is anticipated that this body will endeavour to develop facilities and services in the areas of healthcare, education and sports, which will benefit and help provide cohesion to the locally resident communities. An independent auditor will be appointed to monitor and publish details of how the fund has been invested.

Current Land Use

The proposed terminal site is near Bellanaboy Bridge, in the townland of Bellagelly South. It covers an area of approximately 160 hectares. The terminal itself will occupy an area of about 13 hectares although construction activities will have an impact on a further 1 hectare.

The proposed site is located within the former An Foras Taluntais Peatland Experimentation Station. This area was subject to various trials in the 1950s related to the productivity of crops on blanket peatland, including forestry and grass production. In this context, the ecology of the original blanket peat has been substantially altered. A detailed review of the terminal area shows that the site supports the common flora species expected for this type of modified habitat and is not of any particular importance. No conservation designations apply to the area. The proposed site is within a partially wooded area and takes advantage of existing visual screening by means of mature trees along its perimeter.

Shell HSE Policy

Shell's HSE policy is that it will conduct all its activities in such a way as to:

The Policy commits Shell to:

- pursue the goal of no harm to people;
- protect the environment;
- use material and energy efficiently to provide our products and services;
- develop energy resources, products and services consistent with these aims;
- publicly report our performance;
- play a leading role in promoting best practice in our industries;
- manage HSE matters as any other critical business activity; and
- promote and culture in which all Shell employees share this commitment.

The overall health, safety and environmental goal for the Corrib development project is that the development and its associated activities shall not give rise to accidents, personnel injuries or ill health, or to material losses or damage to the environment.

To achieve the above, the terminal will be designed in accordance with all relevant standards and codes. Hazard identification activities and Hazard and Operability Studies form integral parts of the engineering effort for the project, and will be conducted to cover design, installation, construction, commissioning, start-up, normal operations, maintenance and decommissioning activities.

All personnel activities will be carried out in accordance with the requirements of the Safety, Health and Welfare at Work Act, 1989 as amended.

Environmental Management

A series of control and mitigation measures have been identified in the EIS. These are summarised below. Shell is committed to implementing these in full.

In addition, an Environmental Management Plan will be prepared by the terminal contractors and verified by Shell prior to the commencement of construction. The plan will include the detailed site procedures to be followed to ensure that environmental impacts during construction are minimised.

Shell commit to operate the terminal in accordance with an environmental management system, ISO 14001 or equivalent.

Control And Mitigation Of Potential Environmental Effects

The construction and operation of the Bellanaboy Bridge Terminal will cause some environmental impact. However:

- control and mitigation measures have been incorporated into the design of the proposed development, from concept selection through to detailed engineering design, to minimise such impacts; and
- outputs and emissions from the terminal will be monitored and analysed in order to demonstrate that emissions are within stringent limits set by the Environmental Protection Agency under the terms of the Integrated Pollution Prevention and Control (IPPC) Licence.

Key areas of environmental concern and the main mitigation measures are summarised below.

Traffic

Shell carried out a series of surveys to determine the existing road and traffic conditions across the study area road network.

The surveys determined that there will be an increase in traffic levels in the local area during the construction of the terminal. These increases will be short-term in nature and principally as a result of the movement of peat off-site for a duration of 5 to 6 months, as well as delivery of materials and construction plant and the daily movement of the workforce to and from the site.

Potential impacts of this increase will be addressed as follows:

- *a Traffic Management Plan (TMP) to actively control the number and types of vehicles arriving/departing from the site and the time at which they occur will be developed and agreed with Mayo County Council;*
- *all HGV movements will be directed to use the route proposed in this EIS, in accordance with advice from the traffic consultant;*
- *any vehicle that exceeds standard transport regulations will require special movement permits from the appropriate county councils;*
- *deliveries will be regulated to minimise the impact on local traffic;*
- *while it is not necessary from a traffic capacity point of view, consideration will be given to the provision of a minibus service to bring the site workforce to and from the construction site. This will have the effect of minimising the traffic impact of the proposed terminal. The minibuses would collect the workforce from local towns in the morning before 08:00hrs and return them in the evening after 18:00hrs; and*
- *all signage relating to the proposed construction routes for construction traffic will be positioned clearly and designed to the satisfaction of Mayo County Council. Drivers of construction vehicles failing to observe the signed routes will initially be given a warning and thereafter be banned from the site.*

The main impact of heavy construction vehicles will be in the context of potential damage to the road surface. The proposed haul route will be upgraded at the developers cost by Mayo County Council prior to commencement of haulage operations, and restored to its original condition at the completion of the construction phase.

Noise

The proposed site is rural and the immediate vicinity sparsely populated resulting in low background noise levels, especially at night.

Construction Phase

Site traffic and construction activities (in particular piling, rock breaking, earth moving and steel erection) will generate noise. Mitigation measures include the following:

- *the majority of construction work will take place during the 'daytime' period between 7am and 7pm. Exceptional operations, such as restricted night-time working, will only be carried out after proper consultation and liaison with the local authorities and the Environmental Monitoring Group to limit their impact;*
- *consideration to be given to use of vehicle reversing lights during hours of darkness instead of the usual reversing bleepers;*
- *noise controls for high noise operations will be agreed with Mayo County Council and levels of these will be monitored to ensure compliance;*
- *the terminal construction contractor will comply fully with the TMP in order to minimise the impact of heavy lorry traffic; and*
- *all plant, equipment and vehicles will be fitted with the correct noise suppression equipment and operated in accordance with the relevant standards and manufacturers requirements.*

The implementation of these measures will ensure that the impacts will be within accepted standards and guidelines for construction.

Operational Phase

Noise minimisation is an integral part of the design of the terminal since the majority of the machinery associated with normal operation of the terminal is continuously active.

The environmental mitigation measures implemented for the operational phase of the Corrib development are summarised below:

- *gas turbines and compressors are acoustically insulated and housed in buildings; the inlet and outlet pipework also being sound insulated;*
- *stringent noise criteria have been specified in accordance with EPA Guidance;*
- *low noise equipment has been specified wherever possible; and*
- *acoustic housing has been provided for engines emitting high noise.*

Operation of the high pressure (HP) and low pressure (LP) flares, when in use, will generate significant levels of noise. The high level flare will be used occasionally during the first three to six months of operation (commissioning phase). Thereafter the high level flare will only be used in exceptionally rare emergency situations.

Ground absorption and screening effects have little impact on noise from the HP and LP flares due to their height (40m). In order to minimise the potential impact from the operation of the flares the following measure will be taken:

- *the high and low pressure flares will not be used during normal plant operation. A ground flare, with lower noise levels than the HP and LP flares, will be included for maintenance depressurisation; and*
- *noise from the ground flare is mitigated by ground absorption while planned operation of the ground flare should normally only take place during the day.*

Noise Monitoring

Noise and vibration monitoring points will be established around the site and at local receptors by agreement with Mayo County Council. The resultant data will be made available to local residents on request, and to the regulatory bodies.

The results will be used to help manage the noise impacts of the site.

Visual Impact (Landscape)

The terminal is situated within an expansive open landscape with distant views available in all directions and views to the south dominated by steep hills. The terminal itself is sited on a predominantly flat, inland area of partly modified blanket bog. The area surrounding the terminal site is sparsely populated.

The terminal site has been carefully selected to minimise its visual impact. A visual impact assessment has been carried out and sensitive views that are likely to be affected by the scheme have been considered. This can be summarised as follows:

- *from most viewpoints it is impossible to see existing ground levels of the proposed site;*
- *the plantations within which the terminal is sited act as an important high level screen, limiting views into the site from the north, preventing views into the site from the adjacent road to the south-east of the site (R314) and partially screening views from the south-west; and*
- *the closest residential properties to the terminal (up to 1.5km) and the middle distance residential properties (1.5-3.5km) are effectively screened by the surrounding coniferous vegetation.*

In addition to careful site selection, the terminal design and equipment have been designed to minimise the height of buildings and structures in the terminal. The two highest structures (the flare stack and methanol still are approximately 40m and 33m high. These will be visible at both close and long distance. All other equipment and buildings will be less than 22m in height and will be screened by the surrounding trees.

Other mitigation measures incorporated into the terminal design include:

- *the maximum area possible of existing mature vegetation will be retained and protected during construction. Screen planting will be used in sensitive locations, such as the boundary with the R314.*

All planting will be subject to a five-year monitoring and maintenance period to ensure growth is established.

- *Existing ground levels will be excavated and site levels kept low to minimise the visual intrusion of the tallest structures in the terminal;*
- *the terminal equipment will be painted in earth and sky tones to minimise its visual impact; and*
- *it will be necessary to provide some lighting at the site during hours of darkness for safety purposes, however lighting will be designed to keep light emissions to a minimum. For example, use has been made of downlighting fittings and low level bollard lights.*

Air Quality

Potential impacts on air quality could potentially occur during all phases of the development. Potential impacts, and measures taken to mitigate those impacts, are outlined below.

Construction Phase

During construction, the main impacts will be from traffic/plant fumes and dust. These will be dealt with as follows:

Generation of exhaust emissions from road traffic, construction vehicles, generators etc.

- *A Traffic Management Plan will be put in place to prevent traffic congestion; and*
- *all vehicles and plant will be inspected and maintained to ensure emissions are minimised.*

Generation of dust is likely, but will generally be associated with dry weather. Dust monitoring stations will be erected between the site and local residences to monitor dust levels., Standard techniques of dust suppression will be used. These will include:

- *in dry weather spraying road and ground surfaces with water;*
- *wheel washing at the entrance/exit of the site to prevent dust generating conditions being created outside of the construction site; and*
- *dusty materials will be sheeted during transport and storage.*

Operational Phase

The latest generation of computer dispersion modelling has been used to predict how releases to air will disperse in the atmosphere and hence determine the potential impact at sensitive locations nearby.

It concludes that emissions resulting from terminal operation are not likely to have a significant impact upon the local environment.

Atmospheric emission limit values will form part of the terms of the IPPC Licence for the terminal. The limits are set such that the emissions are not detrimental to health or the environment. Compliance with the set limits will be monitored continuously. The main pollutants of concern are oxides of nitrogen (NOx) and carbon (CO_2 and CO).

The terminal has been designed to minimise operational emissions of NOx, CO_2 and CO. In particular:

- *low NOx burners have been selected for the heating medium heater and gas compressor turbines;*
- *flaring rather than venting has been chosen as the method for emergency pressure release and maintenance. In terms of Global Warming Potential flaring is considered less harmful than cold venting of methane;*
- *the flare has been designed such that the hydrocarbon releases are efficiently burnt at height;*
- *air quality will be monitored, both on-site and in the wider local area;*
- *natural gas, as it is a clean fuel, has been chosen to fuel the electricity generators;*
- *some of the Corrib gas samples have shown traces of very low levels of mercury. The mercury content of the gas will be reduced through the installation of a mercury removal unit filter on the gas stream; and*
- *there should be no significant hydrocarbon emissions as a result of routine operation of the terminal. In particular, the terminal is designed such that there will be no flaring of gas during normal operations.*

Fugitive emissions of volatile organic compounds (VOCs) and methane may arise from process areas, product tank loading and tank loading/unloading activities. This type of emission, similar to that experienced at petrol stations around the country is small, but unavoidable in this type of installation.

The terminal will be designed to minimise the number of potential sources of fugitive emissions. Tanks containing methanol and condensate will be nitrogen blanketed.

In common with other vehicles on local roads, vehicles accessing the site will emit combustion products. A Traffic Management Plan will be put in place to prevent traffic congestion.

Overall Environmental Impact

Detailed modelling indicates that levels of air emissions will be very low. In particular:

- *the predicted maximum annual average NOx concentration is significantly lower than the EU annual average limits for the protection of both human health and vegetation. Maximum short term hourly average predicted ground level NOx concentrations are well below the current and proposed EU limits;*
- *the predicted maximum annual average NOx concentration during emergency flaring is well below the EU annual average limits for the protection of both human health and vegetation (It should also be noted that the predicted value is highly conservative); and*
- *maximum short term hourly average predicted ground level NOx concentrations are well below the current and proposed EU limits.*

Overall, the study indicates that atmospheric emissions resulting from terminal operations will not have a significant impact on the local environment.

Water

There are potential impacts on water during both construction and operation of the terminal. During construction, there is the potential for silt-contaminated run-off from the site, particularly during peat removal, while during operation, produced water will be pumped to sea via a outfall located 12.7km from the landfall.

Construction Phase

During construction, there is the potential for increased run-off and silt contamination of streams. In addition, nitrates and phosphates used as fertiliser during past agricultural activity could also be released, potentially causing eutrophication, a decrease on available oxygen levels.

The mitigation measures against these potential environmental impacts during or associated with the construction phase of the terminal project are summarised below:

- *current water quality in local rivers and Carrowmore Lake has been established through a detailed baseline study. Quality criteria will be established for run-off and drainage from the terminal site. Both surface and groundwater quality will be monitored prior to, during and post construction;*
- *a perimeter drain will be cut as the first task in the construction process to collect any runoff and groundwater that escapes during excavation;*
- *settlement ponds linked to the perimeter drain will be installed to allow silt load to settle out prior to releasing water into local watercourses. These will be capable of handling storm rainfall conditions;*
- *the site will be operated to the highest environmental standards, including measures such as bunding of tanks, use of drip trays, dedicated refuelling areas and the proper storage of waste; and*
- *the quality of the drainage water from the silt ponds will be monitored on a continuous basis and will not be discharged until clean.*

Operational Phase

The mitigation measures against potential environmental impacts associated with the operational phase of the terminal project are summarised below.

Baseflows

Watercourse baseflows will probably be reduced downstream of the site, although the impact is anticipated to be negligible at the confluence with the Bellanaboy River. Mitigation includes:

- *the amount of paved areas will be minimised, minimising the rate at which rain runs off and thereby helping to maintain watercourse baseflows. The settlement ponds will also help maintain baseflows; and*
- *peat will be replaced with crushed rock and sand and gravel to maintain baseflow.*

Groundwater Contamination

The low porosity fractured bedrock, when exposed, may be vulnerable to contamination: uncontained spills (e.g. of lubricating oil) could percolate into the groundwater system.

- *All areas where a spill could occur will be bunded and sealed from the underlying groundwater system; and*
- *potential sources of regular spillage will be provided with local shelter and collection trays, sumps or interceptors as appropriate.*

Contamination of Surface Water

Rainwater falling on parts of the site could become contaminated. In the event of a fire, firewater could become contaminated with combustion products or foam.

- *Contamination of rainwater will be minimised through the use of separate drain systems. Rainwater and firewater interception and treatment have been incorporated into the terminal design to mitigate the potential for water impact from the terminal;*
- *firewater falling within hydrocarbon processing areas will be collected in the firewater retention pond and treated prior to discharge, as for produced and drainage water;*
- *rainwater that potentially could become contaminated through accidental leaks or spills on the site will be routed through the water treatment plant before being pumped through the outfall pipe to discharge in coastal waters beyond Broadhaven Bay; and*
- *surface water that drains from areas of the site where contamination is not possible will be routed through the perimeter drains and silt traps before discharge to external watercourses.*

Produced Water

The water arriving at the terminal with the gas will contain naturally occurring dissolved salts and metals and small volumes of liquid hydrocarbons. It will also contain chemicals injected from the terminal to prevent the formation of hydrate, corrosion and the formation of scale. To prevent any pollution, produced water will be treated as follows:

- *water quality before discharge will be monitored on a regular basis;*
- *injection chemicals and condensate will be recovered from the produced water (primary treatment);*
- *produced water will be further treated such that the levels of trace elements and chemicals in the*

produced water discharged to sea are so low as to have no discernible impact on background levels of trace elements and chemicals in the receiving environment. Facilities to remove any potential heavy metals will be installed to meet Environmental Quality Standard (EQS) levels; and

- *all treatment will be to levels specified in the IPPC Licence.*

Waste Water and Sewage

Waste water will be generated from toilets and washrooms in the terminal buildings.

- *Waste water from toilets and washrooms will be collected and treated in a 'Puraflo' plant.*

Solid Waste

Terminal operations, including construction, will result in the formation of a variety of solid waste materials, mostly non-hazardous but some hazardous. The following mitigation measures will be implemented:

- *non-hazardous waste, including compacted office and kitchen waste, will be removed by a licensed waste contractor to a licensed landfill site for disposal and with the relevant waste documentation;*
- *hazardous waste, such as oily material and salts and scale from the water treatment plant, will be disposed of by a licensed waste contractor in accordance with prevailing legislation;*
- *hazardous and non-hazardous waste generated during construction will be managed in the same way;*
- *a Waste Management Plan will be drawn up for the project to ensure responsible and effective waste management, including collection, storage and control of waste disposal. This will form part of Shell's environmental management system for the terminal; and*
- *all waste will be subject to a waste hierarchy with minimisation, reuse and recycling being preferred to disposal.*

Human Beings

Construction of the terminal and pipeline will cause temporary disturbance locally, but will also provide employment and economic benefit to the area. Operation of the terminal will provide employment and other economic benefits as described previously.

Construction Phase

The measures that will be put in place to mitigate against environmental impacts that may occur during the construction phase of the terminal project are summarised below.

Economic Impact

There is expected to be an overall positive impact during construction due to the influx of the construction workforce that will be resident in the local area and using local shops and services. This is expected to outweigh any negative impacts such as pressure on accommodation.

Plate 4 Stratified Sheep Sculpture

Language and Culture

The temporary influx of a number of non-local workers may have an impact on the local population in terms of language and culture. However it is not expected that there will be any permanent negative impact.

Traffic Impact

There may be periodic delays associated with construction traffic and deliveries to the site on the surrounding road network. Impacts relating to traffic are discussed previously.

Tourism and Fisheries Impact

With the appropriate mitigation measures employed as detailed in this EIS, there will be no significant impact on fisheries or the natural resources of the area as a result of emissions while the visual impact of the terminal will be minimised as described below. In this regard, important local tourist resources such as fishing and hill walking will not be adversely affected.

Operational Phase

The measures that will be put in place to mitigate against the environmental impacts that may be associated with the operational phase of the terminal are summarised below.

Economic Impact

During operation, there will be an overall positive impact since the development is likely to act as a catalyst to economic development. It will also employ a workforce of 50 who will be resident locally.

Economic regeneration may have a positive effect on tourism, with increased investment and recognition for the area.

Language and Culture

The presence of operational personnel will have an impact on the local population in terms of language and culture but it is not anticipated to be significant.

Shell will develop a Language Plan for the terminal and will look to establish bilingual signage. The Language Plan will promote the use of the Irish language.

A recruitment policy will be formulated which will encourage staff to live locally. This will be an advantage for operational and safety reasons and will help to minimise the cultural impact of the terminal.

Community Benefits

Shell intends to establish a 'Corrib Community Fund' to provide funding for socially beneficial activities in the Erris area.

Flora And Fauna

The ecological value of the vegetation within the site is low due to the relatively low diversity of plant species, and the fact that the habitat has been highly modified by land use management practices since the mid-1950s.

In terms of fauna, there is evidence of foxes in the area, but no dens were identified on site. However there are known to be badger setts within the site but not within the areas of excavation. The common frog is abundant but there are no newts. There are no suitable roosting locations for bats on the site and the landscape would be considered poor for most bat species. There is no evidence of deer in the area. A wide variety of birds are known or expected to occur within the site.

Some areas of scrubland, grassland and afforestation which provide a feeding and nesting habitat for birds and other fauna will be removed, within the terminal footprint and for construction areas and access roads.

Plate 5: Rushy Grassland Dominates the Terminal Footprint.

Shellfish, sponges, anemones, sea squirts and kelp are present in Broadhaven Bay, as are brown crabs, lobsters, crawfish, plaice, sole and grey seals. There are no potential impacts expected from the produced water discharge on these species because of the high degree of water treatment in the terminal. The location of the outfall diffuser point is in deep water beyond the confines of Broadhaven Bay.

Mitigation Measures

The mitigation measures agreed against possible environmental impacts on flora and fauna are summarised below.

Vegetation

- *The period each year during which disturbance of trees and vegetation is allowed will be restricted to reduce impacts on breeding species;*
- *a portion of the grasslands or young plantations within the unaffected area of the site will be replaced with native deciduous woodland. (Such habitat replacement could add to the diversity of the flora and wildlife ecological value of the area.); and*
- *a monitoring programme by wildlife and vegetation ecologist will be established.*

Amphibians

Frog spawning areas will be lost.

- *New breeding ponds will be allowed to develop within unaffected portions of grassland habitats on site.*

Birds

There is the potential for nesting birds to be disturbed through vegetation clearance and by noise and human presence during construction. Once the terminal is in operation, there are unlikely to be any significant impacts on birds. Mitigation will include:

- *wherever possible, vegetation clearance will take place outside of the bird nesting season;*
- *a survey for nests will be carried out prior to construction; and*
- *planting of native species around the site will enhance bird habitat.*

Badgers

The potential impacts to badgers and their setts will be mitigated as follows:

- *the area around the main and subsidiary setts will be excluded from the development;*
- *all shrub clearance will be monitored by experts;*
- *fencing will be designed to assist badger movements;*
- *if found on site, any badgers will be evacuated by licensed personnel prior to construction; and*
- *the semi-mature woodland belt present there will be retained for badger habitat and screening.*

Otters

In order to prevent impacts to otters, the following will be adopted:

- *all vegetation clearance to be monitored by experts; and*
- *any fencing or culverting of drains will allow free access for otters through them.*

Pollution to Watercourses

Pollution incidents could damage invertebrate and fish stocks and lead to loss of feeding habitat for predators.

- *Measures to prevent pollution and sedimentation of watercourses will be implemented. See 'Water' above.*

Marine Impacts

Construction of the discharge pipeline will cause impacts to the fauna along the route. However these impacts will generally be of a temporary nature as the pipeline will be buried and natural re-colonisation will occur.

If not adequately treated, water discharged to the sea could contain material that could accumulate in certain marine organisms.

The water discharged will be treated to ensure that the levels of trace elements and chemicals are so low as to have no discernible impact on background levels of trace elements and chemicals in the coastal waters, except within the immediate vicinity of the outfall point. Even at the outfall point, the impact will be negligible. See 'Water' above for details of the assessment of discharge.

Traffic Impacts

There is a small potential risk of a traffic accident during peat removal causing pollution to part of the Carrowmore Lake Complex candidate SAC site. In order to address this risk, the following will be put in place:

- *A strictly enforced Traffic Management Plan, ensuring all movements are controlled.*

Cultural Heritage

There are no known archaeological sites located within the confines of the proposed terminal site and peat deposition site. The methods employed for intensive forestry plantation such as deep ploughing and ridge and furrow techniques have disturbed the ground. It is unlikely that archaeological sites occur in the bog but, if they did, they will probably have been truncated by forestry practices. Nothing of archaeological significance has been revealed in the trial pits excavated on site to date.

Despite the above an archaeologist will be on site during construction to ensure no historical remains are destroyed.

Soils, Geology and Hydrogeology

A desk-based study and site investigations have been carried out for the Bellanaboy site, including drilling and trial pits. Groundwater conditions have also been measured on site.

The site comprises peat between 1 and 5m deep (1.5 to 3.5m for the terminal footprint. Beneath the peat are mineral soils formed from glacial deposits

and a layer derived from local material. Both types of deposit are about 1.5m thick.

There are no known mineral extraction or landfill sites in the vicinity of the site.

Construction will involve the excavation of about 450,000m3 of peat. Possible impacts and mitigation measures are as follows:

- *consolidation of the peat from vehicle traffic, temporary storage and unpiled facilities. This will be minimised by the use of special construction techniques, such as tracked vehicles, low-pressure tyres and wooden matting;*
- *shrinkage of peat. This is related to drainage but is not expected to be significant due to the low permeability of the peat and the use of sheet piles to support open faces. The peat has been shown to develop a skin when exposed which seals in the water;*
- *phosphate release. Samples of the peat, and of the surface and groundwater, to assess the phosphate content and potential impact. All water will be discharged to settlement ponds. This will allow water to be tested for phosphate content. Local watercourses will also be tested for phosphate; and*
- *contamination by oil spillages etc. during construction. The contractor will be required to adopt the highest standards of pollution prevention, including the use of drip trays, bunding etc.*

Climate

A number of compounds with the potential to contribute to global warming or ozone depletion will potentially be released by the development, in particular, carbon dioxide and methane.

However, the proposed development is expected to lead to a decreased reliance on fossil fuels such as coal, oil and peat-burning, which have much higher emissions levels of carbon dioxide.

In terms of methane, the terminal has been designed to minimise fugitive emissions and to be energy-efficient.

During construction, there will be additional emissions from plant and vehicles, but these will be minimised as far as possible by careful management of vehicle movements, and by regular maintenance.

There are no substances associated with the development that will have a significant impact on ozone.

Cumulative Impacts

The project has been assessed with regard to its cumulative impact, i.e. the impact of the project when considered together with other elements of the Corrib development and with other developments in the area.

The assessment included the proposed demolition of the Bellacorick peat-fired power station, the construction of a small gas-fired power station and the possible development of a windfarm.

The assessment concluded the following:

- *that there will be a significant increase in employment opportunities;*
- *increased demand for local services and accommodation;*
- *some cumulative increases in noise and traffic during construction;*
- *no cumulative visual impact since none of the developments can be seen together from any viewpoint;*
- *a small additive impact on loss of habitat;*
- *the potential cumulative impacts of gases with potential for global warming from the terminal and gas-fired power station will be eclipsed by reduced emissions from the closure of the peat-fired power station; and*
- *little additional impact upon either hydrology or cultural heritage.*

Sustainable Development

Sustainable development can be defined as:

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

The terminal project has been assessed with regard to compliance with national goals as outlined in Ireland's National Sustainable Development Strategy, and the requirements of the Shell Group sustainable development principles.

These objectives include promotion of energy efficiency, limiting emissions of various gases and balanced regional development.

The assessment concluded that the project contributes positively to Ireland's national sustainable development objectives and complies more favourably with Shell's sustainable development principles compared with the 'no project' option.