7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1 ENVIRONMENTAL ASSESSMENT PROCESS

The main objective of the Environmental Impact Assessment (EIA) is to evaluate the Project likely impacts on the environment as described in section 4 of this ESIA. One of the key objectives of the ESIA is to assist in ensuring environmentally and socially sound management of the Project during its entire lifecycle. The description of the existing conditions of the local environment provides a comprehensive data collection and analysis of the baseline conditions at the Project site. The baseline data permits the identification of the main socio-environmental factors that might be associated with the Project activities.

The interaction between the Project activities and the environmental and social baseline conditions of the ecosystem at the Project site is at the core of the ESIA.

The ESIA is designed to forecast the positive and negative effects that may occur to the receiving environment. The early identification of impacts that may occur in the area leads to a reduction of the risk of future adverse environmental effects, and permits the proposal of mitigation guidelines/measures to avoid, reduce or remediate significant adverse effects.

The ESIA also acknowledges potential socio-economic impacts, and predicts the effect on people and communities occurring as a result of the Project.

In this section, key biological, physical, and human receptors are selected from the baseline data. The impacts of the Project activities on each of these "Valued Ecosystem Components" are evaluated using a significance ranking process.

7.2 VALUED ECOSYSTEM COMPONENTS

Valued Ecosystem Components (VECs) are ecosystem components that are considered to be important or valuable and that merit detailed consideration in the EIA process (Treweek, 1999). The concept of VECs has been used in EIAs as a tool to highlight important receptors (individuals or groups) which could be affected (positively or negatively) by the different aspects of a project under evaluation.

The VECs are selected depending on the identification of pathways linking important environmental components with the totality of the project's activities, and as such, VECs are fundamental to the EIA process.

The environmental resources can be divided into their key characteristics or categories from which the VECs can be selected. Table 6-1 presents a list of each environmental resource associated with the VECs that are deemed significant in terms of environmental and social importance in the context of this Project. Each of these VECs have been evaluated in terms of the construction and operational aspects of the Project and relevant mitigation measures will be recommended to ensure that all negative impacts are mitigated.

Table 7.1: Valued Ecosystems Components

Environmental Resource	Valued Ecosystems Component	Importance of the Valued Ecosystem Component
Air and Climate	Air Quality	• Effects on air for local residents • Health implications for all users • Effects on the ecosystem
	Climate	• Contribution to global warming
Land	Geomorphology and Landscape	• Changes in land morphology • Use of non-renewable resources • Importance to local community • Effects of waste disposal methods
Water	Groundwater Quality	• Sustainability issues (is groundwater considered a highly limited renewable resource in the area?) • Effects on local use (irrigation and drinking).
	Surface Water Quality	• Sustainability issues • Effects on local use (irrigation, drinking and transportation) • Health implications for all users
	River Water Quality	• Effects on local use (fisheries, transportation) • Health implications for all users
Ecology and Biodiversity	Terrestrial Ecology and Biodiversity	• Importance to biodiversity value (International, National and Regional) • Important for ecosystem well being and proper functioning • Use to community
	Marine Ecology and Biodiversity	• Importance to the well being of all biological content of the ecosystem • High biological value (International, National and Regional) • Economic use to community
Human Environment	Socio-Economic Activities	• Employment opportunities • Community welfare
	Community Health and Safety	• Operations impact on community safety • Reduction of gas flaring
	Noise Pollution	• Nuisance to local community • Influence on biological diversity
	Agriculture	• Socio-economic importance • National and community value creation
	Light Pollution	• Nuisance to local community and ecosystem

7.3 ENVIRONMENTAL ASPECTS

The environmental aspects are defined as the elements of an operation or project's activities, products, or services that can or does interact with the environment. The key environmental aspects associated with the Project are presented in Table 6-2 below.

Table 7.2: Environmental Aspects

Project Component	Environmental Aspect
Construction Activities – Site Preparation	Soil clearing and land leveling
	Transport and equipment use
	Purchase and delivery of construction materials and services
	Staffing
Construction Activities – Civil Works and Mechanical Erection	Worker's temporary accommodation
	Excavation and earthworks for Plant foundation and buildings
	Transport and use of vehicles and construction equipment
	Construction of infrastructure OSBL (outside Plant Battery Limits) including freshwater intake pipeline
	Plant equipment testing and start-up/commissioning
	Waste disposal
Operation Activities	Operation of ammonia and urea process plants
	Operation of freshwater intake pipeline
	Traffic operation for ingress and egress from Plant site

	Traffic operation for transport of urea product ex Plant site
	Waste disposal
Accidental (non-routine) Events	Fire and explosion
	Spills and leaks

The environmental impact resulting from an environmental aspect can be positive or negative. A number of the impacts for this Project are actually positive.

7.4 PREDICTED IMPACTS

Environmental impacts are caused by environmental aspects and can have a direct impact on the environment, contribute indirectly to a larger environmental change, or be cumulative. This section reviews each of the VECs potentially affected and discusses the predicted impacts that may result from the environmental aspects listed above.

7.4.1 PREDICTED IMPACTS DURING CONSTRUCTION PHASE

The construction phase of the project is described in Section 3.2. This phase is planned to extend for a period of 29 months and to finish during the second quarter of 2013. The main potential impacts anticipated during the construction phase of the Project are outlined in the following sections.

7.4.1.1 AIR AND CLIMATE

Air quality may be affected during site preparation, construction activities, and by the potential occurrence of non-routine events. Impacts could result from the following environmental aspects listed in Table 6-2.

Dust and Particulates

During construction, there may be a localized and temporary reduction in air quality as a result of dust and particulate generation. It is considered to be significant, with the potential to affect workers on-site. However impact on off-site receptors will be minimal as the actual Project site is circa 7 Kilometers from the nearest habitation.

Creation of access roads, excavation and earthworks ISBL (inside the plant battery limits) may lead to the temporary air borne transport of particulates (increased dust). The majority of the dust generated during construction is likely to be deposited within 100 Meters of the site. According to the UK Environment Agency Technical Guidance Document (Monitoring) M17, circa 85% of particulate matter in the ambient air is deposited within 100 Meters of the source while approximately 10% is deposited between 100 and 500 Meters.

It is important to note that the entire area around the Project site is essentially

undeveloped for over 3 Kilometers radius around the site. Indeed most of the undeveloped land around the site is owned by the Project Sponsor. The nearest residential area is located about 7 Kilometers from the site.

Air quality will also be reduced by emissions from machinery and vehicles used for transportation to and from the site and on the site. These emissions are not expected to be significant. Note that most of the equipment is planned to be transported to the Project site with marine vessels via the Ossiomo river.

Gaseous and Exhaust Emissions
Emissions of pollutants during the testing and start-up phase of the Project. The gaseous emissions may include: NO_x, CO_2, CO, NH_3, SO_x, and particulate matter. The start-up phase is necessary to enable testing of the machinery and installations. The start-up/pre-commissioning stage generally lasts for few weeks.

During construction, there may be a localized and temporary reduction in air quality as a result of emissions from site machinery and equipment. Furthermore, heavy equipment such as bulldozers and other construction equipment will produce exhaust emissions from diesel engines leading to temporary increase in SO_x, NO_x, and CO_2 concentrations. Emissions may occur in the event of an emergency.

The main gases of concern include:

Sulphur dioxide - SO_2
The amount of SO_2 in exhaust gases is directly dependent on the sulphur content of the used fuel. Reducing SO2 emissions from engines can be implemented by using low sulphur fuel for machinery and equipment. The Project Company will instruct the contractors to use low sulphur fuel, to the extent available locally.

Nitrogen oxides - NO_x
NO_x emissions from contractor equipment/activities will need to be minimized. Construction equipment and machinery may need to modified, to the extent necessary.

Carbon Oxides
CO_2 is a greenhouse gas and emissions may occur during the construction phase. The emission of carbon dioxide, while not directly harmful to human health or the environment, contributes to global warming and climate change. Carbon dioxide may be generated and emitted both directly and indirectly during the construction phase of the project. It is important that all energy consuming and CO_2-generating activities are conducted as efficiently as possible to minimize CO_2 emissions.

The release of carbon monoxide (CO) may occur as a result of incomplete combustion of fuel in engines. Under normal conditions, air emissions will have minor impacts on the surrounding environment during the construction phase.

7.4.1.2 LAND

During site preparation, construction activities may impact the land. It is important to note that the Project area is benign from a geological perspective with no known history of flooding, tornadoes, earthquakes or other climatic nor seismic events.

However site clearance and ground leveling, necessary for plant construction, will change the geomorphology of the site. The area designated for the construction of the process plants, pipeline, and product storage are not considered as areas where geological features require protection.

Excavation and earthworks are not regarded as sources of negative impact on local geology. As a means of recovery, surface deposits that will be removed during construction phase may be used for leveling or backfill to raise and restore the landscape.

Overall, no significant impacts on geology are considered likely during the Project construction.

During the construction phase of the Project, the site area will be re-landscaped. Any existing vegetation will be removed, the soil will be graded, leveled and compacted to produce a flat and even surface. The Plant facilities and installations completed during the construction phase will be visible and may have a negative visual impact. However, this is consistent with the designation and licensing of the site for the development of a petrochemical complex. In addition there are already a number of oil and gas installations and infrastructure in the Project area.

Solid waste generated during the construction phase may negatively impact the site if handled inappropriately, but contractors will develop a solid waste management plan to ensure that any solid wastes generated by the construction activities are handled appropriately.

7.4.1.3 WATER

Groundwater Quality

Groundwater is a major VEC that needs to be preserved and monitored during the construction of the Project.

The local community mainly uses underground water for subsistence and agricultural activites. The project does not intend to use underground water – the plan is to focus on taking water from the nearby Ossiomo River located beside the site for the Project freshwater intake.

Groundwater quality may be affected by construction activities as well as by the occurrence of non-routine events. The key accidental event risk is mainly attributable to seepage of contaminants from accumulation of solid wastes or inappropriate sanitation facility.

Appropriate mitigation measures discussed in section 8 need to be implemented and monitored. A large number of personnel (up to 1,000 during peak construction) will be required to work on site. The presence of such a large

number of workers will require a sanitation facility which, if not adequate, could lead to pollution of the soil, surface water and eventually groundwater and marine water via the introduction of coliform contamination and/or biodegradable organic matter which would result in a high biochemical oxygen demand ("BOD") load in certain situations. The BOD is a measure of water quality. As BOD load increases, consequently the water quality decreases (i.e. water degradation is associated with an increase in BOD load).

Groundwater quality may also be impacted by inappropriate waste disposal and spillages during construction. Inadequate management of construction materials and fuel could lead to spillages, notably of machine oil. Other hazardous substances that may be in use during the construction phase include paints, solvents, acids, and bases. A spill prevention and response plan should be completed to prevent any effects to groundwater.

Freshwater Quality

Freshwater needed for the operation activities will be supplied from the Ossiomo River located beside the Project site. The water flow on the Ossiomo river at the Project site is about [80 – 120 liters/second] on average based on data collected by the Benin-Owena River Basin Authority over the last 30 years. This is far in excess of the Project requirement during the construction and operation phase. In essence, the Project's use of water from the Ossiomo River will have negligible effect on other users. However it will be a major priority of the Project Company and its Sponsors to protect existing freshwater users and to ensure that the increased demand from Plant use is sustainable.

7.4.1.4 ECOLOGY AND BIODIVERSITY

Terrestrial Ecology and Biodiversity

The Project site area is located in the equatorial belt with an alternating wet and dry season influenced by its proximity to the Atlantic Ocean, wind patterns and sunshine. The area is characterized by high rainfall, relatively high ambient temperatures and high humidity due to its proximity to the coast of the Atlantic Ocean. A number of small mammals and some bird tracks were observed in the site area.

Terrestrial ecology and biodiversity may be affected during site preparation, and construction activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

Creation of access roads
Transport and equipment use
Excavation and earthworks for civil works
Waste disposal during construction
Accidental (non-routine) events: spills, leaks and solids disposal

During the construction phase of the Project, there will be an overall loss of terrestrial habitat, for example, loss of feeding areas, cover and nesting of fauna. However any habitat loss will be minimized through the construction phase.

Accidental (non-routine) events: spills, leaks and solids disposal
Accidental hydrocarbon and chemical spills from motorized construction equipment may occur and impact a great number of VECs.

Under normal conditions, solid waste is not expected to reach or impact the environment if properly disposed. The application of prevention measures, in addition to proper handling of hazardous waste will be mandated to each contractor operating at the site to ensure protection of the marine environment from accidental spills.

7.4.1.5 HUMAN ENVIRONMENT
Valued components that should be evaluated in the context of this impact assessment include the neighboring residents including local farmers. Generally, there will be positive benefits for the local community in terms of enhancement of employment opportunities and increased economic activity for the local economy resulting from the Project activities.

Socio-Economic Activities
Socio-economic activities may be affected during site preparation and construction activities. Impacts could result from the following environmental aspects:

- Purchasing of supplies and services
- Staffing and human resourcing

The site is currently unoccupied and thus no relocation or resettlement will occur. The nearest habitation to the Project site is located about 7KM away. There are no identifiable social concerns in terms of impacting any local indigenous populations and the socio-economic impacts of construction of the project will be positive.

Consultations and discussions with local residents that there is no expectation of negative impact on the socio-economic activity of the local community. Moreover local residents of all categories have explicitly showed considerable interest in exploiting any employment opportunity resulting directly or indirectly from the Project.

Employment prospects will be generated for skilled and unskilled labor, administration staff, caterers and medical staff. Where available, these personnel will be pooled from the local community which, by definition, not only includes the neighboring villages but Benin-City as well.

One major challenge for the Project Company will be A how to balance and manage the expectations of the local community with the real levels of opportunities accessible to them during the construction phase given the relatively low skill and experience levels that currently exits within the local community. However the Project Company will plan significant training programs to enhance technical skills amongst the local community work force. In conclusion, the socio-economic impact of the Project construction will be positive provided that the Project Company effectively manages the expectations

of the community.

Community Health and Safety
Community safety may be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Transport and use of vehicles and motorized equipment
- Waste disposal

During the construction of the Plant, a number of trucks and heavy equipment will be deployed. The increase in vehicular traffic on existing road networks may result in increased safety risks.

However these risks will be significantly mitigated by:

a Maximizing the use of marine transport via the Ossiomo river, as much as possible to reduce vehicular traffic on the local roads
b Operators of construction equipment and operations vehicles will be required to adhere to local speed limits and rules.

Full contingency plans would be in place to prevent adverse actions from accidental events.

Noise
Noise pollution may be increased during site preparation and construction activities. Impacts could result from the following environmental aspects:

- Creation of access roads
- Transport and equipment use
- Excavation and earthworks for nitrogenous project construction

However these impacts will be temporary and unlikely to significantly affect any person given that the area around the site is uninhabited.

Agriculture
Almost all of the area surrounding the area where the project is to be located is industrial land with several existing oil and gas infrastructure) or farmland. However the construction and operation of the Plant will not affect any agricultural activity. Indeed the development of the ammonia urea plant could benefit the local farmers through the ready availability of nutrients to enhance their agricultural production.

Archaeological Heritage
There are no sites of archaeological importance within or in the close proximity of the Plant site.

Light Pollution
During construction phase, the potential use of excess light could represent a

minor environmental impact. The management and control measures identified in section 8 of the report should minimize any impact

7.4.2 PREDICTED IMPACTS DURING OPERATION PHASE

The operation phase of the project is described in section 3.3. The Plant is expected to operate for a minimum of 25 years and up to 40 years after which decommissioning may occur. The Plant operating life will be primarily driven by the availability of natural gas feedstock in the longer term.

The following paragraphs are organized by environmental resource and list the main impacts produced by the various VECs during the operation phase of the Project.

7.4.2.1 AIR AND CLIMATE

During operation, gaseous emissions from machinery and equipment may lead to a reduction in air quality ISBL and OSBL. Potential gaseous emissions are of concern as they may cause general disturbance in the area and could impact human health. Potential gaseous emissions of note include:

Nitrogen oxides - NO_x

NO_x are a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is an odorous, brown, acidic, highly corrosive gas that can affect human health and the environment. In particular, high levels of NO_2 can damage the human respiratory system and increase a person's susceptibility to, and severity of, respiratory infections and asthma. Long-term exposure can cause chronic lung disease. NO_2 is also harmful to vegetation, damaging foliage and inhibiting growth.

NO_2 reacts with oxygen (O_2) to form NO and ozone (O_3). As with NO, O_3, when found in the lower atmosphere, is harmful to human health, producing similar effects on the respiratory system.

Carbon dioxide – CO_2

In addition to it being a greenhouse gas, it is important to monitor and control CO_2 emissions to prevent general air quality deterioration inside and outside the workplace. Carbon dioxide will be generated and emitted both directly and indirectly during the operation of the Plant. It is important that all energy consuming and CO_2-generating activities are conducted as efficiently as possible to minimize CO_2 emissions. However it is important to note that one of the key drivers of the process chemistry is to combine CO_2 with ammonia to form the urea product. Therefore a key Plant performance objective is to maximize the conversion of CO_2 to urea and absolutely minimize any fugitive CO_2 emission.

Ammonia – NH_3

Ammonia when released to the atmosphere in significant quantities is highly poisonous to humans. One of the key drivers of the process chemistry is to combine ammonia with CO_2 to form the urea product. Therefore a key Plant performance objective is to maximize the conversion of ammonia to urea and absolutely minimize any fugitive ammonia emission.

Carbon Monoxide – CO
The release of carbon monoxide occurs as a result of insufficient combustion of natural gas. The anticipated levels of any CO emissions will be low. Therefore, any impact is not considered to be significant given the proven efficiency of the KNO Plant.

Sulphur Oxide – SO_x
The amount of SO_x in exhaust gases is directly dependent on the sulphur content of the used fuel. The levels of sulphur oxides emissions are anticipated to be low due to the proposed use of natural gas fuel. Furthermore the sulphur content of natural gas in Nigeria is statistically nil. In any event, the plant also has an MDEA de-sulphurization unit which will remove any traces of sulphur. In essence, SO_x emission occurrence resulting from Plant operation should be remote.

The KNO Plants 4, 5 and 6 HAZOP study and Process Hazards Analysis outlined in Section 3.3 provides a good history and background of the assessment of the operational hazard associated with this plant. The Project Company will continue the goals and philosophy established for the KNO Plant operation in Alaska.

7.4.2.2 LAND
During the operational phase of the Project, impact on the land may result from the occurrence of non-routine events, such as:

- Waste disposal during operation activities
- Accidental (non-routine) events - spills and leaks.

Over the operational lifetime of the Plant, solid wastes created will require appropriate disposal. The principal solid wastes would be spent catalysts, which will need to be properly managed and disposed of in accordance to the industry recognized waste management best practice. This is addressed in the waste management plan discussed in Section 9.

7.4.2.3 WATER
Groundwater Quality
Groundwater is a major VEC that needs to be preserved and monitored during the operation of the Project. Groundwater quality may be affected during operational phase by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

Waste disposal during operation activities
Accidental (non-routine) events: spills and leakage.

During the operational phase of the Project, the risk of Impact to groundwater from spills and leakages should have been eliminated by a proper operational, maintenance and environmental management of the facility to minimize the risk of spillage and leakages.

Freshwater Quality
Freshwater for the Plant operation will be supplied from the Ossiomo River which flows beside the Project site. In addition to the process plant feed and cooling requirements, water will be also required for potable water in the plant. A key operational objective is to ensure that the river water is used in an efficient manner to protect the resource for the benefit of all users.

Wastewater
The wastewater treatment system is designed to collect the liquid effluents and contaminated surface waters from the plant and to treat them to achieve the required liquid effluent quality in order to meet the national environmental standard for effluent disposal.

The normal flow is made up of the streams from the equalized effluent including blow-down from the cooling tower; backwash water from the side stream filters; treated water from the oily water treatment package; treated water from the sanitary water treatment package, neutralized effluents from the pre-treated water demineralization unit and mixed bed polisher.

In addition, the effluent water will also include storm water flow from rain falling on the open areas within the plant. The seawater outfall will be discharged into the river via a pipeline. The expected rates and types of discharges through the marine outfall are shown in Table […] below.

Table 7.3: Routine Discharges to the River

Routine Discharge via Outfall Pipeline	**Normal Flow from Plant**	**Quality**
Storm water	**No flow, under normal conditions**	**IFC Guideline (see Table 2.2 Section 2)**
Equalized effluent	**Average flow: 300m^3 per hour** **Peak flow: less than 1,000 m^3 per hour**	**IFC Guideline (see Table 2.2 Section 2)**

The quality of treated liquid effluent discharged through the outfall would be monitored and will not exceed the limits for discharge to the marine environment specified by the World Bank environmental guidelines. The effluent will be monitored prior to discharge. In cases where discharge fails to meet the required specifications, off-spec effluent will be recycled for re-treatment inside the plant.

Accidental (non-routine) Events – Spills and Leaks
Detrimental impacts to the surrounding water quality may occur through

spillage of infilling material, accidental discharge of off-spec effluent and/or leaks of process chemicals. Emergency response management plans will be in place to deal with these accidental events.

7.4.2.4 Ecology and Biodiversity

Terrestrial Ecology and Biodiversity

Terrestrial ecology and biodiversity may be affected during operational phase. Impacts could result from:

Process plant operation
Operation of freshwater intake
Accidental (non-routine) events: fire and explosion
Accidental (non-routine) events: spills and leaks
Accidental (non-routine) events: inappropriate waste disposal.

The main impact on terrestrial ecology and biodiversity, particularly on flora, during the operational phase may result from air emissions. Harmful emissions, particularly of NO_x, O_3, and NH_3 have been shown in scientific studies to damage foliage and inhibit growth. Owing to the way air pollutants can travel in the atmosphere, the geographical extent of these impacts could be extensive. Most plants have defense mechanisms against periodic exposure to air pollutants. Plants have inherent protection against short duration, high exposure to air pollutants. Flora cannot, however, defendhigh and continuous exposure, and therefore prolonged exposure can ultimately lead to the loss of particular species within a certain area which could have an impact on biodiversity.

The Plant operating history indicates that predicted emission concentrations for NO_x, NH_3, and SO_2 are well below the considered EU standards. Therefore, these emissions concentrations are unlikely to affect the surrounding ecosystems under normal operation conditions.

The operation of the facility will generate noise and emissions that could affect the neighboring fauna. Generally, fauna will move away from the source of noise and pollution if a suitable habitat can be found which in the case for this Project.

Therefore no significant habitat loss is likely to occur through the operation of the plant.

Marine Ecology and Biodiversity

Operation of the process plant

The impact of the operation of the urea/ammonia plant on marine ecology and biodiversity is limited to those resulting from the operation of the marine outfall which will be further discussed below.

Operation of Freshwater Intake

Operation of the fresh water intake may negatively impact a number of VECs. Appropriate pipe design (for water intake) should eliminate/reduce associated

impacts, especially those related to fish capture.

Operation of Marine Outfall
The existence of an outfall structure may result in a change in the biological community along the corridor of the structure. Biofouling may also occur on the ports and pipeline. The main VECS potentially negatively impacted through operation of the outfall include plankton, crustaceans, molluscs, pelagic and demersal fish, and marine mammals.

7.4.2.5 HUMAN ENVIRONMENT
Socio-Economic Activities
In the operational phase, the Project will provide significant employment opportunities (skilled and unskilled workers) and revenue to local businesses and industries. Population influx into surrounding communities could occur as a result of people coming to the area seeking employment opportunities. Therefore, the local economy will be indirectly enhanced due to the increased economic activity in the area. Indirect positive impacts may result from an improvement in local services, such as transportation and infrastructure.

In general, the Project is likely to act as a catalyst for other investments and economic activities in the area.

In summary, the socio-economic impact of the Project operation will be positive.

Community Health and Safety
Community safety may be affected by the occurrence of non-routine events such as fire and explosion. This may result in human injury and possibly loss of life is. However best global industry practice will be adopted to prevent adverse actions. Full emergency response plans and rescue equipment and personel will be in place to mitigate any accidental event.

Noise
Noise pollution may occur during operation activities. Impacts could result from the following:

Process plant operation;
Traffic operation
Fire and explosion.

Agriculture
Air emissions from the plant is unlikely to affect crop yield in the neighboring fields given the remote position of the Project site within the Ossiomo industrial site.

7.5 IMPACT EVALUATION
In this sub-section, the significance of each potential environmental impact on each VEC is evaluated. Impacts are evaluated using the following criteria:

Character of the VEC
Duration of the impact
Magnitude of the impact
Spatial extent
Type (direct, indirect, cumulative)
Probability of occurrence.

Table 7.4: Assessment of Impact Significance

Duration – what is the length of the negative impact?	
None	No effect
Short	Less than 1 year
Medium	1 to 10 years
Long	Greater than 10 years
Permanent	Irreversible
Magnitude – what is the effect on the resource within the study area?	
None	No effect
Small	Affecting < 1% of the resource
Moderate	Affecting 1-10% of the resource
Great	Affecting > 10% of the resource
Spatial Extent – what is the scale of the impact in terms of area, considering cumulative impacts and international importance?	
Local	Localized/immediate area impact
Regional/National	Large scale impact
International	International scope and dimension
Type – what is the impact?	
Direct	Caused by the Project and occur simultaneously with Project activities
Indirect	Associated with the Project and may occur at a later time or wider area
Cumulative	Combined effects of the Project with other existing/planned activities
Probability – what is the likelihood of an impact occurring?	
Low	<25%
Medium	25-75%
High	>75%

The significance classes defined are outlined in Table 7.5 below.

Table 7.5: Significance classes for environmental impact

Class	Significance	Description/Comments
1	Significant, major impact	Impacts are expected to be permanent and non-reversible on a national scale and/or have international significance or result in legislative non-compliance
2	Significant, moderate impact	Impacts are long term but reversible.
3	Insignificant, minor impact	Impacts are considered to be short term, reversible and/or localized in extent.
4	Insignificant	No impact is expected.
5	Unknown	There are insufficient data on which to assess significance.
6	Positive	Impacts are beneficial to the key VECs

A summary of the significance of the potential impacts of the identified VECs is presented in Table 7.6 below.

Table 7.6: Summary of Potential Environmental Impacts (including workers and community safety) – Construction Phase

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **SITE PREPARATION**	Soil and land leveling	Air Quality	Increased air emissions (dust and exhaust emission)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Geomorphology and Landscape	Geomorphologic changes and visual impact	PERMANENT	SMALL	LOCAL	DIRECT	25-75%	MODERATE
		Terrestrial Ecology and Biodiversity	Effect on flora and fauna	PERMANENT	MODERATE	LOCAL	DIRECT	25-75%	MODERATE
		Socio-Economic Activities	Increased economic activity	MEDIUM	SMALL	LOCAL	DIRECT	25-75%	POSITIVE
		Noise Pollution	Noise generation	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
	Construction of access roads ISBL and OSBL	Air Quality	Increased air emissions (dust and exhaust emission)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Geomorphology and Landscape	Topographic changes and visual impact	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MODERATE
		Terrestrial Ecology and Biodiversity	Loss of habitat and clearing or damage to vegetation	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR

Table 7.6: Summary of Potential Environmental Impacts - Construction Phase (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **SITE PREPARATION**		Socio-economic activities	Local employment prospects	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE
		Agriculture	Degradation of vegetation (exhaust, dust etc)	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MODERATE
	Transport and equipment use	Air quality	Increased air emissions (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and clearing of vegetation	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Agriculture	Degradation of vegetation (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
	Purchase of supplies and services	Air Quality	Increased air emissions (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Agriculture	Degradation of vegetation (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MODERATE
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE
	Human resource	Socio-economic activities	Local employment prospects	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE

Table 7.6: Summary of Potential Environmental Impacts - Construction Phase (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **CIVIL WORKS AND MECHANICAL ERECTION**	Workers' Temporary Accommodation	Water resources and sewage	Potable water use and sewage disposal	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MINOR
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE
	Excavation, foundation, building works and mechanical erection	Air quality	Increased air emissions (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Geomorphology and landscape	Visual impact due to construction activities	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MINOR
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	REGIONAL	DIRECT	>75%	POSITIVE
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Agriculture	Degradation of vegetation (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR

Table 7.6: Summary of Potential Environmental Impacts - Construction Phase (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **CIVIL WORKS AND MECHANICAL ERECTION**	Use of vehicles and construction equipment	Air quality	Increased air emissions (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE
		Agriculture	Degradation of vegetation (exhaust, dust etc)	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
	Construction of infrastructure OSBL (gas pipeline, water intake pipeline and marine outfall pipeline)	Marine ecology and biodiversity	Degradation of ecosystem	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE

Table 7.6: Summary of Potential Environmental Impacts - Construction Phase (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **CIVIL WORKS AND MECHANICAL ERECTION**	Waste disposal	Groundwater quality	Leaching of waste into aquifer	MEDIUM	SMALL	LOCAL	DIRECT	<25%	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Community health and safety	Adverse health impacts	MEDIUM	SMALL	LOCAL	DIRECT	<25%	MODERATE

Table 7.6: Summary of Potential Environmental Impacts - Construction Phase (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
CONSTRUCTION PHASE: **TESTING AND PLANT COMMISSIONING**	Testing and commissioning	Groundwater quality	Contamination	SHORT	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		River-water quality	Contamination	SHORT	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Marine ecology and biodiversity	Degradation of ecosystem	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Air quality	Gaseous emissions	SHORT	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-economic activities	Increased economic activity	MEDIUM	MODERATE	LOCAL	DIRECT	>75%	POSITIVE

Table 7.7: Summary of Potential Environmental Impacts – Operation Phase

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
OPERATION PHASE:	Process plant operation and maintenance	Groundwater quality	Contamination	LONG	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		River-water quality	Contamination	LONG	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Marine ecology and biodiversity	Degradation of ecosystem	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Air quality	Gaseous emissions	LONG	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		Noise Pollution	Increased noise levels	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-economic activities	Increased economic activity	LONG	MODERATE	REGIONAL	DIRECT	>75%	POSITIVE

Table 7.7: Summary of Potential Environmental Impacts (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
OPERATION PHASE:	Operation of freshwater intake and marine outfall pipelines	Groundwater quality	Contamination	LONG	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		River-water quality	Contamination	LONG	MODERATE	LOCAL	DIRECT	<25%	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Marine ecology and biodiversity	Degradation of ecosystem	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Noise Pollution	Increased noise levels	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-economic activities	Increased economic activity	LONG	MODERATE	REGIONAL	DIRECT	>75%	POSITIVE
	Operation of natural gas pipeline (spur connection to process plant)	Air quality	Gaseous emissions	LONG	MODERATE	LOCAL	DIRECT	<25%	MINOR
		Noise Pollution	Increased noise levels	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-economic activities	Increased economic activity	LONG	MODERATE	REGIONAL	DIRECT	>75%	POSITIVE

Table 7.7: Summary of Potential Environmental Impacts (continued)

Project Phase	Activity	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
OPERATION PHASE:	Transportation	Air quality	Gaseous emissions	LONG	MODERATE	LOCAL	DIRECT	<25%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Noise Pollution	Increased noise levels	LONG	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-economic activities	Increased economic activity	LONG	MODERATE	REGIONAL	DIRECT	>75%	POSITIVE
	Water resources and solid waste disposal	Groundwater quality	Leaching of waste into aquifer	MEDIUM	SMALL	LOCAL	DIRECT	<25%	MINOR
		Water resources and sewage	Potable water use and sewage disposal	MEDIUM	MODERATE	LOCAL	DIRECT	25-75%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Community health and safety	Adverse health impacts	MEDIUM	SMALL	LOCAL	DIRECT	<25%	MINOR