incorporated into the standards identified in the Air Quality Standards Regulations, 2002.

Various international initiatives, protocols and Directives also exist to limit and reduce emissions at a national level.

The gas terminal is not subject to the Irish Solvents Regulations (SI 543 of 2000) as solvents are not used for applications covered within the Regulations and corresponding EU Directive. Solvent use at the terminal is very low. Methanol is used as an anti-freeze agent but releases are tightly controlled.

11.5 Background Air Quality Data

No publicly available air quality data for the region has been identified. To assess the current levels of certain key air pollutants around the terminal site, a sampling programme has been carried out. Three sampling surveys have been undertaken:

- September-October 2001;
- January-February 2002; and
- September-October 2003.

The results are summarised in Table 11.3.

Table 11.3: Background Air Quality

Substance	Concentrations (µg/m3)	
	Overall Measured Average	Limit
Nitrogen dioxide	2	40/30 (1)
Sulphur dioxide	2	20
Benzene	<1	5
Total VOC	228	N/A
PM10	12.4	50

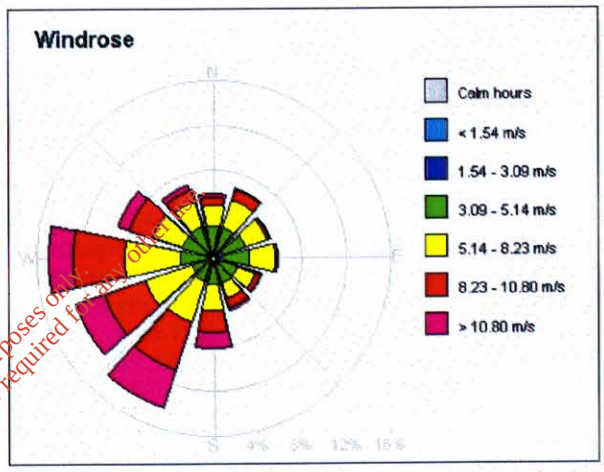
Note: (1): The 40µg/m^3 limit is for nitrogen dioxide for the protection of human health. A 30µg/m^3 limit for oxides of nitrogen (including nitrogen dioxide) also exists for the protection of ecosystems (see Table 11.1)

The results show that the air quality in the region is very good, with pollutant levels well below the relevant air quality standards. This is as expected for a rural area with little road traffic and few industrial sources of air pollutants.

11.5.1 Local Meteorology

The predominant wind direction is from the south-west and will disperse emissions away from the nearest residential dwellings for the majority of time. The frequency of wind direction and windspeed is illustrated in Figure 11.1. The windrose included in this figure identifies the frequency of the wind direction from where the wind is coming from as opposed to going to. Winds are typically moderate to strong and periods of very low winds or calm when dispersion characteristics can be restricted are shown to be very infrequent. The meteorological data was collated at Belmullet, which is the nearest and most representative meteorological station where data is collated in sufficient detail for use in this assessment. The year 1999 has been included for illustration. Local geographic features are not considered to significantly impair dispersion from emission sources or change local wind conditions. The potential influence of the local microclimate on dispersion is described further in Section 11.17.

Figure 11.1 : Windrose (Belmullet, 1999)



11.6 Interactions with Other Sources in the Region

Other emissions sources in the vicinity of the gas terminal include road traffic and potentially, releases from the Bellacorick Power Station, located approximately 10 miles south-east of the terminal. The peat-fired power station is due to stop the generation of electricity in 2004/5. A Planning Application has however been submitted to construct a modern, gas-fired plant on adjacent land. Releases from the Bellacorick peat-fired power station or subsequent proposed gas-fired power station on adjacent land may influence local air quality. Any interactions from these sources however are expected to be limited due to the spatial separation between Bellacorick and Bellanaboy

Contributions from existing road traffic to ambient air quality conditions are identified in the air quality monitoring described in Section 11.5. Background air quality has been included in screening assessments of construction and operational vehicle activity.

11.7 Characteristics of the Proposed Development

11.7.1 During Construction

As identified in Section 11.4, the main source of emissions during construction relate to construction vehicles and machinery. Particulate emissions may also be generated from the handling of raw materials.

Vehicles and machinery will release exhaust fumes into the air. Emissions will include releases of oxides of nitrogen, carbon monoxide, sulphur dioxide, benzene and PM_{10}. Vehicles will also potentially generate dust, including PM_{10}, in the event of passing over dry, unpaved surfaces.

Vehicles movements and onsite construction machinery will include:

- approximately 400 round trips per day using heavy good vehicles (HGV) to remove peat to the planned peat deposition site at Srahmore;
- up to 41 HGV movements per day to the construction site;
- an estimated 262 peak morning trips for construction workers; and
- onsite vehicles and machinery which, like HGV vehicles, will use diesel as a fuel.

The most significant activity with the potential to affect health and ecosystems is predicted to be the movement of peat from the terminal to the peat deposition site at Srahmore, as this will involve the largest number of vehicle trips that are also in close proximity to sensitive locations.

Certain raw materials will be dusty in nature. These raw materials will be kept covered to prevent dust generation.

11.7.2 During Operation

Process Units / Activities

The following equipment / activities at the terminal will result in emissions to atmosphere:

- heating medium heater;
- sales gas compressor turbines;
- electricity generation gas engines;
- emergency power generation engines;
- firewater pump engines;
- HP (High Pressure) and LP (Low Pressure) emergency flares;
- maintenance flare;
- fugitive emissions (leakages); and
- tank and product loading.

There are other minor sources of emissions on the site, such as the Open Drains Sump and the Treated Water Sump, but emissions from these sources are predicted to be negligible.

Emissions arising from combustion processes are summarised in Table 11.4.

A detailed process description is provided in Section 2. A brief description of the purpose of each unit or activity and the resulting emissions is given below. Releases to air will be regulated by the Environmental Protection Agency (EPA) and defined in the site's Integrated Pollution Prevention and Control Licence. An IPPC Licence application is currently under development and will be submitted during 2004. The licence issued by the EPA will be designed to ensure ambient air quality standards are not breached and effects on human health and vegetation are minimised or eliminated entirely.

Heating Medium Heater

The heating medium heater supplies heat to the gas inlet heater, the condensate heater and the methanol reboiler. The main fuel for the heater will be condensate. However, if there is insufficient condensate then the gas will be used particularly later in the field life when condensate production decreases.

Low NOx burners are to be employed in the heating medium heater in order to minimise emissions of NOx. Burners of this nature conform with the application of Best Available Techniques (BAT) principle. As a result, NOx emissions will be an average 203 mg/Nm^3 when fired on condensate fuel and 124 mg/Nm^3 when fired on gas.

The use of produced condensate in the heater as the main fuel for the heater makes use of an otherwise unwanted product.

Sales Gas Compressor Turbine

Two gas turbines (one operating, one standby) drive the sales gas compressors that are used to compress the gas to export pressures. Each turbine will have its own exhaust stack.

The turbines will be designed to comply with the EU's large combustion plant Directive. They will incorporate low NOx burners, significantly reducing emissions of NOx. NOx emission concentrations will be an average 51 mg/Nm^3 of exhaust gas. The relevant limit in the large combustion plant Directive is 75 mg/Nm^3.

Key emissions and operating parameters will be continuously monitored. Should any abnormalities

be found the turbine affected will be shut down and repaired and the spare turbine will operate.

Electricity Generation Gas Engines

Currently there is no external (grid) power supply to the terminal site and the generator packages have been designed to supply the power requirement for the entire site. Initially, three generators will be installed, two of which will be in use during normal operating conditions, running at equal load and discharging through individual exhausts.

Later in the life of the field (after year 9), the power requirement may increase and, if proven to be necessary, it is planned to add a fourth generator. For the purposes of this report, when considering emissions from the electricity generators, it has been assumed that the maximum emissions will be equivalent to the emissions from two of the original specification generators, running concurrently.

Gas is a cleaner fuel than diesel in almost all respects and thus, by using gas as the fuel for power generation on the site, the majority of emissions are minimised. Low NOx burners are to be used, in order to minimise NOx emissions. The specification of the engines will be in accordance with the suggested stack emission limits in the UNECE Long Range Transboundary Air Pollution Protocol.

NOx emission levels from these engines will be 500 mg/Nm^3.

Emergency Electricity Generator and Firewater Pumps

A diesel fired emergency generator will be installed to provide electricity in the event of a failure to the electricity supply from the gas engines. The provision of back-up supplies will ensure that critical systems can continue to operate and ensure site safety. The generator will be run for 1 hour per week to confirm availability.

Four firewater pumps will be driven by diesel fired compression ignition engines. Each pump will be run for 1 hour per week to confirm availability.

HP / LP Emergency Flares and Maintenance Ground Flare

The terminal will be equipped with a high pressure (HP) and a low pressure (LP) flare system, to be used in the case of over-pressure in the relevant parts of the plant. The benefits of the system are protection of personnel, plant and equipment and minimisation of atmospheric emissions.

The two flares will be situated in close proximity to each other and will be 40 m high. Typical vendor information indicates that the flare stacks have a hydrocarbon destruction efficiency of 98%.

The terminal will also house a ground flare for maintenance flaring. The ground flare is normally isolated and is put into service prior to maintenance activities.

Flaring was chosen over venting as the method for emergency pressure release and maintenance as it is considered to be significantly less harmful to the environment.

The extent of emissions arising from flaring activities will depend on the requirement for emergency and maintenance flaring. In accordance with Shell's Environmental Policy, the flare systems will not be used under normal operating conditions. During commissioning, the flare systems will be tested. Table 11.4 presents the predicted annual release of combustion gases arising from pilot gas use for the ground flare. The figures in Table 11.4 are based on operation of the ground flare for seven to fourteen days per year. Annual emissions data for emergency flaring is not included as this event will be very infrequent. Emissions arising from emergency flaring have, however, been assessed by atmospheric dispersion modelling.

Fugitive Emissions

Fugitive emission sources are limited to minor leakages from connections, isolation and control valves, relief valves, rotating equipment and analysers. This type of emission is small but unavoidable in this type of installation. By minimising the number of potential sources, fugitive emissions can be reduced significantly. Low-leakage plant items including relief valves, flanges and pumps will be installed to minimise releases further. United Kingdom Offshore Operators Association (UKOOA) guidelines have been used to estimate the amount of gas released through such leakages. Table 11.5 below gives a breakdown of the expected fugitive emissions. The composition of fugitive emissions has been assumed to be that of process gas.

Tank and Product Loading

Emissions from storage tanks and product loading have been estimated based on the predicted amount of condensate and methanol to be processed during the life of the Corrib gas field. Where volatile and potentially flammable materials are stored, the tanks have been designed to minimise releases to air through a combination of internal floating roofs and use of nitrogen blanketing where appropriate.

Table 11.4 Typical Annual Emissions from Combustion Sources

Source	Annual emission (kg)			
	NOx as NO_2	CO	SO_2	Particulates
Heating medium heater – on condensate	12,264	3,504	TBC	TBC
Heating medium heater – on gas	11,388	4,380	Negligible	Negligible
Sales gas compressor turbines	36,792	45,552	Negligible	Negligible
Power generation engines	50,808	29,784	Negligible	Negligible
Firewater pumps	6,448	603	374	104
Emergency generator	868	244	TBC	21
Maintenance ground flare	504	TBC	Negligible	Negligible

Table 11.5 Fugitive Emissions – Process

Component	Number in Terminal	Emission Factor (kg/component/year)	Total Annual Release (kg/yr)
Connections	4,800	2.4	11,520
Valves	2,384	33.9	80,818
Rotating Shafts	43	101	4,343
Analysers	12	[illegible]	20,102
Other	50	42.7	2,135
		TOTAL	**118,918**

Note: UKOOA emission factors used.

Table 11.6 Emissions from Tanks and Product Loading

Source	Methane emission (kg/year)	VOC emission (kg/year)
Fixed roof condensate tanks	0.35	194.95
Floating roof condensate tanks	0.63	3.13
Floating roof methanol tanks	3.43	17.14
Tanker loading emissions	63.46 – minimum (year 10) 127.2 – maximum (years 1-3)	3525.8 – minimum (year 10) 7071.45 – maximum (years 1-3)
TOTAL	**67.87 – minimum** **131.6 - maximum**	**3744 – minimum** **7334 - maximum**

Note: the floating roof methanol tanks are assumed to have zero emissions of other hydrocarbon components

UKOOA guidelines have been used to estimate tank emissions and the results are presented in Table 11.6.

Road tanker loading emissions have been estimated based on the predicted maximum amount of condensate to be exported during gas field life. A comparison of the variability of emissions has been given based on minimum and maximum condensate fuel usage in the heating medium heater. UKOOA guidelines were used to derive these data.

Emissions of fugitive releases will not occur at concentrations that will impact on human health. Fugitive releases with the potential to generate odour are described in Section 11.9.

11.8 Summary of Mitigation Measures

Potential air quality impacts during construction include releases to air from construction and haulage vehicles and the generation of dust. Traffic emissions will be minimised through appropriate vehicle maintenance and route selection to and from the terminal. Dust will be mitigated by the application of best practice dust suppression and containment techniques including the prevention of dust accumulation and

ensuring dusty materials are either moist or sheeted.

The terminal will be constructed to international design standards and will minimise combustion products and fugitive releases. Such design considerations will minimise releases to air.

Combustion processes have been designed to be energy efficient and minimise the quantity of fuel used, thereby minimising releases of emissions. Gas is the main fuel used onsite and is the lowest emission fuel available. Any out of specification gas will also be used as fuel for heating applications rather than be discharged to atmosphere. Low-NOx burners will be installed on the gas turbines and heating medium heater to reduce NOx releases further. The use of clean-burn gas engines will also minimise emissions from the power generators.

A leak of natural gas from the process presents a fire risk. Inherent site safety features will minimise the potential for uncontained (fugitive) releases of natural gas to air. Such features include continuous welded pipelines to ensure a sealed system from the arrival of offshore gas to the distribution of sales gas. Tanks storing volatile liquid materials will have internal floating roof designs with a nitrogen blanket where appropriate to minimise emissions from these sources.

Monitoring during the construction and operation of the terminal will assess the effectiveness of the mitigation measures introduced.

11.9 Odour Prevention

Sales gas prior to export will be odorised as required by BGE to aid leak detection at its points of use. Odorant will be stored in a double skinned stainless steel vessel. The odorant injection facilities will be mounted in a sealed enclosure with a nitrogen purge to prevent leakage. The purge vent will be fitted with an activated carbon filter. The filter will remove any fugitive releases of odorant and will be replaced as part of planned maintenance to ensure over-saturation does not occur. During maintenance, any releases to air will be neutralised by the use of a water spray mist. Over-filling of the odorant tank during odorant deliveries will be prevented through careful inventory control. Tank filling will be carried out via a closed system with a vapour return to the delivery tank to prevent any release to the atmosphere.

The design of the plant and the mitigation measures employed will prevent odour problems from occurring at offsite sensitive locations.

11.10 Potential Impacts of the Proposed Terminal Development

The potential atmospheric impact of the terminal development is a marginal reduction of air quality as a result of emissions arising from terminal construction and operational activities. The impact on air quality has been compared to ambient air quality standards to assess the potential impact on human health and ecosystems.

11.11 Do Nothing Scenario

In the absence of the development, there would be no anticipated change in air quality. Monitoring surveys carried out in 2001 to 2003 have identified the current air quality is very good. Baseline monitoring is described in more detail in Section 11.5.

11.12 Predicted Impacts of the Proposed Development

11.12.1 During Construction

Elevated levels of dust including PM_{10}, can potentially impact on health. Dust generation during construction is however unlikely to be a significant impact given the wet nature of the terminal site. Should very dry conditions occur, standard techniques of dust suppression will be used. This will involve spraying road and ground surfaces with water. Dusty materials will be sheeted during transport to site and storage. Vehicle wheel washers and road sweepers will also be used to reduce mud and dust build up on haulage roads and minimise any transference onto public highways. Measures to prevent dust generation will also prevent the generation of PM_{10}. Particulate matter is fine enough to enter the respiratory tract and potentially affect health at elevated exposure levels. Additional dust monitoring will be provided during construction activities to demonstrate implemented control measures are effective.

The greatest quantity of traffic-derived emissions will be generated during peat removal, with up to 400 round trips of heavy goods vehicles between the terminal site and the peat deposition site anticipated per day. To assess the impact on emissions from these movements in combination with existing traffic flows, other site traffic and the prevailing background air quality, a screening assessment methodology developed by the UK Highways Agency has been used. The procedure identified in the Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 1 – Highways Agency, 2003) has been used to compare predicted air quality at sensitive locations along the R314 and proposed haul route with ambient air quality standards. Other phases of the

terminal construction will generate lower traffic emissions compared to the initial removal of peat.

The DMRB procedure calculates concentrations for pollutants up to 200m from the roadside using emission factors for the vehicle mix and traffic speeds on the roadway. Where sensitive locations are within 200 metres of different roads, the contributions from each road are aggregated together even though this is normally prevented by the direction of prevailing winds. The assessment incorporated this and other conservative estimates of traffic flows and vehicle speeds to ensure a robust assessment of likely air quality impacts during construction activities.

Concentrations of benzene, carbon monoxide and oxides of nitrogen were predicted for (i) housing located at Bellanaboy Bridge (ii) near to the junction of the R314 and local road LP1204 and (iii) along the R314 to the east of the proposed terminal where some houses are located approximately 20 metres from the road. The highest concentrations at any sensitive location were calculated to be less than 30% of any air quality standard identified in the Air Quality Standards Regulations, 2002.

Controlling the flow of vehicles can help minimise emissions from traffic. To assist in the prevention of congestion, a traffic management plan will be in place to manage the vehicular traffic to the terminal site and HGV movements during peat removal. Traffic management and route selection is described further in Section 15.

No significant air quality impacts including negative impacts on human health are predicted to arise from construction activity.

11.12.2 During Operation

Local Air Quality

In the context of this study, the principal substance that has the potential to impact on local air quality and subsequent effects on health and ecosystems is nitrogen dioxide. NOx emissions are generated as a result of combustion activities at the terminal.

The potential environmental impact of NOx emissions from the terminal is discussed in the atmospheric dispersion modelling study (Section 11.13).

Other pollutants such as carbon monoxide, PM_{10}, sulphur dioxide, benzene and other VOCs and mercury can have an effect on local air quality and potentially human health but releases are not anticipated to be significant from the terminal site.

During operation, carbon monoxide will be produced from combustion processes. Emission concentrations will typically be an order of magnitude higher than the ambient air quality standard. Dispersion modelling described in the following Sections predicts that emissions will be dispersed to concentrations three to four orders of magnitude lower than its original emission concentration at nearby sensitive locations. Concentrations will hence be well within ambient air quality standards following dispersion.

There are very few emission sources of PM_{10} and sulphur dioxide as the principal fuel will be gas and any emissions from the use of condensate will be very low due to its clean-burning nature and negligible sulphur content. The principal source of benzene relate to vehicles as opposed to process related sources. Lower vehicle movements will occur during the operational phase of the terminal compared with the construction phase. Predicted concentrations of benzene during operational of the terminal will hence be even lower than those described in Section 11.12.1 (i.e. less than 30% of the air quality standard)

Carbon dioxide and methane (substances with Global Warming Potential) are considered a hazard to the global environment rather than the local air quality and are discussed in Section 14. Substances with Photochemical Ozone Creation Potential can have effects on a local, regional and global scale. These effects are discussed below.

Photochemical Ozone Creation Potential (POCP)

Although ozone in the stratosphere has a beneficial role, ozone in the lower layers of the atmosphere is considered to act as a 'greenhouse' gas. At sufficient concentrations low-level ozone can also cause respiratory problems and affect vegetation. Low-level ozone formation arises primarily as a result of a series of complicated chemical reactions, initiated by sunlight. The main source of ozone formation occurs through the reaction of oxides of nitrogen and VOCs.

Emissions of compounds that can contribute to photochemical ozone creation may arise from fugitive releases of natural gas and methanol. Methane, the principal component of natural gas, has a very low POCP value. Releases of natural gas will be minimised by the mitigation measures identified in Section 11.8. Methanol, whilst having a higher value of POCP will also only be emitted to atmosphere in relatively minor concentrations due to the mitigation measures employed. Such measures include the recovery of methanol in the methanol still and use of internal floating roofs and nitrogen

blankets to prevent evaporation of methanol from storage tanks.

11.13 Modelling Approach and Methodology

Atmospheric dispersion modelling has been used to predict the potential air quality impacts of the proposed terminal and hence any potential influence on human health, flora and fauna. The approach and the input data used are described in this section.

11.13.1 Approach

Detailed dispersion modelling has been undertaken using BREEZE AERMOD (v4.0.7), a third-generation model approved by the EPA and other regulatory bodies worldwide. The modelling predicts how emissions released from the terminal will disperse in the atmosphere under the prevailing weather conditions and the likely concentrations of pollutants to which members of the public and sensitive locations will be exposed to. Both long term (annual) and short term (hourly or eight-hourly) NO_2 and CO concentrations have been calculated for comparison with the Irish statutory air quality limits discussed in Section 11.4.1. Other pollutants potentially emitted have not been modelled as they will not be emitted if significant quantities relative to air quality standards.

The following scenarios have been modelled:

(i) Typical Operation

Typical operation includes emissions from the heating medium fired heater, sales gas compressor turbine and two electricity generating engines.

The scenario does not include emissions from the ground flare, firewater pumps or the emergency generator as these are only expected to operate infrequently (typically around one hour per week).

(ii) Emergency Flaring

The emergency flaring scenario was included in dispersion modelling undertaken as part of the first Bellanaboy Bridge Terminal EIA. It showed that air quality impacts from emergency flaring were not significant. Emergency flaring will be a very infrequent event.

11.13.2 Model Input Data

All critical factors that can influence dispersion were included in the modelling. This included the development of a three-dimensional representation of the site and surrounding terrain to predict how buildings and terrain would influence airflows across the site and plume dispersion. Five years of meteorological data, collected from a representative meteorological station, were incorporated into the model (1997-2001, Belmullet Meteorological Station). The model subsequently predicted air quality concentrations beyond the site boundary for every hour of the five years of met data collated.

11.13.3 NOx Chemistry

NOx emissions arising from combustion processes consist largely of nitrogen monoxide (NO). On release to the atmosphere, NO is oxidised to NO_2, which is of greater concern in terms of air quality. The chemistry of NO_2 formation is complex and depends on a number of factors including the presence of oxidants such as ozone.

The modelling exercise was undertaken assuming that 100% oxidation of NO to NO_2 took place. Actual maximum ground level NO_2 concentrations arising from the terminal are likely to be significantly less than the values predicted by the modelling, as much of the NOx emitted will be in the form of NO when it reaches the ground. The modelling is therefore conservative in nature in order to ensure a robust assessment of potential air quality impacts associated with the proposed development.

11.14 Modelling Results: Predicted Ground Level Concentrations

The tables below present the maximum ground level concentrations (glc) for each modelling scenario. Long term (annual) and short term (hourly for NO_2, eight-hourly for CO) ground level concentrations have been calculated for comparison with existing and proposed EU standards / limits:

- Annual average glc: average concentration experienced throughout a calendar year; and
- 1 hourly average (99.8th percentile) glc: 1 hour average concentration that is not exceeded for 99.8% of the year (i.e. may be exceeded for 18 hours of the year).

The stated concentrations identify process contributions only. The interaction with background air quality is identified in Section 11.13.2.

The predicted maximum annual average NO_2 concentration (4.9 $\mu g/m^3$) arising from process contributions is significantly lower than the annual average limits for the protection of both human health and vegetation. The maximum short-term hourly average (99.8th percentile) predicted ground level NO_2 concentrations (71 $\mu g/m^3$) is also well below the applicable ambient air quality limit.

Concentrations of carbon monoxide are clearly insignificant and are not discussed further.

Table 11.7: Predicted Maximum Ground Level Concentrations

Year of meteorological data	Ground level concentrations (µg/m^3) – maximum of all model output points		
	NO_2 annual average	NO_2 1 hour average, 99.8th percentile	CO 8 hour average
1997	3.2	54	49
1998	3.6	67	58
1999	4.9	71	57
2000	4.2	67	54
2001	3.4	64	52

Modelling of the flares undertaken as part of the first Bellanaboy Bridge Terminal EIA showed that the impact of emissions from emergency flaring will not cause a significant impact on local air quality. Emergency flaring will be a very infrequent event and any impact will be short in duration.

11.14.1 Receptors

Twenty houses (human receptors) have been identified within a 2km radius of the proposed terminal site. The mapped location of houses is presented in Figure 11.2.

Sensitive ecological sites in the vicinity of the terminal include:

- Sruwaddacon Bay SPA (part of the Glenamoy Bog Complex);
- Carrowmore Lake Complex (inc. Aghoos river and the river from Muingingaun);
- Pollatomish Bog; and
- Slieve Fyagh Complex.

The maximum long term and short term ground level concentrations of NOx at these receptors, arising from typical operating conditions for the terminal, has been determined and the results are presented in Table 11.8.

The geographical variation in concentration of predicted NO_2 beyond the site boundary is illustrated in the form of concentration contours at the end of this Chapter. If a location is within two contours, the predicted concentration at that location will be between the values stated for each contour line. The contours demonstrate that predicted concentrations fall rapidly with distance from the site boundary and are well within applicable ambient air quality standards at all times.

11.14.2 Discussion of Modelling Results

Tables 11.7 and 11.8 illustrate NOx concentrations at all locations beyond the site boundary including houses and ecological features will be well within relevant air quality standards. NOx modelling assumes all NOx is in the form of NO_2.

The maximum predicted annual average glc of NO_2 arising from typical process contributions is 4.9 µg/m^3 occurring at a point adjacent to the terminal's southern security fence.

The maximum predicted 1 hour average (as a 99.8th percentile) glc of NO_2 is 71 µg/m^3, occurring as a result of typical operation, at the same point on the southern security fence. This compares against the EU and Irish standard of 200 µg/m3. The highest 1-hour concentration (as a 100th percentile) during the same period was 77 µg/m^3. This is the one-hour concentration which is not exceeded and compares against the WHO standard of 200µg/m^3.

During typical operation, the maximum ground level NO_2 concentrations (as process contributions) in the vicinity of human and / or sensitive ecological receptors are low, being never more than 2.5% and generally less than 1% of the annual average limits for the protection of human health and vegetation and not more than 7% (generally less than 5%) of the short term limit (as a 99.8th percentile).

The above predicted glc values relate to process contributions only. Given the very good air quality in the area surrounding the gas terminal, concentrations in combination with background air quality will still be well within air quality standards.

Existing background air quality was discussed in Section 11.5. The highest predicted annual average NO_2 concentration resulting from the operation of the terminal in combination with measured background levels is 7µg/m^3. Such a concentration is less than 20% of the ambient air quality standard for NO_2 designed for the protection of human health. The highest predicted concentration in combination with existing air quality at any domestic dwelling is 7% of the standard.

Figure 11.2: Location of Nearby Houses

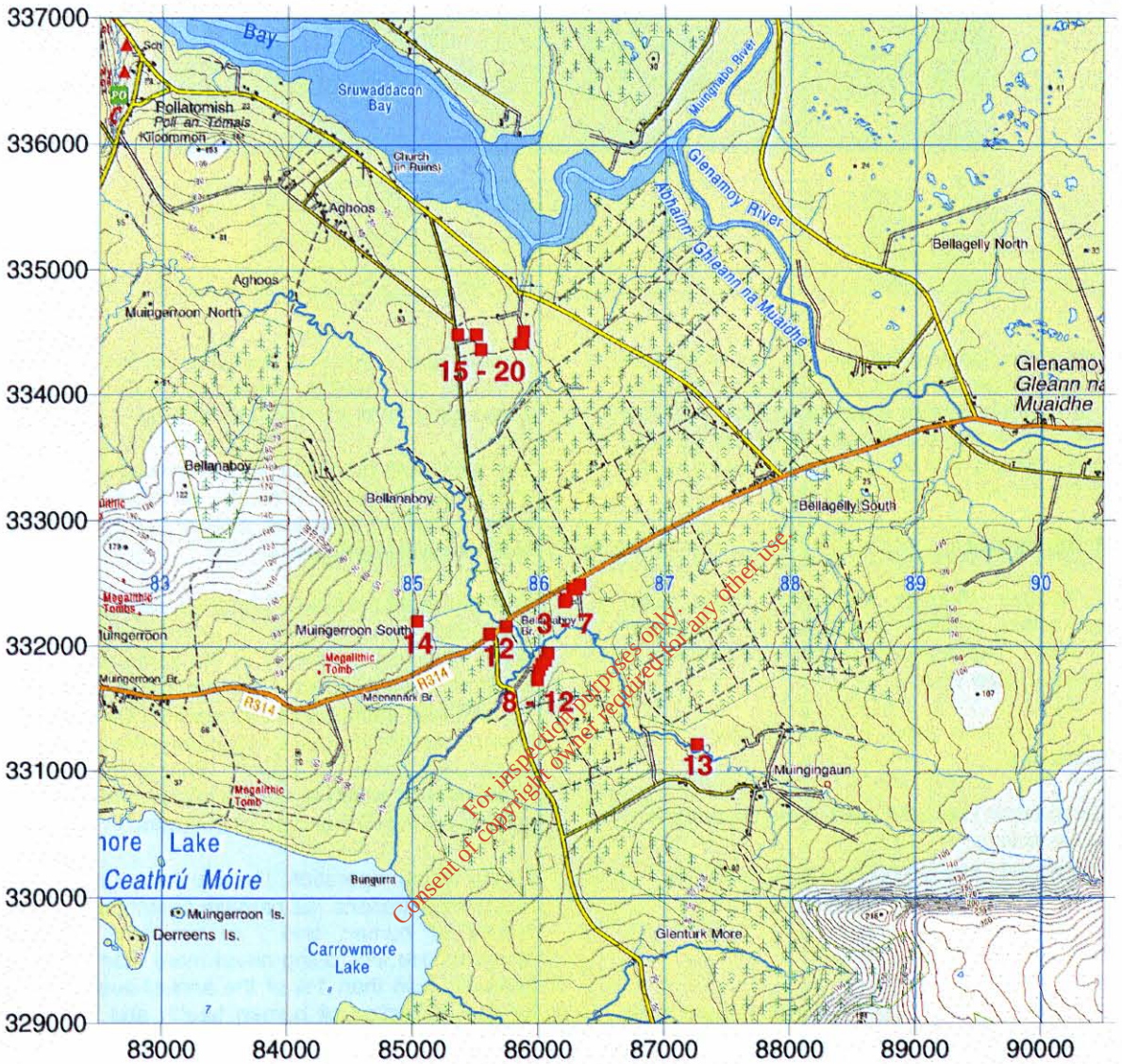


Table 11.8: Maximum NO_2 Ground Level Concentrations at Key Receptors

Receptor	Location		Annual Average	1 hour average (99.8th percentile)(2)
			Max GLC ($\mu g/m^3$)	
House 1	85609	332096	0.2	7.1
House 2	85740	332158	0.3	7.4
House 3	86206	332355	0.5	9.9
House 4	86217	332374	0.5	10.3
House 5	86297	332454	0.6	11.3
House 6	86324	332491	0.7	12.2
House 7	86269	332457	0.6	11.4
House 8	86072	331945	0.2	7.3
House 9	86054	331890	0.2	7.1
House 10	86025	331861	0.2	6.8
House 11	85991	331736	0.2	6.2
House 12	86003	331813	0.2	6.5
House 13	87261	331219	0.2	7.7
House 14	85033	332199	0.2	6.5
House 15	85350	334488	0.2	7.1
House 16	85535	334368	0.2	7.7
House 17	85867	334423	0.2	8.4
House 18	85875	334514	0.2	8.5
House 19	85498	334487	0.2	7.5
House 20	85845	334412	0.2	8.3
Sruwaddacon Bay(3)	~ 1.5km N of Terminal		0.2	5 to 10
Carrowmore Lake Complex(3)	~ 2km SW of Terminal		<0.1	<5
Pollatomish Bog(3)	~ 2.5km W of Terminal		<0.1	<5
Slieve Fyagh Complex(3)	~ 2.5km SE of the Terminal		<0.1	5 to 10

The EU and Irish ambient air quality limit for oxides of nitrogen (NOx) is designed to ensure the protection of ecosystems. NOx includes both nitric oxide (NO) and nitrogen dioxide (NO_2). Whilst no background monitoring data is available for NOx, the majority of background NOx in rural areas is typically in the form of NO_2. The dispersion modelling has effectively modelled NOx (assuming all NOx emissions are in the form of NO_2, not just the actual NO_2 component).

The modelling results for NO_2 are hence likely to be a very good indicator of combined levels of NOx arising from both process contributions and background air quality (from other sources), The highest predicted annual average concentration in this case is less than 25% of the ambient air quality standard designed to protect ecosystems. Predicted concentrations at sensitive ecosystem receptors are much lower still than this highest predicted value. The concentrations are also within the WHO guideline value for the protection of sphagnum dominated vegetation.

The modelling assessment incorporated a number of worst-case assessments that are likely to over predict ground level concentrations. Additionally, the predicted maximum concentration originating from industrial sources such as those present at the gas terminal typically occur under different weather conditions to background sources such as traffic. The peak concentrations (e.g. over a one hour period) arising from process and background sources may therefore not coincide either spatially or temporally. Given the very low background concentrations of NO_2 measured over extended periods, short period concentrations arising from existing sources are also likely to be low. It is generally regarded that provided process contributions are controlled, as demonstrated in this Chapter, compliance with annual average standards will also ensure compliance with short period standards (i.e. the one hour NO_2 standard) including the WHO guideline value. Even if the highest predicted short period concentrations from the process coincided with the highest short period concentration from existing sources, compliance with all applicable standards for the protection of health is predicted.

11.15 Air Quality Monitoring

Dust monitoring will be implemented during the construction phase of the development to confirm that dust control strategies are effective and will not

cause dust deposition problems or an adverse impact on health.

No monitoring of air quality associated with releases from vehicle exhausts is proposed. The screening assessment described in Section 11.12 predicted that air quality would be well within air quality limits at sensitive locations in close proximity to the R314 and haul route during the construction phase. Traffic flows during the operational phase of the gas terminal will be significantly lower than during the construction phase.

Stack emissions will be monitored at source in accordance with the requirements of the IPPC Licence.

11.16 Reinstatement and Residual Impacts

No combustion will occur after gas reception has stopped and there will be no vehicle activity associated with the terminal once decommissioning and abandonment is complete, therefore there will be no residual air quality impacts as a result of the terminal development abandonment.

11.17 Microclimate Considerations

The site and surrounding area within 1km is relatively flat and open and good dispersion conditions are expected. The prevailing wind direction is from the south west. However, localised land-sea effects, land to lake effects and the influence of hills on wind direction can be expected. Such effects are likely to lead to higher localised winds than would otherwise be the case, again aiding dispersion.

The Bellanaboy hill ridge lies approximately 3km to the west of the terminal road. The peaks of Glenturk Beg, Slieve Fyagh and Carrafull lie to the south and hill ridges are extensively present to the south east. The hills however do not form a continuous boundary where land rises steeply on all sides of the terminal site. The site is therefore not located within a basin, where poor dispersion effects can be extenuated. The hill ridge may cause localised influence in wind direction and wind speeds but such effects are not expected to decrease the level of dispersion.

Poor dispersion can occur under certain weather characteristics known as inversions which form in very light or calm wind and stable atmospheric conditions. The wind rose illustrated in Figure 1 identifies that such wind conditions are very infrequent.

11.18 Conclusions and Summary

The study concludes that atmospheric emissions resulting from the development will not have a significant impact on the local environment or human health, either during its construction or operation.

The greatest potential impact to health and the environment during construction was identified to be from construction vehicle emissions. An assessment has identified exposure levels at nearby sensitive receptors including domestic dwellings will be well within ambient air quality standards. A dust management strategy combined with ambient monitoring will be implemented to control releases of dust and PM_{10}.

The pollutant most likely to impact on local air quality as a result of terminal operation is NO_2. Predictive dispersion modelling has been carried out to determine the maximum ground level concentrations of NO_2 for typical operation and for emergency flaring.

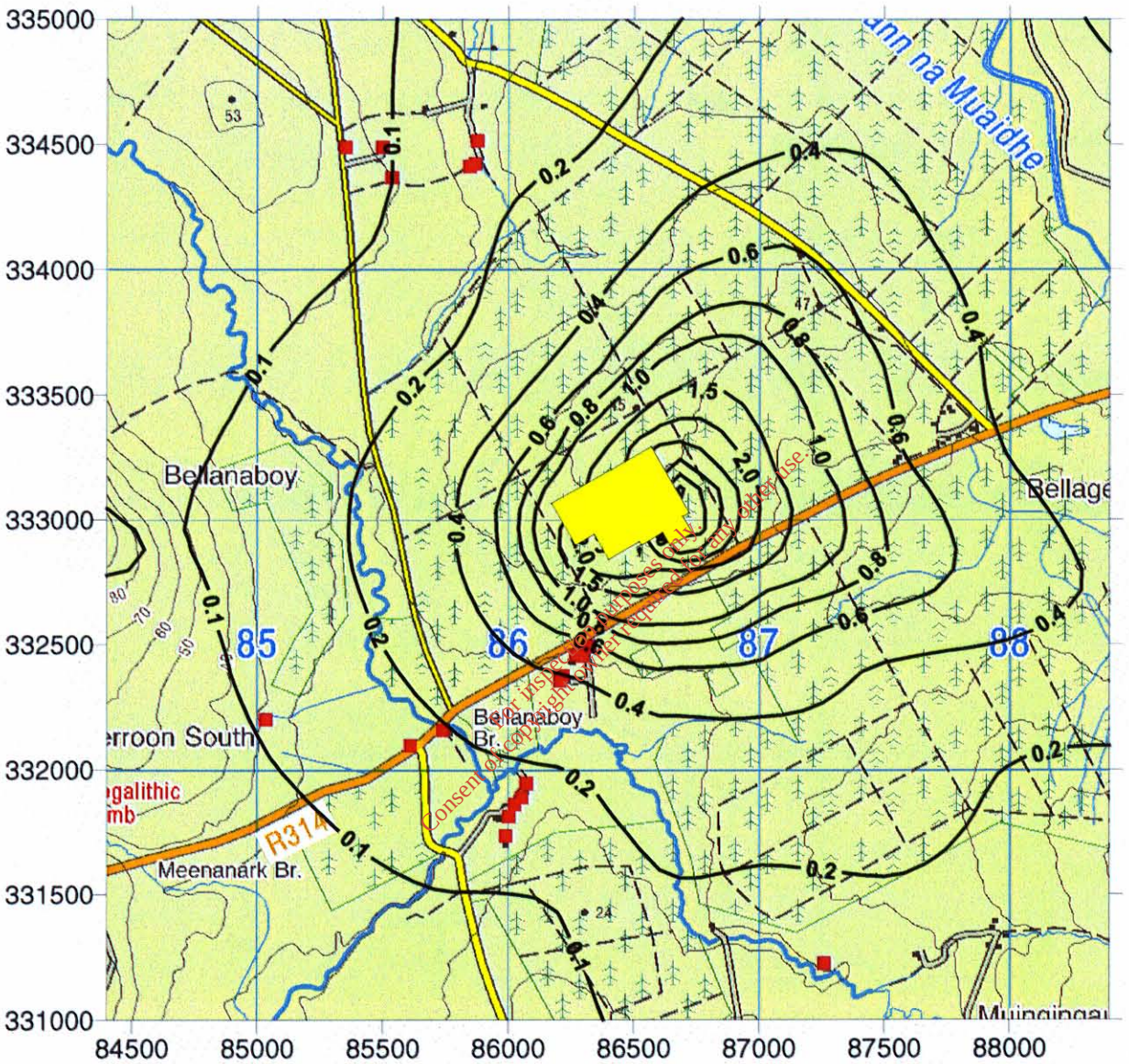
The modelled scenarios were highly conservative and the results indicate that:

- typical operation does not result in ground level concentrations of NO_2 that would exceed or approach any of the air quality limits;
- emergency flaring does not result in ground level concentrations of NO_2 that would exceed or approach any of the air quality limits for NO_2; and
- even in the hypothetical event that worst case emergency flaring and typical operations were taking place concurrently, the limits would not be exceeded.

Based on the modelling results, operations at the terminal site will not result in a significant impact on local air quality. This conclusion is based on a comparison of the ground level NO_2 concentrations predicted by highly conservative dispersion modelling with relevant air quality standards and guidelines. Such standards and guidelines have been set by environmental and health professionals across Europe following extensive worldwide research. They are designed to protect the most sensitive of receptors, including for example elderly humans with existing respiratory ailments and sensitive areas valued for their flora and fauna.

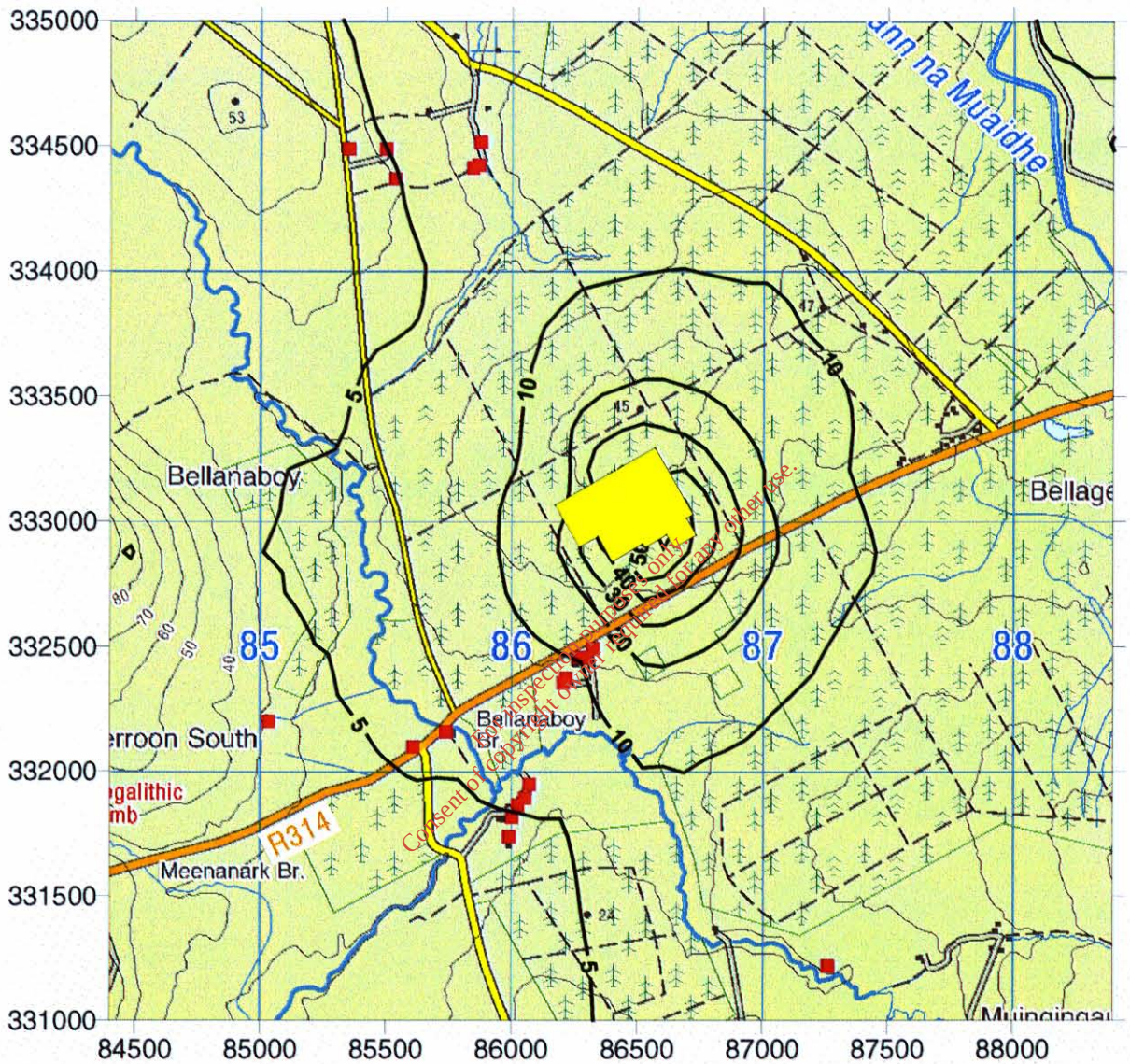
Existing air quality is very good and will remain so with the terminal in operation. No residual air quality impacts are anticipated as a result of the terminal development.

Figure 11.3 Concentration Contour of Annual Average NOx as NO_2 Concentrations Arising from Process Contributions from the Terminal



(1999 Meteorological data. Air Quality Standard is 40µg/m^3 for the protection of health and 30µg/m^3 for the protection of ecosystems)

Figure 11.4 Concentration Contour of One-Hour NOx as NO_2 (expressed as a 99.8th percentile) Arising from Process Contributions from the Terminal



(1999 Meteorological data. Air Quality Standard is 200µg/m^3 for the protection of health)

Twelve

Noise

12 Noise

12.1 Introduction

This section considers the potential impact of noise and vibration generated during the various stages of the proposed terminal development. The assessment has been undertaken by Alan Saunders Associates on behalf of Shell.

Implications of construction, commissioning and operation of the terminal facilities are considered in the context of appropriate standards and guidelines, along with requirements for monitoring and controlling levels of resultant noise and vibration.

General procedures for construction are well known. Typical techniques have been assumed in order to predict the impacts in this section, enabling previously measured and published standard noise and vibration source data to be considered.

The precise details of methods to be used in the construction and commissioning will be the responsibility of the construction contractor (yet to be selected). The contractor will be required to produce detailed environmental and safety management procedures. These will be discussed with Mayo County Council and agreements will be made on noise limits for points in the vicinity before construction begins, together with any requirements to monitor compliance with such limits.

Detailed noise data has been supplied regarding the actual equipment proposed for the terminal from the vendors. This information has formed the basis of the terminal assessment.

The Environmental Protection Agency will regulate the noise emissions from the terminal under the Integrated Pollution Prevention and Control (IPPC) Licensing regime. An IPPC Licence will be applied for in due course.

12.2 Study Methodology

12.2.1 Guidelines for Noise Impact Assessment

Guidelines published for consultation jointly by the Institute of Acoustics and Institute of Environmental Management and Assessment in 2002 have been used for reference, the overriding requirement however, being compliance with the EIA Directive (85/337/EEC).

12.2.2 Environmental Noise Climate

The area surrounding the proposed terminal site is rural and sparsely populated. Consequently, only a relatively small population will be impacted. These characteristics also result in low background noise levels against which increased levels of noise will be more noticeable.

12.2.3 Environmental Noise Surveys

An integral part of an environmental noise impact assessment of a proposed development is an understanding of the noise environment that exists in the area potentially affected by the development. It is, therefore, accepted practice to undertake background noise measurements at surrounding locations that may be sensitive to noise. These are usually the dwellings that are in the immediate vicinity of the site.

Background noise measurements were carried out in July 2000, November 2001 and October 2003. These noise surveys established baseline conditions in the vicinity of the proposed terminal site in accordance with ISO 1996 Acoustics - Description and measurement of environmental noise.

Various weather conditions were encountered during the noise surveys, ranging from strong wind and heavy rain to relatively calm, benign conditions. Noise levels measured during periods of precipitation are generally excluded from baseline noise data, as are excess levels generated by traffic movements on wet roads after periods of rain.

12.3 Receiving Environment

12.3.1 Noise Survey Results

Prevailing conditions in the vicinity of the site are dominated by westerly weather fronts coming in from the Atlantic Ocean, with high average and maximum wind speeds. Entirely calm conditions occur infrequently; a review of weather data from June 2002 to March 2003 indicates calm conditions occur less than 2% of the time.

When calm conditions do occur, and in the absence of other local noise sources, such as local traffic and agricultural vehicles, very low background noise conditions can be experienced.

Detailed survey measurements were carried out employing both manned and automated monitoring equipment to establish fluctuations in prevailing noise levels over time, and provide qualitative assessments of dominant ambient noise sources. These noise survey measurements are summarised in this section.

For the purposes of this assessment a 24-hour period has been divided into daytime (07:00-19:00), evening (19:00-23:00) and night time (23:00-07:00).

Daytime

During the daytime period individual traffic movements along the nearby roads, which generate considerable noise levels at times, dominate the noise environment around the site. Traffic along the R314 is generally audible at considerable distance, with a lesser contribution from traffic on the local road to Bangor.

Daytime minimum background noise levels have been measured below 30dB L_{A90}, but average L_{Aeq} levels are generally above 50dB, depending on proximity to road noise sources.

Evening

The minimum background noise levels during the evening tend to be similar to those during the quiet periods of the day, although the average level decreases along with a reduction in traffic activity. L_{A90} levels below 30dB are normal, with L_{Aeq} averages dropping to around 45dB.

Night-time

During the night the area can be described as an isotropic environment (no continuous dominant noise sources). Background noise levels are consistent with those occurring during lulls in activity during the day and evening, but with more frequent opportunities to approach minimum values.

Although relatively infrequent, calm conditions at night can result in the lowest background L_{A90} values of around 20dB. Average L_{Aeq} levels at night tend to drop to between 35 and 40dB.

12.4 Characteristics of the Proposed Development

The proposed terminal development refers to the construction and operation of all plant and facilities within the boundary of the site.

The terminal has been assessed in terms of the construction phase, normal operational conditions and emergency conditions.

12.4.1 Construction Phase

The construction of the terminal will take place over a period of two years. The ambient noise will fluctuate depending on the machinery used, time of construction and distance of receptors to the terminal site. In addition increased traffic will also result in an increase in ambient noise level. The key potential sources of noise and/or vibration are as follows:

- site traffic;
- piling;
- earth moving; and
- steel erection.

12.4.2 Normal Operation of Terminal

There are a large number of plant items associated with the normal operation of the terminal, the majority of which are continuously active throughout the working period.

The engineering design of the terminal processes and systems enables the use of accurate vendor noise data for the plant proposed.

12.4.3 Emergency Operation – Terminal Flare

The use of the flare will be addressed in isolation, as this constitutes high level emergency operation where safety concerns are paramount. A ground flare will be used during maintenance.

12.4.4 Maintenance Ground Flares

A small isolated ground flare has been installed to avoid non-emergency use of the high level flares. This flare will be used for the combustion of the non-recoverable gas prior to a maintenance activity. This is configured to minimise noise impact, as part of the normal operational noise control strategy for the terminal.

12.4.5 Other Emergency Plant

There will be a number of additional emergency plant items on the terminal site including emergency electricity generators, fire water pumps and pressure safety valves. These will be markedly quieter than the flare. To provide for a robust assessment, these items have been included in the normal daily operation of the terminal.

12.5 Potential Impact of the Proposed Development

12.5.1 Construction Phase

The impacts of all construction work will be within the scope of the accepted standards and guidelines. These will maintain a regime of noise and vibration control and monitoring to ensure that impact on the sensitive receivers is kept to a reasonable level on an ongoing basis.

Exceptional operations, such as restricted night-time or weekend working, will require consultation and liaison with the local residents and local authority to limit their impact.

The assessment presented here has been prepared using the most recent, typical noise data available for construction operations likely to be employed and the timings of such operations.

The terminal contractors' responsibilities will include reference to this document prior to commencement of site operations. In consideration of these factors, the contractors will also be responsible for any mitigation requirements to ensure that any agreed target noise levels can be achieved in practice throughout the scheme.

Standard Construction

Normal construction activities have been cross-referenced with standard noise source data to give an estimate of site noise levels. These values have been calculated using the procedures described in British Standard (BS) 5228:1997 'Noise Control on Construction and Open Sites'.

These calculations indicate that typical daytime construction noise levels will not exceed approximately 65dB $L_{Aeq,1hour}$ at any of the closest dwellings. However, in the early stages of the construction project with piling and soil stabilisation operations underway, these levels may be exceeded.

Due to the nature of the processes involved, noise levels will not be constant, fluctuating with operating periods for each item of plant and the combination of machinery being used at any one time. Noise levels will also vary depending on time and distance from the terminal site. Neighbouring residents will not, therefore, be continually exposed to these noise levels for extended periods.

During the period of earthworks where peat is transported from the terminal site to the peat deposition site at Srahmore, there will be additional road noise traffic (see below).

Road Traffic Noise

Traffic associated with construction of the terminal will be routed via main roads as far as is possible. Due to the rural nature of the area, however, some minor roads will have to be used for access. These routes proposed in Section 16 are subject to the Traffic Management Plan to be agreed with Mayo County Council.

The increase in traffic movements on minor roads is likely to cause a noticeable increase in daytime noise levels. This effect will be localised and temporary, and will be restricted to the construction phase of the scheme.

HGV traffic on local roads will need to be controlled by careful planning of material movements to and from site as part of the construction programme.

Significant numbers of such vehicle movements will be required at specific times in the construction programme. Although these activities will increase road traffic noise levels, they do not represent an introduction of a new noise impact as the local roads already support a wide variety of agricultural and construction-related heavy vehicle movements.

Communication with affected residents is essential in minimising the adverse affect of this potentially noisy process in the early stages of the construction program.

Rock Excavation

The construction of the terminal will require large movements of material within the site and from it. A large proportion of this material (peat and weathered rock) will be excavated by back hoe. This is unlikely to result in high levels of noise and vibration. It is possible that very small areas may require the use of ripping/rock breakers, which will produce more significant levels of both noise and vibration. The extent, nature and depth of these activities will be determined by a detailed borehole survey prior to construction.

Piling

The piling operation will take place during the first part of the construction process, when retaining walls and foundations are being built as part of the civil construction phase (see Section 3.3.4).

It is possible to control the levels of noise and vibration generated through piling, by adjusting the force applied on each impact cycle. Reduced impact force, however, reduces the process efficiency such that the operation takes considerably longer. It is usually found that the benefits of slightly reduced noise levels are out-weighed by the resultant increase in exposure duration. Only in extreme cases, usually due to very close proximity to residential properties, is this justified.

Ground conditions in which piling is required are expected to be relatively compliant, with significant resistance only encountered at the end of the piling cycle as competent load-bearing sub-strata are encountered. Generated levels of both noise and vibration are expected to be relatively low for such activities.

Good communications and public relations in the early stages of the construction program are the most important factors in minimising the adverse

affect of this potentially noisy process. Any resultant impact will be short-lived.

Other Site Operations

In addition to the operations above, the excavation of peat will necessitate the need for pumps on site. Generators will also be required for security lighting at night.

The combined noise levels for one diesel pump and one generator have been predicted using BS 5228, and can be expected to drop below 55dB(A) at distances in excess of about 300m.

During the construction period, there will also be air compressors on site for pneumatic tools.

Appropriate noise control measures will be implemented to minimise noise emissions, especially at night.

The limited period of construction and compliance with the requirements for mitigation of noise and vibration will ensure that impact on the local environment is kept to an acceptable level.

12.5.2 Normal Operation of the Terminal

Under normal operational conditions, noise levels emitted from the terminal site will be relatively constant with the majority of plant items running continuously. Some items that run intermittently contribute less to the overall noise levels, but are more likely to attract attention during start up and shut down. All such plant items are assumed to run continuously to offset this effect.

The normal operation of the terminal plant will be controlled such that it has an acceptable impact on the local environment and sensitive receivers.

This will require compliance with the nighttime criterion of 35dB $L_{Aeq,15mins}$ at the nearest sensitive receptor.

Daytime operation has been designed to comply with the daytime criterion of 45dB $L_{Aeq,1\ hour}$. This includes maintenance and routine test operations, which are normally expected to be operated on a daytime only basis.

The engineering design of the terminal plant and processes has been developed and amended to ensure that compliance with these requirements can be achieved.

A plant noise emissions model was developed during this process by the engineering team to prioritise noise control activities, which comprised over 150 separate noise sources, including external plant, process buildings and noise re-radiated from pipework.
Typical noise data have been used comprising a combination of vendor data for the actual equipment proposed and comparable data from similar installations.

This model was independently verified using alternative proprietary software, to within an overall accuracy of 1dB(A).

The degree to which this data will reflect actual noise levels emitted from the terminal site has been reviewed. It is considered that the predicted noise levels are sufficiently accurate to ensure compliance at the most sensitive receptor positions for specific meteorological conditions.

This engineering model was then developed further, using topographical and meteorological data, to provide a more detailed study of noise propagation over greater distances. This enables the overall impact on the area at large to be better assessed.

The results of the noise propagation model show contour maps of predicted noise levels for daytime and night time scenarios at 1.7m above local ground height. These are shown in Figures 12.1, 12.2, 12.3 and 12.4.

A daytime model is also presented which allows for typical prevailing wind conditions of 16.7 knots from 190 degrees.

12.5.3 Emergency Operation – Terminal Flares

In an emergency situation, such as a gas leak or a fire, safety considerations would require the removal of gas inventory from certain sections of plant or from the inlet of the export pipeline by the combustion of vented gas from the emergency flare.

Emergency flaring could occur at any time of day or night, whereas maintenance operations are normally carried out during the day. Rather than releasing the gas directly to atmosphere, it is burned in the form of a controlled flare. Flare facilities will be provided at the terminal for low and high-pressure emergency gas systems. These flares are referred to as the LP and HP flares.

Noise levels generated by the emergency flares are likely to be higher than any item of general plant within the facility, and are not readily attenuated by any form of industrial noise control.

Figure 12.1 Daytime Operational Noise: Calm Conditions (Includes Ground Flare)

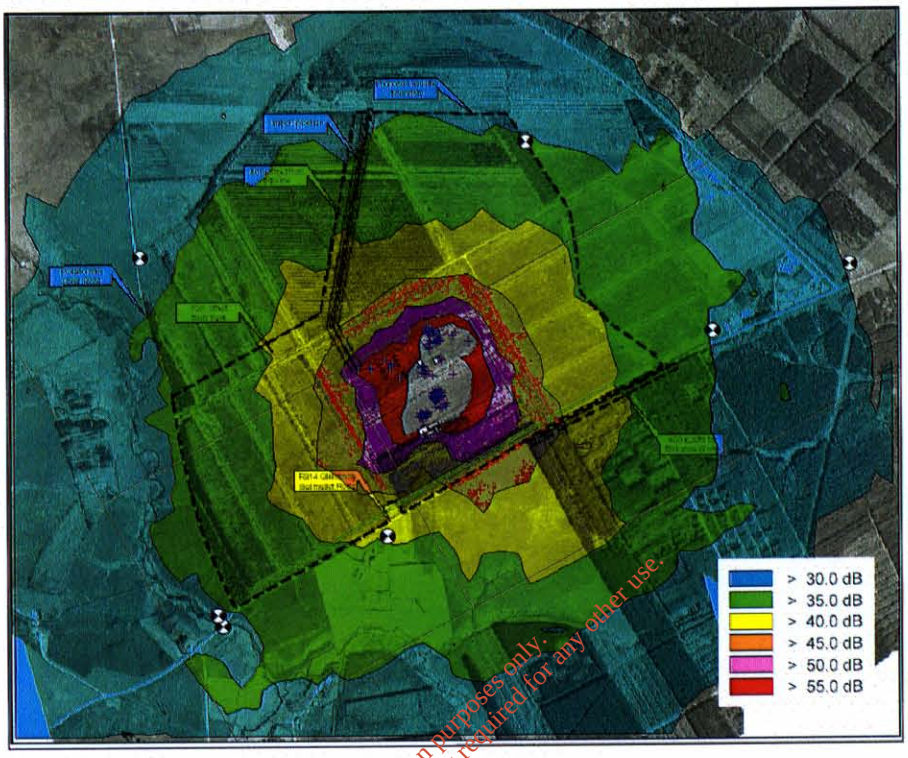


Figure 12.2 Daytime Operational Noise with 190° Wind at 8.6m/s, Met Condition D (Includes Ground Flare)

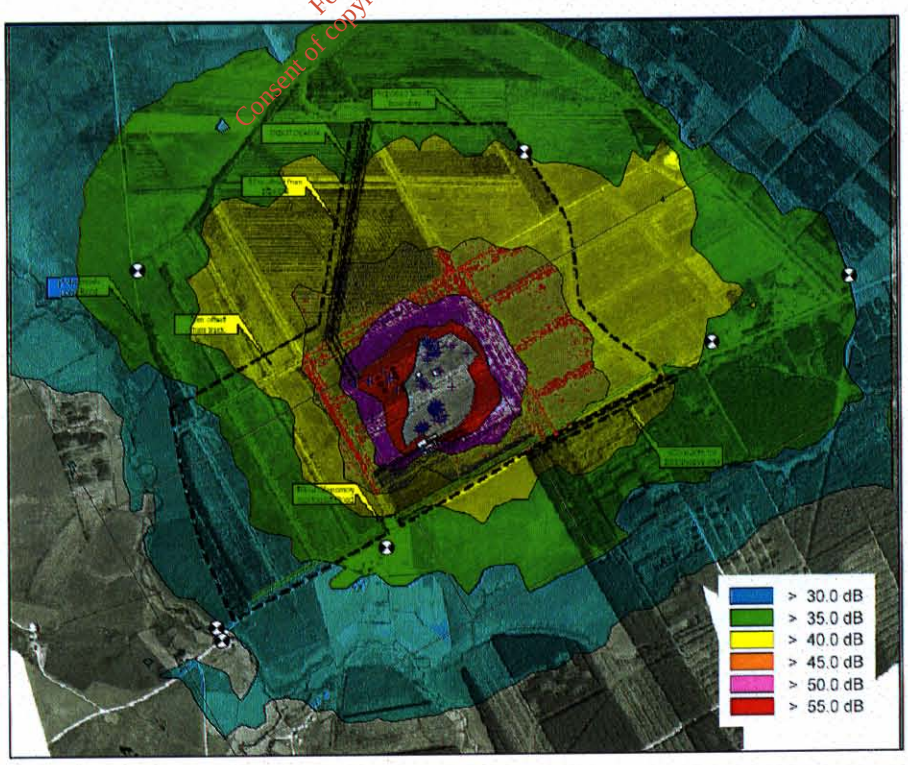


Figure 12.3 Night-time Operational Noise Calm Conditions

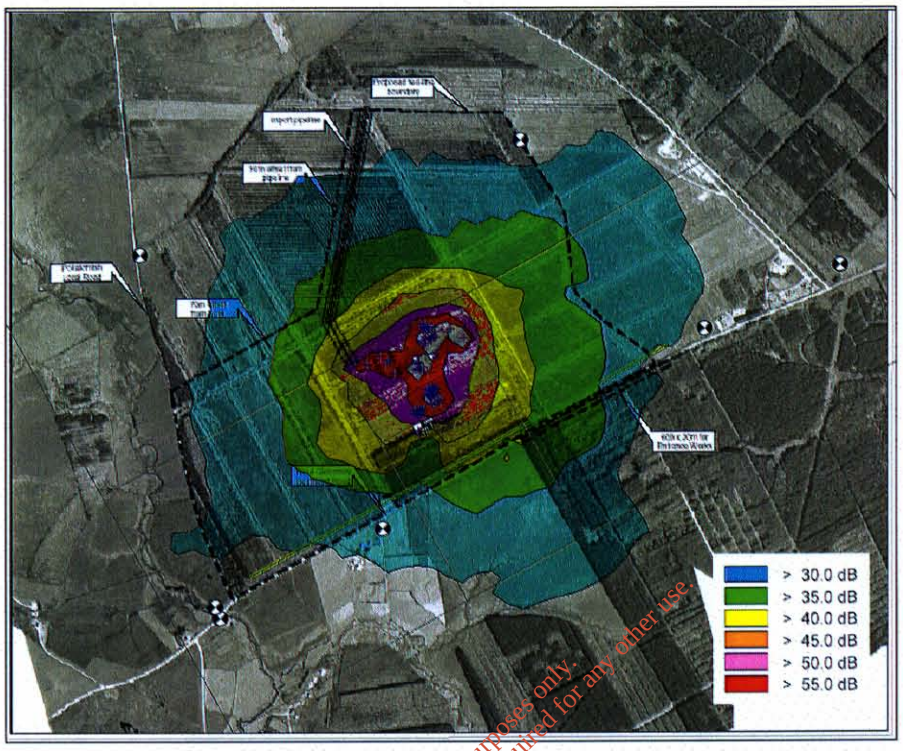


Figure 12.4 Night-time Operational Noise with 190° Wind at 8.6m/s, Met Condition D

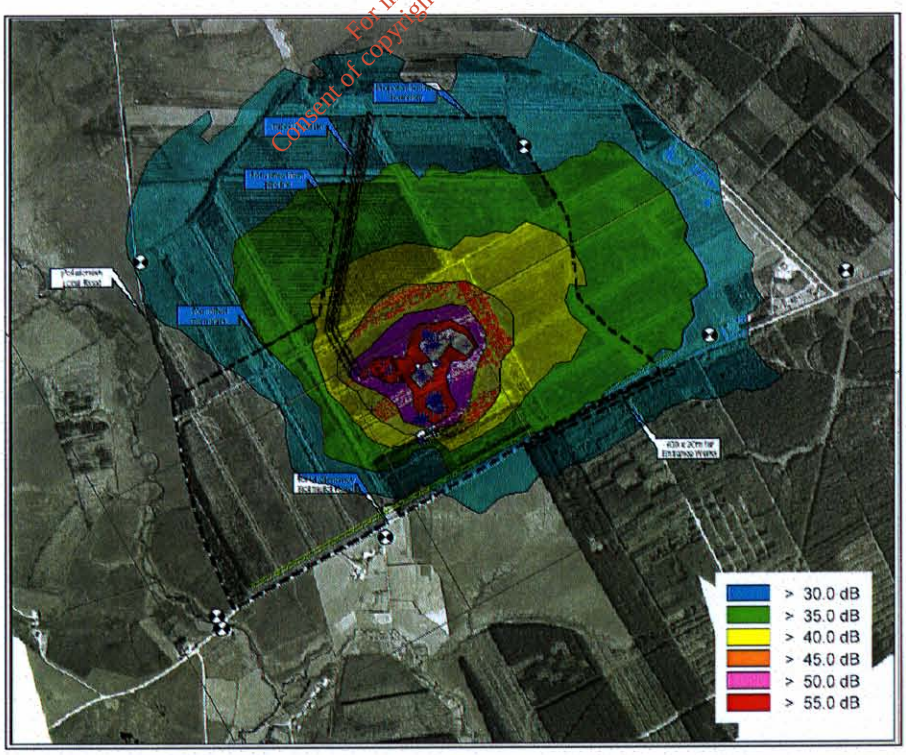
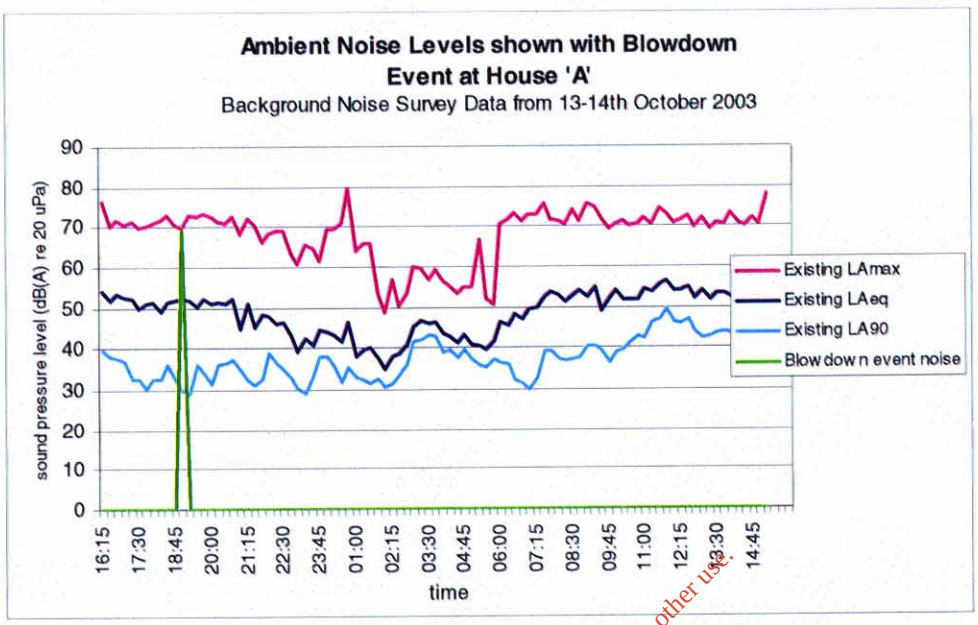


Figure 12.5 Ambient Noise Levels Shown With Blowdown Event at House 'A'



In the event of the emergency flare having to be used, the noise limits set by EU (Noise Directive 86188 EEC) for workers in the plant will not be exceeded.

Since the flares are not lit under normal operating conditions, it is not relevant to apply noise control restrictions as for everyday plant and machinery.

The flares will need to be tested on commissioning of the terminal to ensure correct operation, and this would be a planned event, with public notification. Operation thereafter would be a highly unusual occurrence, which could be described as a once in a lifetime event.

The resultant noise levels should be considered, nonetheless, to gain a full appreciation of the environmental impact of the entire operation.

To achieve the statutory depressurisation requirements, the engineering design has established flare rates and durations, which would be involved in a depressurisation event. Noise emissions have been assessed for this profile to the nearest residential property, at a distance of approximately 615m.

An $L_{Aeq,15min}$ level of just below 70dB has been established for such an event. By way of comparison, this is a similar noise level to that generated by a small modern petrol lawnmower at a distance of about 10 metres.

The significance of such a depressurisation flaring event can be assessed against otherwise prevailing background noise levels in Figure 12.5, which plots the resultant noise level against ambient noise monitoring data from the terminal site.

12.5.4 Other Emergency Plant

The terminal will include other plant items, such as emergency generators, and fire pumps, which are only required for operation under emergency conditions and for programmed daytime testing. These pieces of equipment are less noisy than the flares and are located much closer to ground level.

It can be concluded that these quieter emergency plant items can also be deemed acceptable in the context of their operational necessity. Such plant is largely included within the control of normal daytime plant in any event.

12.6 Mitigation Measures

12.6.1 Construction Impact Mitigation

In the absence of other specific legislation or guidance documentation relating to noise emissions from construction sites, reference will be made to British Standards and other relevant planning and reference documents as appropriate. The EPA document Guidance Note for Noise in Relation to Scheduled Activities does, however, give guidance on noise and vibration thresholds for quarrying and mining activities. It is understood that these limits

will be considered applicable to any rock blasting which may be required in certain areas.

The BS 5228 Standard states that complaints due to industrial noise increase as the difference between generated noise level and the background increases. It considers that a similar effect could occur for construction activities but suggests the tolerance may differ when it is known that the timing of the activity is of a short duration.

In consideration of the likely noise and vibration levels to be generated during the various phases of the scheme, the following mitigation measures will be adopted to minimise the impacts on neighbouring residents:

- detailed impacts for these activities will be assessed by the contractors to ensure compliance with the stated standards and guidelines, and local authority requirements;
- consideration to be given to use of vehicle reversing lights during hours of darkness instead of the usual reversing bleepers;
- the majority of construction work will take place during the 'daytime' period of 0700 to 1900 hours;
- fundamental to the contractors' duties will be the requirement to provide mitigation of noise and vibration where required and to the best standard practicable;
- the contractors will be required to minimise the need for heavy lorry traffic. This will be essential in minimising noise and vibration impacts on local residents and those living along the routes proposed for the delivery to site of construction materials (see Section 16);
- best practicable measures to reduce noise levels to a minimum will be employed at all times;
- normal working hours will be discussed and agreed with Mayo County Council before construction begins;
- any construction activities that may have to continue on a 24-hour basis will only proceed following consultation with Mayo County Council;
- where appropriate, residents living near the terminal site will be kept informed of the contractors' proposed working schedule and will be advised of the times and duration of any abnormally noisy activity likely to cause concern; and
- the contractors will be made aware of the necessity to avoid unnecessary noise from the site, particularly at night.

Recommendations have also been made with specific reference to the local L1204 road between R313 and R314, which will carry significant volumes of peat transportation vehicles during the early stages of construction. These comprise:

- road condition survey prior to commencement;
- repair works to all sections of road where the surface generates excess noise and / or impact, in the immediate proximity of roadside residences;
- additional signage specific to site traffic, including speed restrictions in key areas; and
- road condition survey on completion and repair works as necessary.

12.6.2 Noise Control Targets

Control of noise from the normal activities associated with construction of the terminal will be achieved by restricting working hours and by the best practicable means mitigation measures described above.

A working target of 65dB $L_{Aeq,1hour}$ is suggested as a daytime limit for resident's properties for most of the construction phase, against which noise monitoring throughout the construction programme can be compared. By way of comparison, this is a similar noise level to that generated by a small modern petrol lawnmower at a distance of about 14 metres. However in the initial months, the levels may be higher.

Noise monitoring positions would then be agreed with Mayo County Council, prior to commencement of significant works on site, to determine compliance with the noise emissions targets. Positions should be determined which can be readily access by site personnel, but accurately reflect the degree of off-site noise impact.

If specific activities are required which can be expected to exceed this level, this would be agreed in advance with Mayo County Council, with sufficient notice given to nearby residents and other interested parties.

A complementary target for night-time noise emissions from the construction site would be 45dB $L_{Aeq,1hour}$. To achieve this level, overnight plant such as pumps and lighting generators will need to be suitably attenuated. By way of comparison, this is a similar noise level to that generated by a small modern petrol lawnmower at a distance of about 140 metres.

12.6.3 Vibration Control Targets

The only site operation likely to give rise to any noticeable vibration levels is piling.

The Guidance given in 'Guidance Note for Noise in Relation to Scheduled Activities', 1995 on vibration levels relates to blasting operations, and states a limit of 8mm/s peak particle velocity at any residence for frequent operations. Piling vibration levels must be kept well within this limit.

Experience of piling vibration impact suggests that at levels in excess of a lower threshold of 1mm/s, some adverse comments can be expected from occupants of exposed dwellings. For operations expected to be at or in excess of this threshold, therefore, prior notice should be given to Mayo County Council and the residents concerned.

12.6.4 Operation Impact Mitigation

Minimising noise has been an integral part of the design of the terminal. For example:

- gas turbines and inlet and outlet pipework will be acoustically insulated, along with other major plant items and housed within buildings with specified sound insulation performance;
- the plot layout has been configured considering the location of dominant noise sources and the noise emission footprint; and
- stringent noise limits have been specified for all significant items of plant.

The Environmental Protection Agency will regulate noise under the Integrated Pollution Prevention Control (IPPC) Licence. This will apply to ongoing noise emissions from terminal operation.

The terminal will house numerous items of noise generating equipment, most of which will operate continuously.

Mitigation of noise related to the day-to-day operation of the terminal site will be achieved as an integral factor in its design and installation. After baseline noise surveys and discussions with Mayo County Council, the specified noise criteria (as assessed at the nearest noise sensitive property under free field conditions) were set as follows:

- Daytime (07:00 - 23:00) 45dB $L_{Aeq,1hour}$
- Night-time (23:00 - 07:00) 35dB $L_{Aeq,15mins}$

By way of comparison, these are similar noise levels to those generated by a small modern petrol lawnmower at a distance of about 140 and 450 metres respectively.

These noise criteria represent the best standard of noise control available, and are considerably more stringent than those often applied to such developments. For example they are 10dB lower than the EPA guidance document for noise 'Guidance Note for Noise in Relation to Scheduled Activities'.

A significant degree of industrial noise control will be required to achieve these levels, and will be the sole function of a considerable amount of terminal equipment. Commissioning tests will be required on completion of the facility to demonstrate that compliance with the criteria levels has been achieved, with additional mitigation implemented if required.

Ongoing compliance with the noise criteria levels will require a detailed test and maintenance program to ensure that noise levels are appropriately controlled and noise control equipment continues to function effectively. Noise limits and associated performance monitoring will be carried out in accordance with conditions to be set as part of the IPPC Licence for the terminal.

Any new plant or processes subsequently installed at the site will be subjected to a thorough noise audit to ensure that compliance with the environmental criteria is not compromised.

The noise impact of flaring will be mitigated by the relatively large propagation distances involved and by the use of the low-noise ground flare, for planned maintenance activities.

12.7 Predicted Impact of the Proposed Development

12.7.1 Construction

Construction of the terminal will last approximately two years. During this period, the construction processes and ancillary noise sources will generate increased noise levels.

The site is remote, and it is expected that compliance with normal construction noise controls can be achieved without undue impact on the construction program.

Noise controls have been specified, which the construction contractors will be required to observe. These controls are not set at an onerously low level, since it is appreciated that a certain degree of increased noise is inevitable during the construction phase and can be tolerated due to its finite duration.

Any particularly noisy operations or activities will be planned in advance, in order to ensure that appropriate community liaison can be put in place. The maintenance of good communications and

public relations are essential in minimising the impact on the local community.

The most significant noise impacts will arise from piling, earth moving and site traffic.

Vibration levels generated by piling works are unlikely to reach the stated limit as measured on the site boundary. Levels at the nearest dwellings will be significantly lower, and unlikely to exceed the threshold recommended for triggering additional liaison with Mayo County Council. Vibration measurements will be carried out at the commencement of the piling programme to confirm this.

The impact is shown in Table 12.1 and can be summarised as moderate in the immediate vicinity of the site and access roads, and temporary.

Table 12.1 Construction Noise Impact

Indicator	Predicted Change at Receptor		
	< 1km from Terminal	Traffic Along Haul Route	> 1km from Terminal
L_{Amax}	None / Slight Increase	None / Slight Increase	None
L_{Aeq} / L_{A10}	Increase	Large Increase	Slight Increase
L_{A90}	Slight Increase	None	None
N	Increase	Increase	None
Summary	Moderate Impact	Moderate Impact	Negligible Impact

12.7.2 Terminal Operation

Detailed modelling of noise emissions from the terminal has been undertaken. This has established that compliance with the specified noise limits is achievable with the type of installation proposed.

The residential receptor positions to the south and south west of the terminal site, near Bellanaboy Bridge, are likely to be the most affected by noise levels, since these are the closest to the terminal. Noise emissions modelling activity has concentrated on these areas to ensure compliance with the planning noise criteria.

Normal wind conditions will serve to reduce noise exposure at all of the key receptor points, as the prevailing wind blows to the north east - the direction in which residential properties are most distant.

Table 12.2 Operational Noise Impact

Indicator	Predicted Change at Receptor		
	< 1km from Terminal	Traffic Along Haul Route	> 1km from Terminal
L_{Amax}	None	None	None
L_{Aeq} / L_{A10}	None / Slight Increase	None	None
L_{A90}	Increase	None	None / Slight Increase
N	None	None	None
Summary	Moderate Impact	No Impact	Negligible Impact

The prevalence of relatively high wind speeds in the area also reduces the extent of noise impact from the terminal, by elevating background noise levels, which would otherwise be very low.

The impact is shown in Table 12.2 and can be summarised as moderate, affecting a relatively small number of individuals.

12.8 Monitoring

A programme of noise and vibration monitoring will be implemented in accordance with the conditions stated as part of the planning permission of the IPPC Licence and may include the following:

- operation – initial commissioning measurements of noise emissions and annual monitoring of noise impacts at sensitive receivers or at positions stated by IPPC Licence; and
- additional plant – the introduction of additional plant or variations to the proposed installation may require an acoustic audit as determined by conditions of the IPPC Licence.

12.9 Reinstatement and Residual Impacts

Ongoing noise impacts are only likely to be experienced in the immediate vicinity of the terminal site during construction and, to a much lesser extent, operational phases of the project.

Construction noise has been considered and assessed. It has been determined that some residents may be adversely affected, albeit temporarily, within close proximity of the terminal and mitigation measures have been established to minimise this impact.

Operational noise limits have been specified to control this impact, which will be controlled through IPPC Licensing. Calculations based on the currently proposed equipment at the terminal site confirm that compliance with the limits anticipated can be achieved.

Decommissioning activities will be carried out under the same controls and mitigation activities as construction of the terminal, although the impact can be expected to be significantly lower.

No residual noise impact is predicted following decommissioning and reinstatement.

Thirteen

Landscape and Visual Impact

13 Landscape and Visual Impact

13.1 Introduction

This section assesses the likely impacts of the proposed development on the landscape character and visual amenity of both the immediate and wider environs of the site.

This landscape and visual impact assessment has been undertaken by RSK ENSR Environment Ltd in conjunction with Brady Shipman Martin between August and October 2003, and builds upon an existing detailed knowledge of the proposed terminal site and its wider environs.

This assessment is based upon extensive and detailed existing baseline data dating from 2000 to early 2003, and includes information gathered in previous extensive consultations with Shell, representatives of Mayo County Council, Coillte Teó and others.

In order to assess the likely impacts, detailed site surveys to assess the landscape character and visual environment were undertaken.

13.2 Study Methodology

The landscape and visual impact assessment assesses the following:

Landscape Impacts, including:

- direct impacts upon specific landscape elements within and adjacent to the site;
- effects on the overall pattern of the landscape elements which give rise to the landscape character of the site and it's surroundings; and
- impacts upon any special interests in and around the site.

Visual Impacts, including:

- direct impacts of the development upon views in the landscape; and
- overall impact on visual amenity.

Visual impacts may be defined under 'visual intrusion' and 'visual obstruction', where:

- 'visual intrusion' is impact on a view without blocking, and
- 'visual obstruction' is impact on a view involving blocking thereof.

13.3 Significance Criteria

Various significance criteria are commonly used in assessing landscape and visual impacts. Many of these are particular to practices and based on years of professional experience in the area of landscape and visual impact assessment[1]. Yet others are proposed by particular bodies in relevant fields[2] or as standardisations of significance criteria across a wide range of environmental issues[3]. The criteria as set out in the EPA Guidelines on Information to be contained in Environmental Impact Statements are general in their description present difficulties in the direct relevant application and description of landscape and visual impacts.

Table 13.1 sets out the significance criteria ratings used for this assessment, which has been based on criteria included in the guidance from The Landscape Institute, listed in conjunction with the relative EPA criteria guidance.

The ratings may have negative, neutral or positive applications where:

- Positive impact – A change that improves the quality of the environment.
- Neutral impact – A change that does not affect the quality of the environment.
- Negative impact – A change that reduces the quality of the environment.

Terms relating to the duration of impacts are as described in the EPA Guidelines as:

- Temporary Impact - lasting one year or less;
- Short-term Impact - lasting one to seven years;
- Medium-term Impact - lasting seven to fifteen years;
- Long-term Impact - lasting fifteen to sixty years; or
- Permanent Impact - lasting over sixty years.

[1] 2002, The Landscape Institute & Institute of Environmental Managements & Assessment: Guidelines for Landscape and Visual Impact Assessment (2nd Ed.)

[2] 2002, Department of Environment (UK) Design Manual for Roads and Bridges, Vol. 11, Section 3, Part 5.

[3] 2002, EPA Guidelines on information to be contained in Environmental Impact Statements, Glossary of Impacts.

Table 13 .1 Significance Criteria

Project Criteria	EPA Rating
None / Negligible - No or only a very small part of the development, or work or activity associated with it, is discernible.	Imperceptible - An impact capable of measurement but without noticeable consequences
Slight - The proposals constitute only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposals would not have a marked effect on the overall quality of the scene.	Slight - An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate - The proposals form a visible and recognisable new element within the overall scene and may be readily noticed by the observer or receptor.	Moderate - An impact that alters the character of the environment in a manner that is consistent with the existing and emerging trends
Substantial - The proposals form a significant and immediately apparent part of the scene that affects and changes its overall character.	Significant - An impact which, by its character, magnitude, duration or intensity alters a sensitive aspects if the environment
Severe - The proposals become the dominant feature of the scene to which other elements become subordinate and they significantly affect and change its character.	Profound - An impact which obliterates sensitive characteristics

13.4 References

The assessment included a review of relevant statutory documents, including the Mayo County Development Plan 2003-2009 and the associated Landscape Appraisal.

The assessment has been undertaken with due regard to the advisory guidelines set out in the following documents:

- EPA: Advice Notes On Current Practice (in the preparation of Environmental Impact Statements) 1995;
- EPA: Guidelines On Information To Be Contained In Environmental Impact Statements 2002;
- The Landscape Institute / Institute of Environmental Management & Assessment: Guidelines for Landscape and Visual Impact Assessment, Second Edition 2002;
- Mayo County Development Plan, 2003-2009; and
- Appendix X Landscape Appraisal of County Mayo County Development Plan 2003-2009.

Various amenity and landscape publications and information relating to the local environment have also been reviewed.

13.5 Characteristics of the Proposed Development

The full site comprises approximately 160 hectares of which approximately 25 hectares will be used in the provision of the terminal and associated development as detailed in the following paragraphs.

Approximately 13 hectares will be graded to provide a level base set at 33.4m AOD Malin for the proposed terminal. One hectare will be used for parking and temporary construction facility.

The remaining approximately 135 hectares will primarily be used in the retention and long term protection of existing conifer screening and open grassland areas, the provision of additional screening, together with areas set aside for ecological mitigation proposals. As such, the proposed terminal area itself will occupy less than 10% of the site where over 80% comprises areas of existing plantation / screening, proposed planting / screening and buffer.

The development will comprise the following principal elements, which are to be considered as part of the landscape and visual impact assessment:

- single finished platform level of 33.4m AOD Malin;
- combined high pressure & low pressure flare stack - height approx. 40 m above existing ground level at the flare stack location (36.5m AOD Malin);
- ground flare stack – approx 12m above finished platform level;
- methanol still - height approx. 33 m above finished platform level;
- heating medium heater - height approx. 20 m above finished platform level;
- sales gas compressor/turbine stacks- height approx. 22 m above finished platform level;

- power generator exhausts – approx 16m above finished platform level;
- sales gas compressor after coolers - top of equipment approx 20m above finished platform level, top of inlet pipes approx 22m above finished platform level;
- telecommunications mast - height approx. 22 m above finished platform level; and
- bulk product methanol storage tanks, raw methanol storage tanks & condensate storage tanks - approx 10m above finished platform level.

Other features of the development include:

- establishment of a temporary construction and lay down areas to the north-east of the terminal footprint;
- sequential operations to undertake the on-site windrowing and exportation of excavated peat (as described in Section 3.5.6);
- car parking to accommodate 40 car spaces;
- areas of hard-standing for tankers for loading and off loading and internal circulation roads
- main access road from the R 314;
- warehouse and maintenance buildings ridgelines at approx 45.3m AOD;
- control building, ridgeline at approx 43m AOD;
- administration building ridgeline at approx 40m AOD;
- security fencing around the terminal footprint and low level stockproof fencing close to the boundary of the site; and
- low-intensity lighting and high level emergency lighting.

The proposed development has an anticipated life-span of about 20 years at which stage it is proposed to substantially remove all of the development back to base level, cover the site with soil and finish by grassing and general landscaping.

13.6 Receiving Environment - Character of the Surrounding Wider Landscape

The site is located toward the northern reaches of a large inland area of predominantly flat to gently undulating low-lying and partly modified blanket bog. This landscape is notably enclosed to the south and west by prominent uplands and the open and exposed nature of the lowland landscape is interrupted by prominent and extensive coniferous plantations and occasional lines of trees. The site itself is located on gentle south face slopes within the north western extent of this large coniferous area.

In general the area is sparsely populated, with individual dwellings and farmsteads well spaced and scattered throughout the area. Small numbers of residential properties tend to be varyingly clustered on and around small areas of improved grassland and along the more distant coastal edge where the land is of a more improved nature. In the vicinity of the site properties are located immediately south & south west of the site (less than 1km distant) near Bellanaboy Bridge. They are also found at greater distance (over 1km) north of the site both approaching, and at, Aghoos and east of the site (over 1.5km) again both approaching, and at, Glenamoy.

Within plantation areas the roads are strongly enclosed, otherwise the roads are generally open, not being defined by walls or hedges, so enabling long range views, occasionally restricted by landform or by vegetation.

Within the expansive landscape, even in close proximity, the site is not significant, viewed as it is, as part of a much larger complex of coniferous plantation. When travelling the roads or traversing the landscape the eye is drawn over the low-lying moorland/grassland to the dark encircling ranges of hills and mountains, including the Muingerroon-Bellanaboy Hill (170m AOD) to the north west, Slieve Fyagh (331m AOD) to the south east and the Knocknascollop-Derreens range of hills (238-244m AOD) to the south-west.

To the south west Carrowmore Lake offers diversity, and in appropriate light, reflection to the dark upland landscape. As such, the site is neither prominent or of particular focus of attention in travelling through this landscape either by road or otherwise.

The principal amenity activities in the area are walking on surrounding roads and hills, and fishing the local streams and Lake Carrowmore. The fifteen-piece North Mayo Sculpture Trail, 'Tír Sáile', which extends from Ballina to Blacksod via Belmullet, has one piece, '*Stratified Sheep*' located along the Bangor Local Road just off the R314 Belmullet-Ballycastle Regional Road, near Bellanaboy Bridge (see Section 5, Plate 5.1).

13.7 Character of the Proposed Gas Terminal Development Area

The site is situated in the townland of Bellagelly South, north of and contiguous with, the R314 Belmullet-Ballycastle regional road at a point almost immediately east of Bellanaboy Bridge, near Bangor Erris in northwest County Mayo. Glenamoy, some 3km to the east and Pollatomish, some 4km to the north are the nearest villages. The site lies approximately 8km inland from the proposed pipeline landfall site at Dooncarton.

The site is on part of the former Peatland Experimental Station at Glenamoy, which was established by the Department of Agriculture in 1959. The Station ceased to function in the early 1980s. The topography of the site within the planning application boundary rises from approximately 15 m AOD in the extreme south west of the site by Bellanaboy Bridge to a high point of almost 46m AOD in the north eastern corner of the actual terminal footprint.

The site itself comprises approximately 160 hectares partly of wet soft rush dominated grassland varyingly surrounded and divided by wide belts and plantations of primarily Lodgepole Pine (*Pinus contorta*) and Sitka Spruce (*Picea sitchensis*). The conifer plantings, which are laid out in generally regular east-west and north-south blocks, are of greatly varying age with average heights ranging from 3m to over 16m in height. The highest stands within the site are located to the south along the R314 Belmullet-Ballycastle Regional Road, to the west along the Bellanaboy Bridge-Pollatomish Local Road and to the north.

The plantations are prominent features within the local and wider landscape and act as important high level screens interrupting the otherwise smooth terrain of moorland/grassland. All the existing plantations show good growth patterns and younger plantations exhibit strong annual growth.

Figure 13.1 illustrates an aerial photograph of the landscape surrounding the site, taken in August 2003, with the proposed terminal superimposed. A sequential letter has individually identified all the existing plantations within the planning application boundary.

From detailed information obtained from the 1992 Coillte Teo Inventory Reports both the species composition and year of planting has been determined.

A feature of many of the roads around the site is the prominent and dense groves of Rhododendron, (*Rhododendron ponticum*) which frame the roadside corridors. These plantings are most notable along the R314 Belmullet-Ballycastle Regional Road where it runs along the site and especially along both sides of the Bellagelly-Pollatomish Local Road to the east of the site. New Zealand Flax, (*Phormium tenax*) is also frequently seen in sheltered plantations on the site.

While the above description outlines a complex arrangement of matrix of conifer plantations and open wet grassland, within the local landscape, the site in effect appears as a relatively 'standard commercial coniferous plantation' in its varying stages of planting, growth and harvesting.

13.8 Impact on Landscape Planning

The statutory or non-statutory landscape planning aspects relating to the area can be considered in terms of national, county and local status.

13.8.1 National Landscape Designations or Listings

The 'Inventory of Outstanding Landscapes in Ireland', prepared by An Foras Forbartha in 1977 has no listing pertaining to any part of the site or the immediate surrounds. Such listings in the wider vicinity of the site tend to be focused on the coastal areas (Nr 105 Benwee Head (13km distant) & Nr 106 Erris Head (18km distant) to the northeast and northwest and upland areas (Nr 17 Nephin Beg Range (minimum 20km distant) to the south.

As such, the proposed development will have no negative impact on any national landscape amenity or scenic designations or listings.

County Landscape Designations or Listings

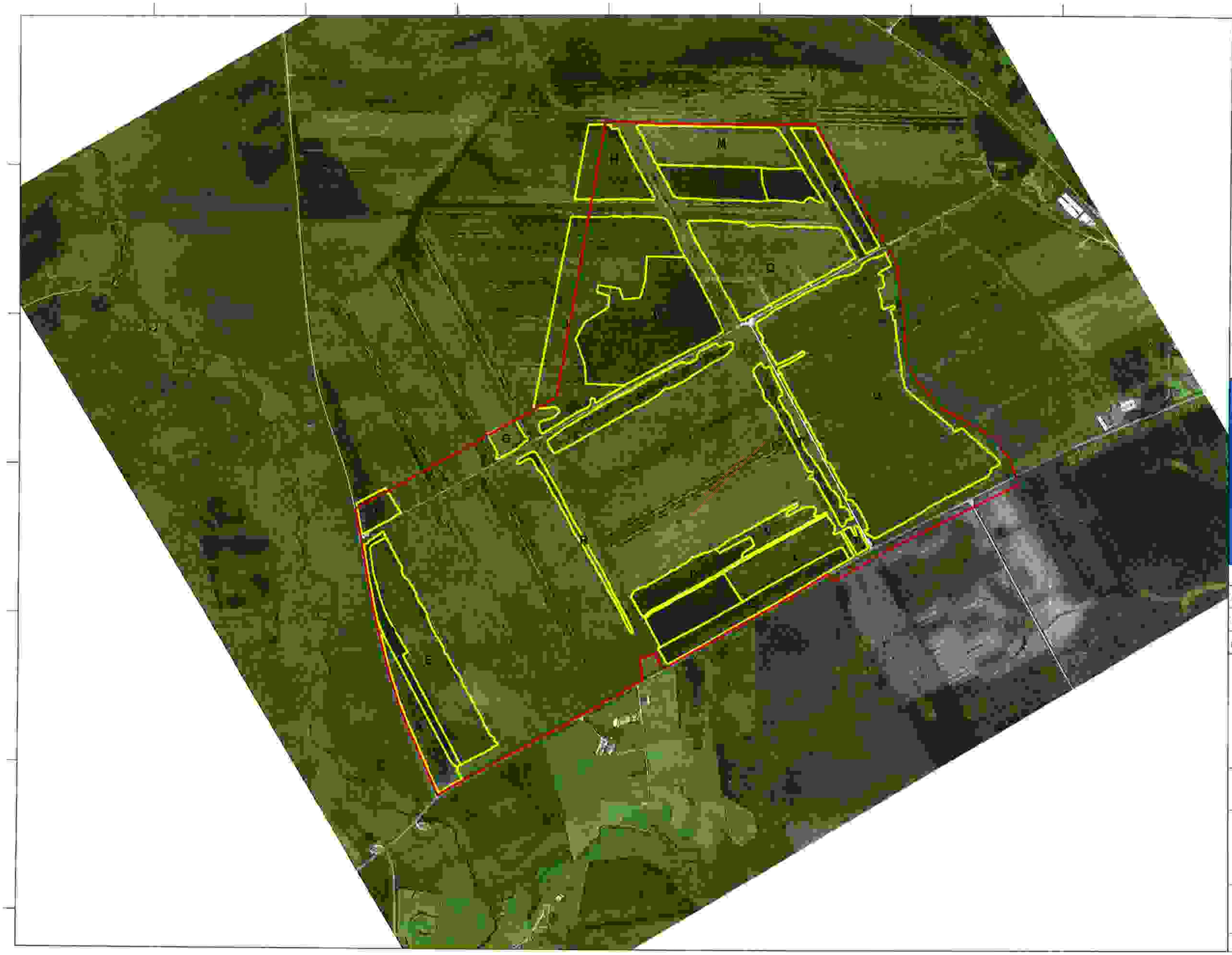
The County Mayo Development Plan 2003-2009 is the statutory planning control document pertaining to the study area. Appendix X of the Development Plan includes a Landscape Appraisal of County Mayo.

13.8.2 County Mayo Development Plan 2003-2009

At Section 3.1.5 'Environment, Heritage & Conservation' the Plan includes the following principal landscape / visual related references:

Policies EH-LC1 and EH-LC2 specifically relate to Landscape Character. Policy EH-LC1 confirms that it is an objective of the Council through the Draft Landscape Character Appraisal "to recognise and facilitate appropriate development in a manner that has regard to the character and sensitivity of the landscape, to ensure that development will not have a disproportionate effect on the existing or future character of a landscape, in terms of location, design, visual prominence, that development will have regard to the effects of the developments on views from the public realm towards sensitive or vulnerable features and areas".

Policy EH-LC2 confirms that it is an objective of the Council "that all development in the County shall be considered in the context of the policies set out for the four Principal Policy Areas defined in the Landscape Character Appraisal of County Mayo,



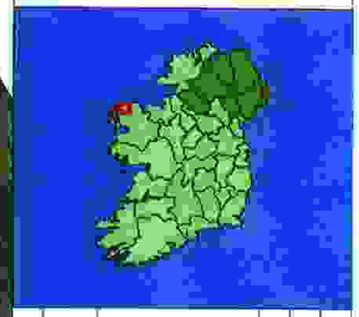
Existing Plantation Areas

Planning Application Boundary

Existing plantations within proposed SEPIL ownership

Area	Existing average height (m)	Year of planting	Species composition
A	13.0	1959	SS/LP
B	14.0	1959	SS/LP
C	13.5	1959	SS/LP
D	7.6	1985	LP
E	8.0	1985	SS
F	12.5	1958	SS/LP
G	3.5	1985	SS
H	7.3	1985	SS/LP
I	8.0	1985	SS
J	9.0	1985	SS/LP
K	8.2	1985	LP
L	6.2	1985	SS
M	4.0	1985	SS
N	9.3	1985	LP
O	18.8	1959	LP
P	14.6	1959	SS/LP
Q	1.7	1986	SS
R	2.5	1985	LP
S	4.0	1985	LP
T	4.0	1985	LP
U	2.2	1996	SS
V	4.0	1985	SS/LP

Average existing heights based on BKS survey of September 2005
SS Sitka Spruce
LP Lodgepole Pine



Rev	Date	Description	Drn	Chk	App
01	16/12/03	Revised Title Bar	IM	NH	JW
00	4/11/03	Initial Draft	IM	NH	JW

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BELLANABOY BRIDGE TERMINAL

TITLE 13.1
AERIAL PHOTOGRAPH INDICATING EXISTING PLANTATIONS

SCALE 1:10,000 REV 01

FILE NAME P400396C1-AERIAL PLAN.WOR

provided such policies do not conflict with the County Development Plan".

Policy EH-VP1 states that it is the policy of the Council "to ensure that development does not adversely interfere with views and prospects and the amenities of places and features of natural beauty or interest when viewed from the public realm. Views and prospects worthy of preservation and protection are indicated on Map 12".

Map 12 entitled 'Scenic Views' indicates there are no Views and Prospects pertaining to the site itself or its immediate surrounds. The plan does indicate that scenic views are available to either side of the Barnatra - Dooncarton - Pollatomish – Aghoos Local Road. The plan indicates that the 'Highly Scenic Views' are out to sea and that the 'Scenic Views' are severely restricted by topography. This road is some distance northwest and north of the site and primary views are away from the site towards the coast. The site is almost always screened or otherwise insignificant and largely imperceptible within its context. Any impact is considered to be negligible given that the proposal will be effectively screened and visually insignificant in any wide and expansive landscape view from this area. See Photomontage Viewpoint Nrs. 12 & 13.

Plan 12 indicates that both 'Highly Scenic Views' and 'Scenic Views' are available along the western shoreline of Carrowmore Lake to the south west of the site. The Plan also indicates that the Belmullet to Ballycastle Road (R314) is listed as one of the Scenic Routes in the County.

From west of Carrowmore Lake, views of the site are very limited and where possible are from distance (5km +) where there are significantly wider and expansive views to the surrounding landscape. The site is relatively indistinguishable in its wider coniferous setting. As such, any impact is considered to be slight given that the proposal will be insignificant in this wide and expansive landscape view. See Photomontage Viewpoint Nr. 14.

It is considered that the proposed development will be most readily viewed when travelling east along the R314 Belmullet to Ballycastle Regional Road. The impact is limited to approximately a 2.5km stretch of the R314 Road approaching Bellanaboy Bridge. As the site comes in to view travelling east along the R314 at some 2.5km distance, the view from the road is both expansive and panoramic south over Carrowmore Lake, southeast towards the Slieve Fyagh Uplands, which lies straight ahead, and to a lesser degree, north to the Muingerroon Upland. The site is largely unremarkable and not a point of visual attention other than as part of a large area of conifer plantation.

Most of the low level plant is completely screened by the existing trees along the Pollatomish Road, however it will be possible to view the upper sections of the tallest features of the terminal, which will be seen protruding above the trees and above the skyline. Some of the pipe racks, the power generation building, and the maintenance flare will also be visible above or contiguous with the existing tree line to the west of the site. The impact is considered to be moderate/substantial in nature along this short section of road, see Photomontage Viewpoint 10.

As the road approaches Bellanaboy Bridge and the site, lower elevation and existing plantations effectively screen out the proposed development. See Photomontage Viewpoint 9. With the exception of the immediate entrance area there is no view of the terminal or its associated features from the R314 immediately adjoining the site boundary. See Photomontage Viewpoint 5.

From the vast majority of the R314 in the vicinity of the site, the terminal will be either entirely or effectively screened by existing coniferous plantation with negligible impact. While aspects of the terminal will be visible from a short section of the road, it is considered significant that even here the proposal is substantially screened and the site is not primary or significant in views from the road. The overall impact of the proposed development on the experience of travelling the R314 in the vicinity of the site is considered to be of a slight negative nature and principally of short to medium term during as proposed coniferous planting on lands to the west of the terminal footprint will establish as effective screening.

The issue of 'Scenic Routes' and Areas Designated as 'Highly Scenic Vistas' are also included in the Landscape Appraisal.

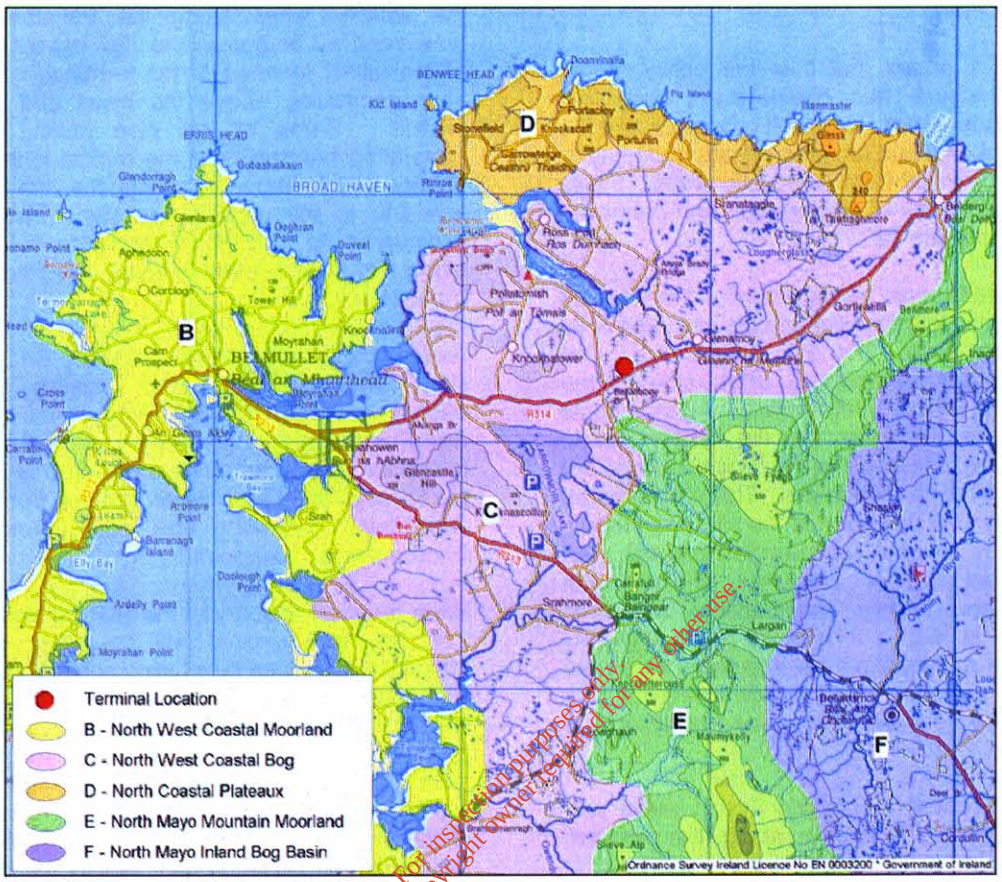
Landscape Appraisal of County Mayo 2003-2009

In Section 2.4, of the Landscape Appraisal the proposed terminal site is located within landscape character unit, Area C – North West Coastal Bog. Figure 13.2 is an extract from the Appraisal and illustrates the location of the site within Area C.

The key characteristics of this large landscape unit are described as:-

"...low lying bog strip, located between the western coastline and the Beg Range to the east. It has a homogeneous, exposed, moorland appearance throughout. The topography is smoothly contoured with bog/moor type grasses being the predominant vegetation."

Figure 13.2 Landscape Character Units



The land use is described as essentially peat bog, with areas of agriculture (i.e. complex cultivation patterns) and coniferous forestry also being present. Areas of natural grassland and transitional woodland scrub occur throughout the major land uses.

Section 2.4 characterises the Critical Landscape Factors of Area C as essentially smooth terrain covered by low vegetation comprising moorland and bog grasses. The Appraisal determines that in landscape terms the low vegetation has similar characteristics to the smooth terrain and that the two factors are interrelated due to soil attributes.

The Appraisal assesses that the smooth terrain covered by grassland vegetation, is generally uniform in appearance, allowing vistas over long distances, and that the uniform appearance of the grassland vegetation cover fails to break up the long distance visibility.

The Appraisal concludes that in such terrain, distances can appear shorter and development closer or larger. As a result development can have a disproportionate visual impact in such terrain, due to an inherent inability to be absorbed, physically or visually.

However, as illustrated on Figure 13.1 and described in Section 13.7 above, in contrast to the landscape characteristics which are more typical of the vast majority of the landscape within Area C, both the immediate and wider surroundings of the proposed terminal site are somewhat atypical of the character unit in that the proposed site benefits from the presence of extensive areas given over to dense coniferous plantations of varying age and structure.

The existing plantations provide an immediate, significant and effective screen enclosing the majority of the boundaries of the terminal. The inherent screening provided by the plantations ensures that they have the ability to physically and visually absorb the development.

The plantations have the effect of breaking up long distance visibility and significantly limit views across the landscape, particularly at close range. Furthermore, the effective coniferous matrix derived from the stages of forestry, including, planting, various growth patterns, mature forest and felling

presents a visual discontinuity within the landscape, which is in stark contract to the otherwise smooth terrain of open moorland or grassland typical of the landscape unit. Given the nature and variety of coniferous dominated plantations which pertain, it is considered that the site has a high visual absorption capacity. i.e. a high ability to visually absorb development without adverse impact on the surrounding landscape typical of the landscape character unit.

In addition to descriptions of landscape character, Section 3 of the Appraisal designates areas as 'Vulnerable, Sensitive, Normal and Robust'. The policy with regard to areas designated as Vulnerable, states that "development in the environs of these areas must not be shown to impinge in any significant way upon its character, integrity or uniformity when viewed from the surroundings. Particular attention should be given to the preservation of the character and distinctiveness as viewed from scenic routes".

With specific regard to the proposed site, the following designations are of relevance.

In Section 3.1(a), 'Areas Designated as Vulnerable', a sub-division under this designation includes 'The Shorelines of Lakes, Rivers and Estuaries'. Carrowmore Lough, Bellananaminnan River and the Glenamoy River are all listed under this designation. The proposed site does not directly abut upon the banks or shorelines of any of these lakes or rivers. Distant views from the western shoreline of Carrowmore Lake have been considered previously.

Within the sub-division 'Skylines and Ridges', the principal skylines and ridges relevant to the proposed site include Slieve Fyagh, Knocknalower, Carrafull, Knocknascollop, Carrowteige and Pollatomish. At varying distance these ridges almost encircle the site. In views from elevated locations to the west, north west, south west and south east, the site is visible to varying extents set low and contained within its surrounds of extensive conifer plantations. Views from such elevated vantage points are long ranging with dramatic and focusing landscapes in the background. As such, any impact from such areas is slight at most.

In Section 3.2(a) 'Main Areas Designated as Sensitive', a sub-division under this designation includes 'Natural Grassland' and two small areas west of Glenamoy (north of the R314) are listed. The western most area is contained within the site. The policy with regard to sites that are listed as sensitive states that "these are areas with a distinctive, homogeneous character, dominated by natural processes. Development in these areas has the potential to create impacts on the appearance and character of an extensive part of the landscape".

As described earlier, the proposed site was formerly the location of a Peatland Experimental Station. The objectives of the Station were to find suitable methods of reclaiming and fertilizing blanket bog for agriculture and forestry. The land management included drainage, improvements, liming and fertilizing the vegetation and introduction of shelterbelts planting, horticultural and industrial crops. Consequently, in scientific terms, the grasslands within the proposed site cannot be designated as 'natural'. Furthermore open areas of the site are all visually contained within a surround of dense coniferous plantation, limiting the visual sensitivities of such areas from external vantage points. The proposal entails the retention of large grassland areas though the central grassland area will be excavated for the terminal footprint giving a locally moderate negative impact.

'Coniferous Plantations' is included as a sub-division of Section 3.3(a) 'Areas Designated as Normal'. As described, the proposed site is located within a larger area of extensive coniferous plantations and the policy with regard to areas designated as normal states " large areas of Mayo are designated as normal landscape. These areas have a potential to absorb a wide range of new developments, subject to normal planning and development control procedures".

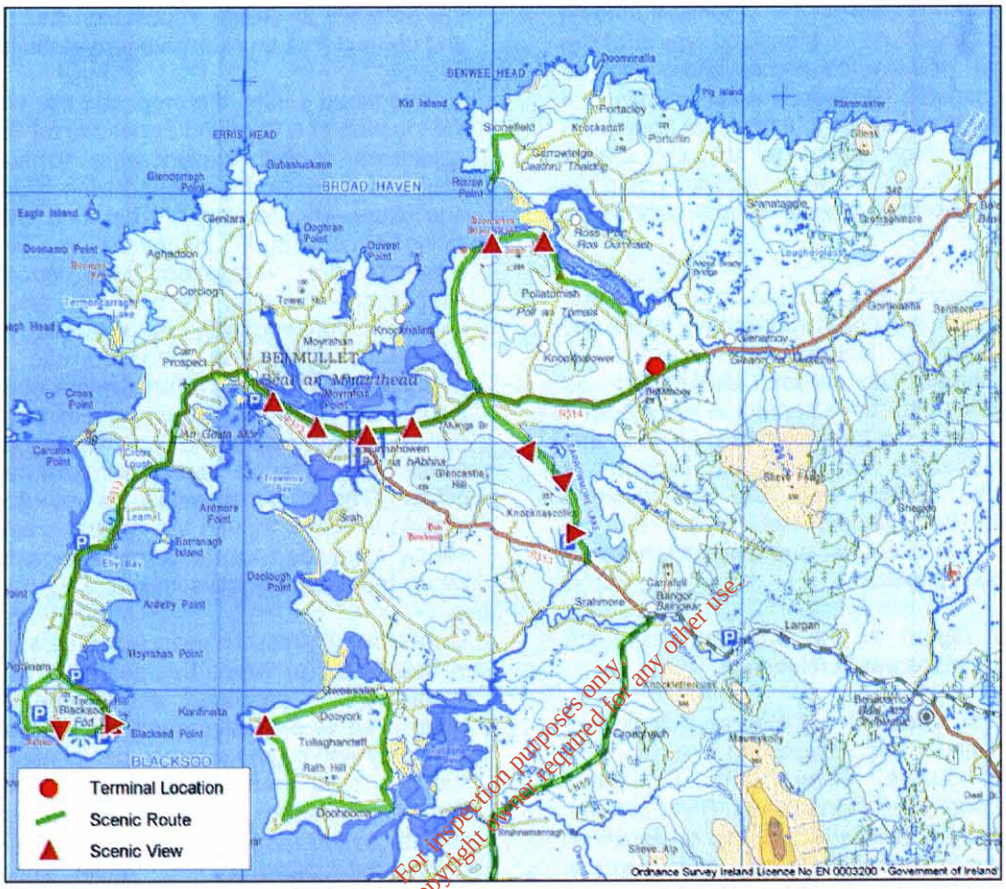
The site of the proposed development benefits from its location, being essentially contained within extensive coniferous trees, consequently, the site has a significant level of inherent screening potential increasing its visual absorption capacity. The proposed development is considered to have a slight negative impact within this designation.

In Section 3.6 of the Appraisal the document lists 'Areas Designated as Scenic Routes'. Figure 13.3 indicates both the designated scenic routes and locations of scenic vistas. All of these areas are similarly designated in the County Development Plan and have been discussed in detail previously.

Principal Policy Areas

In Section 4 of the Landscape Appraisal divides the county into four Principal Policy Areas, based on the grouping of the differing character units displaying similar visual landscape elements. The proposed site is included with Principal Policy Area 1 – Montaine Coastal Zone and its location within the Zone is illustrated on Figure 13.4.

Figure 13.3 Scenic Routes and Vistas



A set of indicative policies have been established for each Principal Area, based on the specific landscape attributes of the character unit (critical landscape factors), to determine the robustness and sensitivities of the landscape. The indicative policies provide a framework in the County Mayo Development Plan.

The Appraisal describes the Montaine Coastal Zone as: "...visually distinct in County Mayo landscape terms, as it incorporates in a relatively small area, two dramatic landscape attributes, being a steep and rugged shoreline and mountains rising immediately above. These elements make it a desirable setting for visitors and also particularly sensitive to inappropriate development".

Seven indicative policies have been established for the Zone, of which 3 are of particular relevance with regard to the assessment of landscape character and visual amenity of the proposed development:

"Policy 3 – Encourage development that will not have a disproportionate effect on the existing character of the coastal environment in terms of location, design and visual prominence".
The development will not have a disproportionate effect on the existing coastal environment due to the careful selection of a site with significant, effective and immediate screening. The positioning of the terminal in a reduced level location within the plantations, combined with proposed mitigation measures in the form of colour treatments and proposed planting will minimise the potential for visual prominence from both the local and wider landscape. The significance of impact of the proposed development is considered to be slight negative.

"Policy 4 – Consider development that does not significantly interfere or detract from scenic coastal vistas, as identified in the Development Plan, when viewed from the public realm".

Figure 13.4 Principal Policy Areas

The site has no visual connection to the coast, located as it is on south facing slopes over 5km from the coast. As such, the proposed development will not detract from designated scenic coastal vistas along either the Pollatomish to Banatra route or the local road north of Pollatomish looking to Broadhaven Bay. From these routes the terminal is either totally screened by intervening topography or the direction of the scenic coastal vista is in the opposite direction to the terminal site itself. Consequently there will have no negative impact on scenic coastal vistas.

"Policy 5 – Encourage development that will not interrupt or penetrate distinct linear sections of primary ridgelines and coastlines when viewed from areas of the public realm".

The development is set within coniferous plantations in an inland lowland landscape. As such, the proposal will have no negative impact on distinct linear sections of primary ridgelines and coastlines.

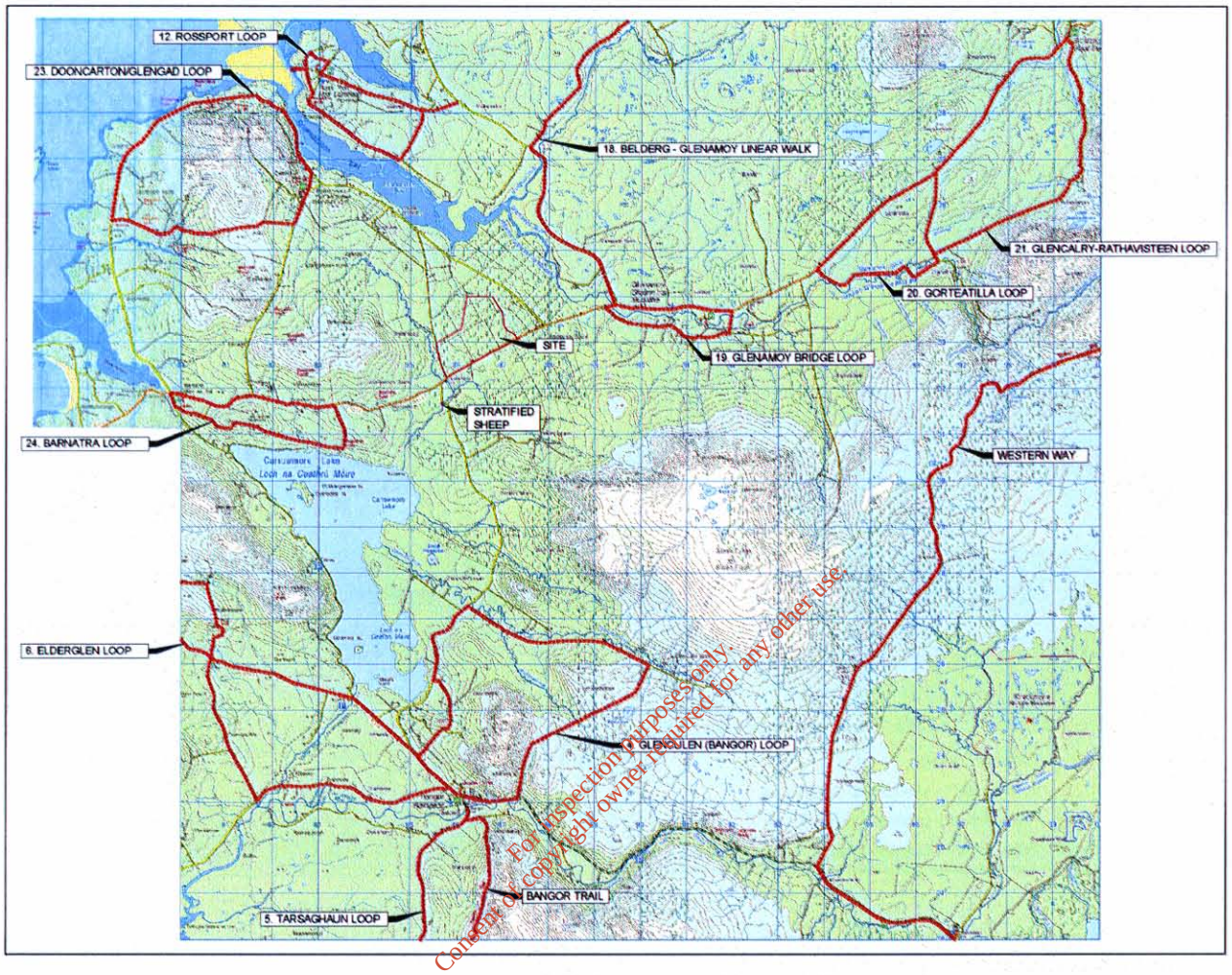
Landscape Sensitivity Matrix

Following the classification of the differing landscape character units into Principal Policy Areas with the differing Indicative Policies determined for each Area, the Council has been able to establish a Landscape Sensitivity Matrix set against a range of potential development types.

Chapter 5 of the Appraisal states under Section 5.1, that the purpose of the 'Development Impact Landscape Sensitivity Matrix' "is to provide a quick reference guide for both planners and developers to determine the likely success of a planning application for a particular land use in a particular area".

The section confirms that the Matrix should be used as a "guidance and decision supporting tool not a decision making tool". The Matrix states that within Policy Area 1, Industrial/Commercial development type would constitute a Medium-Low potential to create an adverse impacts on the existing landscape character.

Figure 13.5 Erris Walks



Medium potential is defined as; "Such developments are likely to be clearly discernible and distinctive, however, by careful siting and good design, the significance and extent of impacts can be minimised to an acceptable level". Low potential is defined as "Such development is likely to be widely conceived as normal and appropriate unless siting and design are poor".

The site for the proposed terminal has been carefully selected to take maximum advantage of extensive coniferous plantations, which will provide immediate, significant and effective screening. The inherent screening provided, combined with careful attention to the design, layout and colour treatments applied to component parts of the facility, will ensure that the vast majority of the development will not be readily discernible in the landscape.

Furthermore the site has the capacity to facilitate appropriate and significant mitigation of landscape and visual impact through retention of existing screening and the establishment of new screening to the west of the terminal footprint. This choice of site combined with the design and layout of the terminal and the mitigation measures proposed ensures that significance and extent of any landscape and visual impact is minimised.

As such, overall, the impact of the proposed development is considered to be slight negative in nature.

13.9 Siuloidi Iorrais (Erris Walks)

A series of 24 circular and linear walks including the Bangor Trail and the Western Way are promoted throughout the Barony of Erris. Among the nearest are the Belderg-Glenamoy linear walk; the Glencullen (Bangor) circular walk, and the Glengad (Pollatomish) circular walk. These routes, together with other local and longer distance routes, are illustrated on Figure 13.5.

None of the walks cross or border the proposed site and any available views that may be discernible from the walks will be expansive, from long distance, with the site enclosed by extensive plantations. Photomontage 16B is taken from a location close to Annie Brady Bridge on part of the Belderg-Glenamoy linear walk. In visual terms, the proposed development will have a negligible impact from designated walks within both the local and wider landscape.

A short section of the Glencullen walk uses part of the Bangor to Bellanaboy local road which will be subject to temporary impacts by increased traffic movements during the peat removal operations, see Section 16).

13.10 Impact on Visual Amenity

The potential visibility of the terminal site is dependent upon a range of factors, including location of viewpoint, angle of the sun, time of year and weather conditions. Of equal importance is whether the development is seen completely, or in part, above or below the skyline, where land provides a backdrop and where there is a complex foreground or an expansive landscape surrounding the view.

13.10.1 Visual Assessment Surveys

In conjunction with the landscape survey, a visual survey has been undertaken in order to assess the potential visual impact of the proposed development.

If the landscape is to absorb the development successfully, it must be integrated in a way that protects, and where possible enhances the visual appearance of the landscape.

Following the site appraisal, a number of key viewpoints from sensitive receptors which may be affected by the development have been identified. Table 13.2 lists the key viewpoints identified, provides a precise grid reference and indicates the distance of the viewpoint from the centre of the site. Figure 13.6 indicates the location of the viewpoints.

Computer generated photomontage images have been prepared from all the identified viewpoints and are included in Appendix A. A statement of photomontage methodology is provided in Appendix A.

It should be noted that the photomontage study was undertaken during October 2003. However, due to the dominance of the coniferous vegetation in the surrounding landscape, any seasonal variation in the assessment of visual impact would be negligible.

13.10.2 Site Visibility

In visual terms, even in close proximity, the site is insignificant. The site appears as a relatively 'standard commercial coniferous plantation' in its varying stages of planting, growth and harvesting. The site does not display any notable characteristics and is both unremarkable and indistinguishable from its wider surroundings, viewed as it is, as part of a much larger complex of coniferous plantation. As such the site is not a focus of attention in travelling through the landscape, either by road or otherwise.

The proposed site of the terminal is surrounded on all sides by coniferous plantations and/or lines of trees, with the plantations along the north western and south eastern boundaries being particularly effective screens.

13.10.3 Assessment of Visual Impact of the Proposed Development

The greatest potential for visual impact as a result of the proposed development is the introduction of an industrial type facility into an essentially rural landscape. The proposed terminal facilities include a small number of tall features in excess of 30 m high, some of which will be visible as they protrude above the surrounding coniferous plantations. The majority of the facilities will be screened by the surrounding trees.

A Visual Impact Schedule has been prepared which summarises the results of both the landscape and visual studies and assesses the overall degree of significance of visual impact for each viewpoint. The Schedule is presented with the photomontages in Appendix A, and a brief description of the degree of significance of the visual impacts is included below.

13.10.4 Visual Impact From Properties

The screening is such that there will be no or negligible visual impact on the nearest properties, which are located to the south and south west of the site (Photomontage Viewpoints 7, 7a, & 9).

Properties to the south west at greater distance will have a moderate/substantial negative impact, see (Photomontage Viewpoint 11). The site is not of prime focus in views from this property, which are generally of an expansive nature encompassing the surrounding uplands to the south and west and the existing coniferous planting along the south of the site means that all of the eastern part of the development will be screened. However, views of the tops of the flare stack, methanol still, some of the methanol tanks and pipe racks in the north west of the site and the tops of the water treatment building will be visible, some of which will break the skyline.

Figure 13.6 Viewpoint Locations

Table 13.2 Viewpoint Locations

Viewpoint No.	Title	Easting	Northing	Distance From Target (m)
1	View looking North East from residential property, Bellanaboy Bridge (Mr S Murphy).	85076	332147	1,700
2	View looking SE adjacent to residential property.Lenamore (Mr B Sheeran)	85823	334407	1,510
2A	View looking SSE from Bellagelly to Pollatomish Local Road	85604	335057	2,000
3	View looking SE from residential property. Lenamore (Mr J Flannery)	85444	334455	1,750
4	View looking W from access road adjacent to residential property Glenamoy	89766	333424	2,980
5	View looking W from R314 road	87934	333354	1,510
5A	View looking W from R314 road just west of Glenamoy	88665	333589	2,300
6	View looking SW from residential driveway on Rossport Road, Glenamoy.	89353	334129	3,080
7	View looking NNE from residential property Bellanaboy Bridge (Mr P Healy)	86333	332490	570
7A	View looking NE from residential property Bellanaboy Bridge (Mr P Healy)	86211	332408	650
8	View looking NNE from Bangor – Bellanaboy Local Road.	85716	331690	1,540
9	View looking NE from R314 adjacent to residential property Bellanaboy Bridge (Mrs J Healy)	85657	332119	1,260
10	View looking NE from R314 road near Meenanmark Bridge	84945	331757	2,090
11	View looking NNE from residential property Bellanaboy Bridge (Mr M Healy)	86067	331958	1,230
12	View looking SE from Bellanaboy Bridge to Pollatomish Local Road.	85405	333754	1,300
13	View looking SE from road adjacent to residential properties, Aghoos	84118	335519	3,360
14	View looking NE from 'Scenic View' parking area, Carrowmore Lake	83046	328320	5,830
15	Not used			
16	View looking SSW from road above Glenamoy and Muingnabo Rivers.	87005	336318	3,430
16A	View looking SSW from road at confluence of Glenamoy and Muingnabo Rivers	87005	336318	3,900
16B	View looking SW from Local Road just south of Annie Brady Bridge	87886	336346	3,700
17	View looking NNW from highest dwelling, Muingingaun	87672	330528	2,960
18	View looking N from Bangor to Bellanaboy Bridge Local Road	85979	331001	1,940
19	View looking SE from track at Carnhill.	81306	335964	5,820

There will be a generally negligible neutral impact on properties to the north and east of the site where the tops of the higher stacks/flares will only appear contiguous with or slightly above the existing tree-line, a tree-line which will continue to grow and provide increasing screening (Photomontage Viewpoint 2, 2a, 16, 16 a & 16b from the north and 4, 5 & 6 from the east).

There will be a slight neutral impact on properties to the north west of the site where the tops of the higher stacks/flares/methanol still and some pipe racks and methanol tanks will appear contiguous with the existing tree lines. None of these elements will break the skyline and the tree lines will continue to grow and provide increasing screening (Photomontage Viewpoint 3 & 13).

Only one property lies directly west of the site located at a similar elevation to the terminal (Photomontage Viewpoint 1). Available views from this property will include the most open views of the development, which will be seen within a large conifer plantation where expansive panoramic views are both south of and beyond the site to distant hills and mountains. Following construction, taller features including the flare stack, methanol still and the sales gas compressor stacks will be seen protruding above the trees and above the skyline. The methanol storage tanks, heating medium heater stack, pipe rack to the north west of the site, and parts of the slug catcher will be visible above the coniferous trees. Much of the intervening lands between the site and property have been planted with conifers, which will in time, together with proposed on-site planting, provide almost entire screening.

The impact is assessed to be of a moderate/substantial negative nature in the immediate and short term but developing coniferous screening proposed for immediately west of the terminal footprint will provide effective medium and longer term screening.

In overall terms, the terminal will be screened from most properties from the outset, though significant short term visual impact is expected to arise at a small number of properties. All of these properties will be effectively screened in the medium and longer term and as such the overall visual impact from properties is considered to be slight adverse in nature.

13.10.5 Visual Impact from Roads and Surrounds

Even with existing planting, the screening is such that effectively there will be no view of the proposed development from roads and other areas to the immediate south, east, north east and north. As such, areas anti-clockwise from south through east to north will have no or only a negligible impact (Photomontage Viewpoints in anti-clockwise order: 7, 7a, 5, 4, 6, 16, 16a, 16b, 2, 2a & 12).

There will be a slight neutral impact on roads and surrounds to the north west and east of the site, where only the upper sections of the taller features will appear either contiguous with the tree lines or at greater distance above the treelike, (Photomontage Viewpoints 5A, 3 & 13).

The proposed development will be most readily viewed when travelling north along the Bangor to Bellanaboy Bridge Road. The impact is limited to approximately a 2.5km stretch of the Bangor Road approaching the junction with the R314. From this road, expansive views are directed north and north west towards the rounded upland area of the Bellanaboy / Muingerroon Hills. The site lies to the east of true north and is not directly in a forward line of vision. From this location, it will be possible to see the flare stack, the methanol still and the air coolers above the tree and skyline. The methanol tanks and the pipe racks to the north west of the site will also be visible, but these will be set into the surrounding forestry and will not break the skyline. The existing and proposed view from this part of the road, which is considered to have a moderate/substantial negative impact, is shown in Photomontage Viewpoint 18.

Nearer the site, as shown in Photomontage Viewpoint 8 the view is also a moderate/substantial negative impact. For road users, views of the site will be at right angles to the direction of travel and when travelling the Bangor Road, views are generally directed north and north west towards the rounded upland area of the Bellanaboy / Muingerroon Hills. The existing coniferous planting along the south of the site, the low level of this viewpoint relative to the site, and the fact that the site is cut into the existing topography, means that most of the eastern part of the development will be screened, with the exception of the tops of the flare stack, the methanol still and the air coolers. In addition, the tops of the water treatment building, the methanol tanks, and the pipe racks to the north west of the site will be visible, some of which will break the skyline.

As the site comes in to view travelling east along the R314 at some 2km distance, the view from the road is both expansive and panoramic south over Carrowmore Lake, south east towards the Slieve Fyagh Uplands, which lies straight ahead, and to a lesser degree, north to the Muingerroon Upland. The site is largely unremarkable and not a point of visual attention other than as part of a large area of conifer plantation. It will be possible to view the

terminal as a small element in the wider landscape and not directly located in the primary views. However, the flare stack, methanol still, sales gas compressor stacks, air coolers, heating medium heater stack and the water treatment building will be seen protruding above the trees and above the skyline. Some pipe racks, the power generation building, and the maintenance flare will also be visible above or contiguous with the existing tree line to the west of the site. Most of the low level plant is completely screened by the existing trees along the Pollatomish Road. The impact along this short section of road is considered to be moderate/substantial negative in nature, see Photomontage Viewpoint 10.

As the road approaches Bellanaboy Bridge and the site, lower elevation and existing plantations effectively screen out the proposed development. See Photomontage Viewpoint 9.

In views from the south east from higher elevations than the site, the terminal will be visible contained within extensive plantations. The tops of the flare stack, the methanol still, the air coolers, the sales gas compressor stacks, the water treatment building, the heating medium heater, the methanol tanks, the pipe racks along the north of the site, and the warehouse and maintenance building are visible above the tree line to the south of the site. Of these, only the flare stack, the methanol still, the air coolers, and the sales gas compressor stacks break the northern tree line beyond. None of the features break the skyline. The impact is considered to be moderate negative in nature. See Photomontage Viewpoint 17.

In long distance views (5km +) from the western edge of Lake Carrowmore. Expansive, open views looking north east across the lake in the direction of the terminal. From here, the terminal will be insignificant in the wider landscape. The north western half of the terminal will be visible against a backdrop of forestry and mountains and the flare stack will be the only element that will break the skyline. The impact is considered to be slight negative. See Photomontage Viewpoint 14.

In views from elevated locations to the west and north west, the development is visible but set low within the conifer plantation. Views from such elevated vantage points are long ranging and towards the more dramatic and focusing landscapes in the background. As such, any impact from such areas is slight negative at most (see Photomontage Viewpoint 19).

In overall terms, the terminal will be effectively screened from local roads, though significant short term visual impact is expected to arise from short sections of the R314 and Bangor to Bellanaboy Bridge Roads. Even in these instances, it is considered that given the proposed planting west of the terminal, the development will eventually be substantially screened from local roads in the medium and longer term. As such the overall visual impact from roads is considered to be slight adverse in nature.

13.10.6 Night Time Visual Impact

At night, the local landscape in the vicinity of the terminal is almost completely dark, with only very limited sources of light visible, primarily from the scattered residential properties and from the elevated vantage of Erris Water Works overlooking Carrowmore Lake. The local roads are unlit, with car headlights providing passing light source.

During the operation of the terminal, the site will require to be lit at night, essentially for safety and site security purposes. The following types of lighting will be required:

- emergency/escape lighting;
- security and perimeter fence lighting;
- general building lighting;
- road lighting within the terminal only;
- illumination of walkways, platforms and pipe racks; and
- illumination of car park and security gate.

The main access road from the R314 to the terminal boundary will not be lit.

All lighting has been designed to keep the potential for light emissions to a minimum. The terminal is operated from the control room and at night operators will rarely need to visit the plant process areas. In consequence the walkways, platforms, and pipe racks will normally not be illuminated by outdoor lighting. Outdoor lighting within the terminal itself will be controlled by photoelectric cells so enabling lights to be activated only in the vicinity of where it is directly required. Road-lighting within the terminal will be a maximum of 5m high and will utilize high pressure sodium vapour lamps to include precise optical control to eliminate the potential for excessive upward or spill light.

The security fence lighting shall be arranged such that the fence and the area outside of the fence itself will be illuminated to approximately 10Lux (whilst leaving the patrol / perimeter road in comparative darkness). Fence lighting will utilise tungsten-halogen lamps within luminaries of a narrow beam type and will only operate in limited instances of emergency or when triggered by intrusion.

Aimed luminaries shall provide illumination at ground level, on each walkway or platform, and below pipe racks.

The taller features such as the flare stack and methanol still will have permanent light fittings attached to them, however, the number of lights that may be visible above the tree lines will be minimal.

In addition to the choice of light fittings that will minimize the potential for light pollution, the effective screening provided by the surrounding coniferous plantations would further assist in minimising any spread of light away from the site itself.

To illustrate a typical arrangement of light fittings and potential light levels emitted from a similar gas facility, Plates 13.1 and 13.2 of the existing gas terminal at Point of Ayr, North Wales are indicated below.

It should be noted that this terminal includes a constantly burning flare stack, which is not proposed at Bellanaboy, and that the Point of Ayr terminal does not benefit from being contained within extensive coniferous plantations which provide a high level screen to prevent views of the lower level equipment.

Plate 13.1 Point of Ayr Terminal - Day

Both the day and night time photographs are taken from the same location, from an elevated position with direct, clear views onto the terminal site. Plate 13.2 illustrates the night time view and indicates that the most obvious light source is emitted from the flare stack. The other light sources are not as bright as the flare source and do not emit or spread light either upwards or away from the terminal. (It should be noted that the lowest level of lighting on the photograph would, in the case of Bellanaboy, not be visible due to the screening provided by the coniferous trees).

For both the local road user and for local residents, the lighting arrangement proposed for the terminal will appear little different from the existing isolated property lighting within the local and wider landscape.

It can be assessed that the significance of night time visual impact will be slight neutral.

Plate 13.2 Point of Ayr Terminal - Night

13.11 Do Nothing Scenario

If the development did not proceed the landscape character would remain essentially unchanged, with the only changes being the plantation management programme involving the felling and re-planting of the different plantation blocks.

13.12 Mitigation of Landscape and Visual Impact

The mitigation strategies proposed for the development, particularly in respect to the mitigation of impacts relating to landscape and visual effects will take numerous forms.

The implementation of these strategies will have the effect of ensuring that the development will be successfully integrated into the local and wider landscape.

13.12.1 Terminal Design

Minimising the apparent height and massing of the terminal, as a result of architectural detailing and colour treatments, can lessen the potential visual impact of the terminal facilities. It is proposed that the following colour finishes will be applied to the terminal facilities:

- structural steel – dark grey;
- piping, equipment (including tall structures) – mid grey;

- methanol, condensate, diesel and other miscellaneous storage tanks – olive green;
- equipment building walls – olive green
- architectural building walls – light grey; and
- equipment and architectural roofs – dark grey.

In particular, for nearer receptors, the choice of colour finish will assist in softening the visual impact and help to blend the new structures into the existing backdrop of surrounding trees, and distant hills. In longer distance views the colour choice is not as critical, the actual layout of the terminal facilities on the site and final juxtaposition of the taller structures in association with the existing features is more important.

In addition to colour treatment, other mitigation measures such as locating the terminal within an area of mixed age coniferous plantation; retention of existing screening; setting a reduced level for the terminal platform, etc have already been incorporated into the design of the terminal.

13.13 Landscape & Ecological Mitigation Strategy

In conjunction with the mitigation measures proposed for the terminal facilities themselves, other specific strategies have been developed to mitigate the significance of impact on the landscape character, visual amenity and nature conservation interest of the site.

13.13.1 Retention and Protection of Existing Trees

The principal strategy is the long term retention and protection during construction, of the maximum possible area of existing coniferous plantations, not only around the immediate boundaries of the terminal, but on all land within the planning application boundary. Significantly all the existing plantations show good growth patterns and younger plantations exhibit strong annual growth.

13.13.2 Coillte Teo Felling Programme

During the detailed discussions held with Coillte Teo information was provided on the anticipated felling programme of the plantations around the terminal site. The felling programme has influenced the securing of land to be held under the long term control and future land management responsibility of Shell.

The securing of land within the planning application boundary will ensure that a continuous effective screen around the whole of the terminal site can be maintained throughout the lifespan of the development. The plan included as Figure 13.7 illustrates the existing plantations within the planning application boundary, and is included in Appendix B.

13.13.3 Proposed Planting

The site surveys and subsequent visual impact assessment has identified that the south western boundaries of the terminal are the most open to views from the surrounding landscape. Consequently, in order to supplement and reinforce the existing remnant coniferous tree belt to the west of the terminal site, an additional belt of predominately coniferous trees up to 100 metres wide is proposed in the open wet grassland to the west of the terminal boundary.

This new plantation will be implemented by the importation of new forestry tree stock supplied from Coillte Teo nurseries. It will comprise of predominately coniferous species consistent with those species currently growing on the site including Lodgepole Pine (Pinus contorta), Sitka Spruce (Picea sitchensis) and Scots Pine (Pinus sylvestris). Imported coniferous stock would range between 25-30cms, 40-60cms and 60-80cms in height.

In conjunction with the proposed plantation, and throughout the rest of the site, frequent groupings of low deciduous tree and shrub species will be planted on the margins of the plantations. On the drier ground Mountain Ash (Sorbus aucuparia) and Birch (Betula pubescens) will be used and in the wetter more waterlogged ground, Alder (Alnus glutinosa), and Willow species (Salix aurita, S cinerea subsp oleifolia and S. caprea) will predominate.

The height of imported deciduous stock would range between 40-60cms, 60-80cms and 100-125cms and will comprise native species.

It is proposed that the imported plant stock will be supplemented, where possible, by the translocation of some of the existing willow scrub directly impacted by the construction works, together with the taking of hard wood cuttings from existing deciduous trees such in as the Salix species.

13.13.4 Ecological Mitigation Proposals

The ecological mitigation proposals have been incorporated as an integral part of the landscaping strategy for the development. These will aim to enhance the diversity of the known flora and fauna of the area.

These proposals should be read in conjunction with information included in Section 6 Terrestrial Flora and Fauna.

The principal ecological mitigation will include:

- Supplementing the low deciduous scrub habitat (comprising essentially of Willow species) lost to construction works. The scrub will be planted along the margins of the existing plantations and will include other native tree species such as Alder, Birch and Mountain Ash. This proposal will assist in extending planting belts that act as foraging and breeding areas into the areas of wet grassland.

- It is envisaged that this mitigation measure will have the benefit of increasing the semi-natural woodland habitat and will assist in offsetting the dominance of the transient, intensively managed coniferous plantations by increasing the habitat diversity on the site.

- Provision of wetland compensation habitat, including small areas of open water and areas of redbud. Reed species such as Phragmites australis (Common Reed). Phalaris arundinacae (Canary Reed Grass) and Typha latifolia (Reedmace), in conjunction with marginal plants including Soft Rush (Juncus effusus) will be translocated from other parts of the site and planted into the wetland areas.

- The increased provision of wetland habitat will be principally located in association with the proposed settlement ponds in the southwest corner of the site. The open water habitat will be developed primarily as breeding sites for frogs and to increase the diversity of habitats on the site.

The strategy for both the landscape and ecological mitigation are illustrated on Figure 13.8 and Figure 13.9, and included in Appendix B.

Site Reinstatement Proposals

Following the decommissioning of the terminal, it is proposed to remove offsite all terminal facilities, however the perimeter drains and settlement ponds will remain. The concrete platform will be broken up and the material removed offsite. Any remaining foundation stone will be ripped to relieve compaction. The ground level will be roughly graded to fall towards the perimeter drains. It is proposed to import mineral soils across the area formerly occupied by the platform, to an average depth of 300mm. The imported soil will again be roughly graded so as to form small hollows and gentle undulations with levels generally falling towards perimeter site drains. It is envisaged that water will collect in the hollows to supplement the wetland habitats elsewhere on the site.

The ground will be sown with a 'basic' grass seed mix of locally sourced seed which will be supplemented by seed collected from site. Juncus and Calluna vegetation from elsewhere on the site will be translocated into the grass area. Tree and shrub species tolerant of waterlogged ground will be planted to form an open mosaic of deciduous trees and low deciduous scrub. Species will include Alder (Alnus glutinosa), Willow spp. (Salix aurita, S. cinerea subsp. oleifolia and S. caprea). The reinstatement proposals will provide additional habitats to complement habitats created during the initial planting scheme.

The reinstatement proposals are indicated in Figure 13.10, included in Appendix B.

13.13.5 Mitigation Programme

Phase 1 Programme

Phase 1 mitigation works will be undertaken during the construction phase of the terminal. Works within this phase will comprise the planting of the new coniferous plantation to the west of the terminal site. Extensive planting of deciduous trees and low deciduous scrub along the margins of the new plantation together with the additional marginal planting in association with the existing plantation to the north of the terminal will be implemented.

In association with the construction of the settlement ponds during the early stages of the construction works, the wetland compensation habitat will be developed.

Tree and shrub planting will be undertaken along the boundary with the R314, in conjunction with the creation of small areas of open water and redbud compensation habitat in the southwestern section of the site.

Phase 2 Programme

Mitigation works within this phase will be implemented following completion of construction activities.

Further planting of deciduous trees and low deciduous scrub along the margins of the existing plantations to the east and south of the terminal will be implemented. New planting will be undertaken in association with the proposed main entrance features, including the proposed stone walling and ESB facility.

13.14 Predicted Impact of the Proposed Terminal

13.14.1 During Construction

Landscape and visual impacts will result both from the temporary construction and the permanent structures associated with the operational phases of the terminal development. Impacts may result from the following aspects:

Temporary

- site establishment requiring the removal of existing landscape features, including remnant lines of coniferous trees and shrubbery; and
- construction activities, including presence of large plant and cranes.

Permanent

- permanent features introduced as part of the terminal, including buildings and stacks;
- operational features, such as visible emissions, lighting; and
- height above ordnance datum (AOD) of tall features.

The potential impacts on the landscape resource are identified by addressing the following issues:

- aesthetic value of the landscape setting and its sensitivity to change;
- nature and value of any landscape resources likely to be lost due to development; and
- visual relationship between its site and its setting.

13.14.2 Impact of Proposed Development on Landscape Character

The development proposes the construction of a major facility in a generally remote but accessible landscape. The impact on landscape character as a result of the terminal development is primarily a result of a change in land use in a relatively small section of the overall site from peat bogland and commercial forestry, to that of an industrial facility, in an area which has few major industrial areas of any scale, and no significantly sized structures or built up areas.

However, while not entirely so, the proposed site is inherently and strongly screened by evergreen conifer plantations, particularly along the sensitive southern boundary with the R314, a tourist route with residential properties at proximity.

The site of the proposed terminal has been carefully chosen to take maximum advantage of extensive coniferous plantations, which will provide immediate, significant and effective screening. The inherent screening provided, combined with careful attention to the design, layout and colour treatments applied to component parts of the facility, will ensure that the vast majority of the development will not be readily discernible in the landscape. This choice of site ensures that overall, the impact of the proposed development is considered to be slight negative in nature.

This assessment of the significance of impact is further confirmed with reference to the Sensitivity Matrix included in the Landscape Appraisal document. As outlined in Section 13.8.2 of this assessment, the Matrix states that within Policy Area 1, Industrial/Commercial development type would constitute a Medium-Low potential to create an adverse impact on the existing landscape character.

13.15 During Operation

Although the landscape and visual impact can be considerably reduced from nearby receptors, through the implementation of the proposed mitigation measures, the visual impacts produced as a consequence of the protrusion of the taller elements into the skyline from certain viewpoints cannot be fully mitigated. This is of more relevance when viewed across the open landscape from middle and longer distance viewpoints. However, in these views, the development is a relatively small element within the landscape and is not of prime focus in the views, which are generally of an expansive nature.

The choice of site ensures that during the life time of the terminal, overall the impact of the proposed development is considered to be slight negative in nature.

13.16 Monitoring

Following the completion of the planting operations proposed as part of the mitigation of the development, it is best practice to undertake a period of post planting monitoring ('aftercare'). This will last for a five-year period.

After the five-year period, once planting has become established, monitoring will be governed by a Shell Landscape Management Plan, which will monitor planting throughout the life of the project.

13.16.1 Aftercare Inspections

Typical monitoring operations during the five-year aftercare period will include:

- regular inspections at least once every four months;
- plant replacement - near to the end of the growing season (September), the identification and replacement of trees and shrubs which have died within the previous growing season to be undertaken; and
- ensuring the site is neat and tidy and maintaining all planting and grassed areas in a healthy condition.

13.16.2 Maintenance Operations

The aim of the monitoring period is to provide for the proper establishment and growth of all plant material by the operations listed below:

- replacement planting as necessary;
- weed control;
- irrigation;
- pruning of trees and shrubs;
- prevention of insect attack and disease;
- checking of tree stakes, ties;
- refirming plant material; and
- removal of waste materials.

13.17 Reinstatement and Residual Impacts

Shell is keen to adopt a sensitive and sustainable design approach, and integrate the scheme into the landscape whilst retaining and respecting both the landscape character and the visual environment.

The long term proposal will see the substantial removal of the terminal, including all above-ground features. Thereafter it is proposed to reinstate a peat/grassland environment sensitively planned on the basis of actual monitored site conditions to reflect and enhance local ecology and bio-diversity. In such, a manner it is considered that the proposed development will have no adverse residual impacts, see Figure 13.10 in Appendix B.

Fourteen

Climate

14 Climatic Impact

14.1 Introduction

This section describes the emissions associated with the gas terminal that have the potential to affect or contribute to:

- global warming (releases of 'greenhouse' gases); and
- ozone depletion.

Releases with the potential to impact on local air quality are described in Chapter 11. This includes discussion of microclimate considerations.

14.1.1 Global Warming

The main compounds that contribute to global warming are carbon dioxide (CO_2) and methane (CH_4). Other compounds have the potential to contribute to global warming but are generally released in much smaller quantities.

Global warming and the management of emissions with the potential to contribute to global warming are an increasingly important issue for Ireland. An international agreement was drawn up (the Kyoto Protocol) in response to rising emissions of the principal contributing compounds which has subsequently been ratified by the European Union.

Under the burden sharing agreement within the European Union to implement the Protocol, Ireland agreed to a limit of 13% above 1990 emission levels to be achieved between 2008 and 2012. By 2001, the level of global warming releases however had risen by 31% above the 1990 levels following a period of rapid economic growth. Numerous initiatives are in place to reduce emission levels under the Government's National Climate Change Strategy and EU initiatives including the draft Directive on Emission Trading.

Global warming has numerous potential implications for Ireland's environment including:

- greater risk of seasonal flooding with an increased rainfall in winter and decrease in summer;
- changes to habitats and ecosystems including the drying of peatlands; and
- effects on sea and river levels and influence on water resources.

14.1.2 Influence of the Gas Terminal on Releases with Global Warming Potential

The proposed development should be viewed in the context of:

- the benefits of providing a secure and indigenous supply of natural gas;
- the combustion of natural gas produces lower global warming emissions in comparison with alternative fossil fuels; and
- the requirement to minimise releases during the construction and operation of the terminal itself.

Most primary energy in Ireland is provided by fossil fuels, the majority of which derive from imported coal and oil. Domestically, peat is also used and natural gas use has increased with the provision of supplies from gas fields off the Cork coastline and via an interconnector from the UK.

Natural gas releases lower emissions of carbon dioxide than alternative fossil fuels per unit of useful energy contained within the fuel. As can be seen in Table 14.1, natural gas releases 23% less carbon dioxide than crude oil and 47% less than peat per unit of energy. Natural gas use is additionally more efficient at its point of use, thereby requiring less fuel to be consumed and hence producing lower emissions. This applies to the use of gas for most applications including space heating and electricity generation.

Table 14.1: Emissions of Carbon Dioxide (CO_2) from Different Fuels

Fuel	CO_2 Generated per Unit of Energy Content (tonne CO_2 / TJ)
Natural gas	56.1
Natural gas liquids	63
Crude oil	73.3
Peat	105.9

Source: IPCC, 1996.

The use of natural gas to displace other fossil fuels will assist in minimising and potentially reducing global warming emissions at a national level in combination with other initiatives.

Releases to atmosphere with global warming potential will arise as a result of both the construction and operation of the terminal. This includes:

- releases of carbon dioxide from the combustion of natural gas and other fuels to provide energy for the site; and
- potential fugitive emissions of natural gas during its operation.

The terminal process plant has been designed to minimise such releases and these measures are described in Section 14.6.

14.1.3 Other Releases with the Potential to Affect Climate

Other considerations with the potential to influence climate include the generation of ozone at lower levels of the atmosphere (tropospheric or low-level ozone formation) and the depletion of ozone at higher levels in the atmosphere (stratospheric ozone depletion).

The use of ozone depleting substances during the operation of the terminal is not anticipated. Refrigerants used may have global warming potential, however such systems are sealed and loss of material would not normally occur. Leaks are not considered to be significant in the context of site operations. Impacts on ozone depletion associated with the proposed development are not considered to be significant and further discussion within this section has been limited to releases with global warming potential and specifically to carbon dioxide (CO_2) and natural gas, the principal component of which is methane (CH_4).

14.1.4 Global Warming Potentials of Specific Releases

Many compounds released to air have the potential to contribute to global warming. The measure of Global Warming Potential (GWP) was developed in order to express emissions on a common basis. GWP is a measure of the global warming potential over a 100-year period relative to the GWP of carbon dioxide. In this scale, carbon dioxide is assigned a GWP value of 1. Natural gas (assuming all gas is methane) has a GWP factor of 21.

A release of 1 kg of natural gas therefore has the equivalent GWP of 21kg of carbon dioxide. There are hence significant benefits in minimising releases of natural gas and, where such releases do occur, converting the release into carbon dioxide through combustion. Such considerations have been incorporated into the design of the gas terminal.

14.2 Study Methodology

This section of the EIS aims to identify and assess the sources and describe the measures in place to minimise releases of compounds with global warming potential. The residual generation of these compounds has then been quantified. Many natural and human activities generate releases that can contribute to global warming. Due to the diverse nature of sources, the effect that releases from the gas terminal have on global warming cannot be specifically quantified within this EIS. Quantities however have been related in comparison to total emissions of global warming gases in Ireland (as CO_2 equivalent) and relative to the benefits of greater gas use by the end-user.

14.3 Characteristics of Proposed Development

14.3.1 Construction

The combustion of fuels in contractor, construction and haulage vehicles along with small-scale electricity generators will emit carbon dioxide. Additional emissions may be generated during the commissioning of the gas terminal including relatively minor releases of natural gas during the purging of equipment.

Releases of carbon dioxide will also be generated in the production and transportation of raw materials used in the construction of the terminal. In particular this includes the use of cement and steel. Whilst not included in the quantification of releases within this assessment, releases associated with raw materials will be minimised through careful purchasing controls and construction scheduling.

Peat will be removed from the site prior to construction. Peat during its formation captures carbon in the form of biomass accumulation. As the peat bed grows methane can be emitted where low levels of oxygen are present within the peat deposit (anaerobic conditions). Microbes within the peat may also emit smaller concentrations of nitrous oxide (N_2O). Methane is a more potent global warming gas than carbon dioxide and nitrous oxide is more potent still.

Whether peatland is a net sink or net emitter of global warming concentrations depends primarily on the balance between carbon dioxide fixation and the release of methane. This balance can vary depending on many factors including the level of the water table. Bord Na Mona considers the peatland at the terminal site to be approximately carbon neutral given the prevailing conditions at the site.

The peat removed from the site will be repositioned at a local peat extraction site owned by Bord Na Mona to conserve peatland and prevent the release of locked carbon into the atmosphere. Whilst the removal of the peat will lead to a release of trapped methane emissions as the peat is moved, this

methane would have been released to air over time regardless if the peat remained *in situ*. Any release with global warming potential during peat removal will hence be insignificant.

14.3.2 Operation

During operation, terminal emissions will comprise:

- releases of carbon dioxide from combustion processes to provide energy to the terminal; and
- fugitive emissions of natural gas.

The principal combustion processes include the gas compressors to pressurise sales gas into the national distribution network and power generators to provide electricity to the site. A heater unit will also be present to refine and recycle methanol used as an anti-freeze within the onshore and offshore facilities.

Fugitive emissions may occur from non-permanent connections such as valves and flanges. Potential fugitive release sources and appropriate mitigation measures have been described further in Section 14.6

Significant hydrocarbon emissions are not anticipated as a result of routine operation. In the event of emergencies or abnormal operating conditions natural gas and hydrocarbon releases will be efficiently burnt at height. The design incorporates numerous safety features to prevent the loss of natural gas. They include relief valves, flare systems and emergency shutdown (ESD) valves to prevent the generation of potentially flammable leaks and hence loss to air in the unlikely event of an overpressure in the system or equipment failure.

14.4 Potential Impact of the Proposed Development

The terminal development will result in emissions associated with climate change. This includes releases of carbon dioxide and natural gas and to a much lesser extent, other hydrocarbon compounds.

14.5 Do Nothing Scenario

In the absence of the development, there will be no anticipated change in releases to air at the terminal Location. However, the potential benefits of the Corrib development for control of greenhouse gases in Ireland generally will also not be realised.

14.6 Mitigation Measures

14.6.1 Initial Design Considerations

The gas terminal has been designed to minimise combustion products and fugitive releases. These measures will minimise releases to air with global warming potential.

Combustion processes have been designed to be energy efficient and minimise the quantity of fuel used, thereby minimising releases of carbon dioxide. Hydrocarbon condensate that would otherwise require offsite disposal is also used as a fuel for the heating medium fired heater.

A leak of natural gas from the process presents a flammable risk. Inherent site safety features will minimise the potential for uncontained releases of natural gas to air. Such features include continuous welded pipelines to ensure a sealed system from the arrival of offshore gas to the distribution of sales gas. The terminal will be constructed to international design standards.

Pressure relief valves designed to prevent over-pressure in the system will be additional sources of fugitive releases. Low leakage relief valves have been considered in the design of the terminal. Should a significant leak or venting of natural gas occur from the valves, the gas will be collected and flared, thereby converting natural gas into carbon dioxide, which has a much lower GWP.

Onsite heating requirements will be met by the combustion of off-spec gas or hydrocarbon condensate.

14.6.2 During Operation

Combustion efficiency checks will be carried out on combustion plant to ensure all plant operates at optimum efficiency.

Fugitive emissions of natural gas will be minimised through regular maintenance and the implementation of the Environmental Management Plan that will be prepared as part of the site's Integrated Pollution Control (IPC) licence issued by the Environmental Protection Agency (EPA). A maintenance flare will also combust gas where depressurisation of the plant is required for maintenance activities. In the highly unlikely event of a significant leak of natural gas into the air in the vicinity of plant, gas detection systems will identify any leak, which will then be remedied by onsite technicians.

Table 14.2: Greenhouse Gas Emissions from the Terminal

Source	Emissions (tonne/yr)		GWP (tonne of CO_2 equivalent per yr)
	CO_2	CH_4	
Energy Use/Power Generation			
Heating Medium Heater	10,560	0.03	10,560
Sales Gas Compressor Turbines	26,795	3.9	26,878
Electricity Generator Engines	6,341	6.2	6,471
Fugitive Releases			
General Process Gas Leaks plus Tank and Product Loading	1	105	2,206
Total	43,697	115	46,115

Note: Emissions are calculated using predicted fuel usage, as detailed in the draft IPC licence application, and UKOOA emission factors (UKOOA, 1999). Emissions from the firewater pumps, emergency generator engine and the flare systems have not been accounted for, as these are intermittent, minor sources only. The GWP emissions from these sources during normal operation will be approximately 100 tonnes CO_2 equivalent.

The application of Best Available Techniques (BAT) to both the design and operation of the gas terminal will be further identified in the IPC licence application. In this regard BAT relates not only to the design of the gas terminal but also the way it is managed during the full life cycle of the site.

14.7 Predicted Impact of the Proposed Development

14.7.1 During Construction

The only predicted impacts will be associated with:

- movements of construction vehicles and on site generators; and
- energy used to produce and transport raw materials.

14.7.2 During Operation

The projected quantity of emissions with global warming potential from each potential source is identified in Table 14.2. Total GWP emissions from the site are projected to be of the order of 0.05 million tonnes per year (as CO_2-equivalent).

In the year 2000, total emissions of CO_2 equivalent released in Ireland were an estimated 66.3 million tonnes. The quantity generated from the gas terminal represents less than 0.08% of this figure.

If the natural gas distributed into the national network by the gas terminal displaced an equivalent amount of crude oil in energy terms, this would lead to a potential reduction of 2.4 million tonnes of CO_2 equivalent ignoring minor leaks of gas from the transmission system. This figure is nearly fifty times greater than the projected releases from the terminal and does not take into account the higher efficiency of use associated with gas at the end-user. In reality the displacement (or emission reduction) will be less than 2.4 million tonnes of CO_2-equivalent as the gas supplied will supplement applications where natural gas is already used or is required to meet rising energy demand to a certain extent. The calculation however demonstrates that when considered on a national level, the benefits of a secure, indigenous source of natural gas outweigh the effect of emissions with global warming potential generated from the site itself.

14.8 Monitoring and Reporting

No direct monitoring of carbon dioxide is proposed as emissions can be accurately predicted from the consumption of fuel or combusted material. Monitoring of natural gas may be required as part of any IPC licence condition to minimise fugitive emissions but this is unlikely to be necessary on a continuous basis. Fire and gas detection systems will also be present.

Annual emission calculations of releases with global warming potential will be prepared as part of the site's Annual Environmental Report the preparation of which is likely to be a requirement of the IPC licence. The calculations will also be required to identify baseline and operating emissions in subsequent years as part of any trading agreement.

The EPA has identified standard methods of calculation to ensure '*completeness, consistency, transparency and accuracy*'. Such calculations are likely to be independently audited. The EU Emissions Trading Scheme will establish allowance trading to promote reductions of greenhouse gases.

14.9 Reinstatement and Residual Impacts

The worst-case combination of fugitive and combustion emissions of carbon dioxide and natural gas result in an estimated maximum annual GWP of approximately 0.05 million tonnes of CO_2 equivalent. It is not possible to quantify the actual impact of specific greenhouse gas sources or sinks on the climate or environment as a whole.