



# Environmental Impact Assessment for the Nigeria LNGSix Project

## EXECUTIVE SUMMARY

### 1 Introduction and background

The potential for a liquefied natural gas (LNG) project in southern Nigeria was first conceived in 1969, but it was not until the 1980s that Philips Petroleum developed proposals for an LNG project based at Bonny Island. The proposed plant site and residential area were cleared in the early 1980s. The project was not pursued further at this time.

The Nigeria LNG project was established in March 1985 with the formation of an LNG working committee, involving the Federal Government of Nigeria, Shell Gas BV, Nigerian Agip Oil Company (NAOC) and Elf Nigeria Ltd. (ENL), to exploit the substantial gas reserves in Nigeria. The company Nigeria LNG Ltd. was incorporated under Nigerian Law in May 1989. The company shareholding comprises Nigerian National Petroleum Corporation (NNPC) 49%, Shell Gas B.V (Shell) 25.6%, Total (15%) and ENI (10.4%). The Nigerian National Petroleum Corporation (NNPC) is managing the Federal Government of Nigeria's stake in the project. More general information about the company, Nigeria LNG Ltd, and its projects can be found on the following website: <http://www.nigeriaing.com/default>

The existing cleared plant site and residential area on Bonny Island were allocated to Nigeria Liquefied Natural Gas Ltd. (NLNG). The subsequent on-site activities involved the relocation of Finima village by the authorities and a purpose-built new town was provided. Relocation to New Finima town took place in 1991, after which the site was levelled and covered with hydraulic fill to raise the site to the correct levels for construction.

The Nigeria Liquefied Natural Gas (NLNG) **Base** project comprised construction of the original two-train LNG plant and a gas transmission system (GTS) of pipelines to transport natural gas from the gas fields throughout the Niger Delta to the plant; this was completed in 1999. The NLNG project envisaged a phased expansion of the plant through the staged addition of further process trains, scheduled to take place over the subsequent 10 years. The first step in this phased expansion was the addition of a third train (the NLNG **Expansion** project), including facilities to produce Liquefied Petroleum Gas (LPG). This created the capability of accepting oil-associated gas, which formerly had to be flared-off in the Niger Delta. The **Expansion** project began in 1999 and the third train was started up in November 2002. This expansion meant an increase in production capacity as well as an improved efficiency in the exploitation of the Nigerian gas reserves with overall reductions of greenhouse gas emissions. The subsequent project, i.e. the NLNG**Plus** project, represents a further expansion phase with the development of two (the fourth and fifth) liquefaction trains. These trains are currently under construction and are scheduled to start-up in the second half of 2005. The addition of a sixth LNG train and associated infrastructure and facilities is the currently proposed project (the NLNG**Six** project). The construction is due to start in 2004 and to be completed in late 2007.

The NLNG plant is located on the western coast of Bonny Island, approximately 40 km south of Port Harcourt, Rivers State, Nigeria; see Figure 1. The plant site is situated between the Bonny Crude Oil Terminal (BCOT) - operated by the Shell Petroleum Development Company of Nigeria Ltd. (SPDC) - and the Mobil LPG site. In addition to the LNG plant itself, there is a permanent residential area, providing accommodation for the plant's workforce, situated approximately 3 km away on the southern coast of Bonny Island.



A series of environmental studies were undertaken for the **Base, Expansion and Plus** projects, culminating in the issuing of several baseline reports and environmental impact assessments for both the LNG plant and for the GTS since 1995. All projects have received the appropriate environmental permits from the Nigerian Federal Ministry of Environment (FMEnv, formerly Federal Environmental Protection Agency (FEPA). The impact assessment for gas transmission systems associated with the developments of the third, fourth and fifth LNG trains have been completed by the upstream gas producers as separate projects. For the NLNGSix project an environmental impact assessment has been carried out parallel to the project development. This assessment was done in accordance with the Federal Government of Nigeria legislation [*EIA Decree No. 86 of December 1992* and the *Federal Environmental Protection Agency (FEPA) 1995 Sectoral Guidelines for Oil and Gas Industry Projects*], internationally accepted (including World Bank) guidelines for environmental assessment and guidelines issued by NLNG's shareholders.

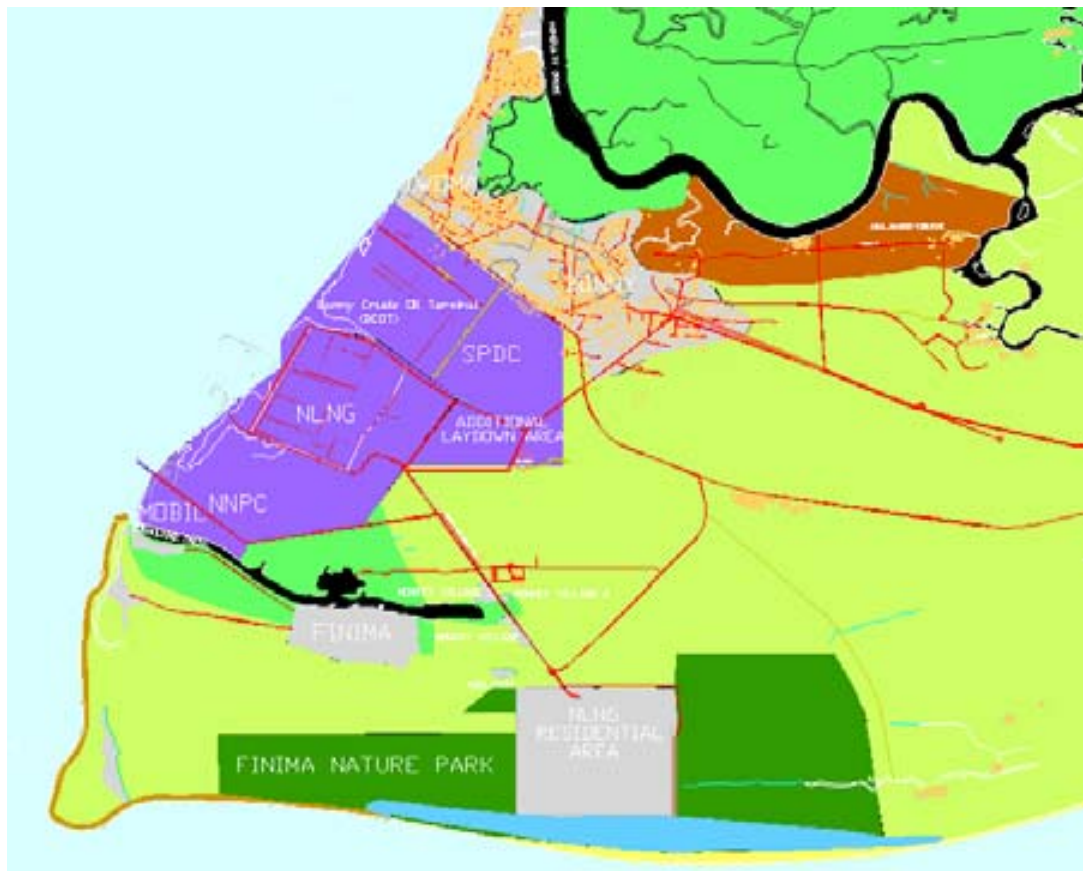


Figure 1: Above: situation of Bonny Island, approximately 40 km south of Port Harcourt.  
Below: location of the oil and & gas industries at the southwest end of the Island.



## 1.1 Report set-up

The current impact assessment for NLNG**Six** is reported in two parts, the actual impact assessment report and a separate volume containing Appendices. It is an addendum to the impact assessment for NLNG**Plus**. The (limited) additional baseline work carried out for this impact assessment is reported in the appendices and is summarised in the main report.

The impact assessment report deals with the environmental, social and health implications of the proposed NLNG**Six** project in an integrated manner – being an Environmental, Social and Health (impact) Assessment (ESHA). It contains:

- An introduction to the project environment, the proponent and other relevant background information – chapter 1.
- A description of the Company (Nigeria LNG Ltd) and the proposed activities (the project) with its hazards in chapter 2.
- Chapter 3 gives a summary description of the present social and environmental characteristics of the project environment. Details resulting from the few field studies that have been carried out are provided in the Appendices. The (future) 5-LNG train operations have actually been included in the baseline for the sixth train, so that a cumulative assessment results.
- Chapter 4 describes the potential effects of the proposed activities – in terms of hazards and issues - on the environmental and social sensitivities.
- In chapter 5 mitigation measures are presented for each adverse impact and enhancement measures to stimulate positive consequences.
- Chapter 6 describes how these mitigation measures will be implemented through an Environmental, Social and Health Management Plan (ESHMP), as part of NLNG's management systems.
- Stakeholder consultation as an integrated part of this ESHA is reported on in chapter 7.
- The chapters 8 and 9 deal with decommissioning and NLNG's Management System.

## 2 The project proposer – Nigeria LNG Ltd. (NLNG)

The founding partners of NLNG have a wealth of experience in developing oil and gas projects world-wide and are well-known in the crude and gas businesses. The NLNG partners form a strong team as they have won their spurs in sound environmental protection in design, construction and operation of large resource development projects.

NLNG wishes to develop the NLNG**Six** project in full compliance with:

- Applicable Nigerian statutory requirements
- NLNG's own policy statements on Health, Safety and Environment (HSE) and Sustainable Development
- Project specific standards, amongst which the so-called HSE Premises
- Policies and principles of NLNG's shareholders
- Applicable international conventions, treaties and agreements
- International standards, including World Bank / IFC / WHO / etc. and international industry / branch organisations.

In line with these standards, NLNG aims to contribute to Sustainable Development. This means that a strategy will be followed that integrates economic, social, health and environmental considerations in all project decisions and actions. This also implies that NLNG is committed to carry out a full Environmental, Social and Health (Impact) Assessment (ESHA), parallel to and as part of the development of this project. This ESHA process was started as early as possible and in such a way that any implications resulting from the assessment could be included in the design and operation. The current report reflects the outcome of this ESHA process and takes into account the natural environmental, human health and social aspects, and any trans-boundary and global environmental aspects in an integrated way. The sustainability principle 'engage and work with stakeholders' entails that NLNG, during the ESHA, consults project-affected groups,



local non-governmental organisations (NGOs) and any other group of stakeholders about the project's environmental and social aspects and takes their views into account.

NLNG has achieved high performance standards on HSE and SD through:

- A systematic approach to HSE management, for which an HSE Management System is in place that is regularly audited
- Active and successful management of community relations
- Certification against the ISO 14001 Environmental Management System standard
- The setting-up of a Sustainable Development Coordination Committee (SDCC), that – amongst others – monitors the implementation of management plans resulting from earlier impact assessments

### 3 The proposed project

The original LNG plant site was designed to provide scope for future expansion and the current sixth train (NLNG**Six**) project is the next stage in the development of the NLNG project. The NLNG**Six** project will provide further opportunities for exploitation of Nigeria's gas reserves, with resulting economic benefits for the country. In addition, the project will increase the capacity of the LNG plant to accept oil-associated gas, which is currently wasted through flaring. The use of associated gas will improve the efficiency of resource use, by providing both LNG and liquid petroleum gas (LPG) products, as well as providing environmental improvements by reducing flaring in the Niger Delta, which contributes to global warming.

The NLNG**Six** project will consist of the construction, commissioning, start-up and operation of an additional (air-cooled) LNG train bringing the total number to six process trains. The new train is to be integrated with existing facilities wherever practicable so that the site is operated as a co-ordinated 6-train complex.

The **Base** plant (two trains) has a production capacity of 6.4 million tonnes per annum (Mtpa) of LNG and the **Expansion** project (third train) has increased this by 3.2 Mtpa. The NLNG**Plus** project will further increase the production capacity by 8.2 Mtpa. The gas processed - as in the case of the third train - will be oil-Associated Gas (AG) as well as Non oil-Associated Gas (NAG). The sixth train will add another 4.1 Mtpa, bringing the total design capacity of the 6-train complex to almost 22 Mtpa. See Table 1 for an overview of the main characteristics of the future 6-train LNG plant.

The NLNG**Six** project includes, like the trains 1-5, sizeable natural gas liquids distillation, storage and use of loading facilities for condensate and LPG. It also includes the construction and operation of an extra (the third) LNG tank, a condensate storage tank and two LPG tanks.

The sixth LNG train will be identical to the fourth and fifth trains currently under construction, which means that the train will be air-cooled. 'Carbon copying' will extend to the make and type of main equipment and systems, subject to availability and commerciality of using the same equipment, contractors, resources, etc.

By the end of 2007, with a 6-train operation, the NLNG site is expected to increase the marine traffic through the Bonny Approach Channel to a total of about 350 LNG carriers, 76 LPG ships and 39 condensate tankers per year.

The maintenance requirements of equipment, electrical and instrumentation and the workload resulting from a regular maintenance and inspection shutdowns will be unchanged from the **Base**, **Expansion** and **Plus** projects.

The permanent facilities to be built for the NLNG**Six** project will be situated within the present fence of the NLNG site complex (see Figure 1), at the east end of the lease area. However, it is anticipated that some land to the east will be required for an extension of the safety and sterile zone and an extension to the perimeter road. The northern part of this zone covers the area that is currently used as temporary lay-down for the **Plus** project and will also be needed during the



construction of the **Six** project as construction and lay-down area. This area will be bounded by new roads.

<b>Projects</b>	<b>LNG trains</b>	<b>Capacity LNG (Mt/a)</b>	<b>Feed gas</b>	<b>Tanks</b>	<b>Jetties</b>	<b>Cooling</b>
<b>Base</b>	1, 2	6.4	NAG	2 LNG 2 condensate	LNG jetty (incl. condensate) MOF	Water-cooled
<b>Expansion</b>	3 + fractionation	3.2	NAG, AG	1 LNG 2 LPG	LPG jetty	Water-cooled
<b>Plus</b>	4, 5	8.2	NAG, AG		LNG jetty Relocated MOF	Air-cooled
<b>Six</b>	6	4.1	NAG, AG	1 LNG 1 condensate 2 LPG		Air-cooled

Table 1. Main elements and characteristics of the 6-train NLNG plant..  
(AG = oil-Associated Gas; NAG = Non oil-Associated Gas)

As part of this project the GTS-2/4 slug catcher will be constructed. This slug catcher is actually an add-on to the trains 4 and 5 project and is meant to receive, separate and distribute the gas-condensate mixture delivered by the GTS-2/4 system.

The project does **not** include the so-called “Channel Deepening”, i.e. the improvement and deepening of the offshore approach channel to Bonny River and Bonny Island. A separate Environmental, Social and Health Assessment (ESHA) will be carried out for these activities with a focus on the deepening of the approach channel and all marine operations and shipping during a full-plant LNG production.

### 3.1 Project alternatives

Starting from the prerequisite that for economic reasons natural gas should be produced in Nigeria, questions about project alternatives have to deal with questions such as “where(to)”, “how” and “why”.

Nigeria faces a number of difficulties in harnessing its abundant gas reserves. Probably the biggest constraint to gas development is the lack of ready markets for the commodity. Domestic gas demand is meagre and significant markets for natural gas can only be used through export of the hydrocarbons. The major international gas markets are located in Europe and Asia. In view of the distances to be bridged, export of Nigerian gas in the form of LNG is the only way to transport gas to these markets. Export of gas through the LNG plant with its LPG and condensate facilities will also boost the utilization of a hitherto wasted resource, i.e. the associated gas. When all six trains are operative it is estimated that the plant will consume about 3 bcf/y<sup>1</sup> oil-associated and non-oil-associated gas, a significant proportion of which would otherwise have been flared and lost to the atmosphere.

In conclusion: there are no economically and technically feasible alternatives for export of natural gas other than through transport after liquefaction and the only way to stop the current flaring of

<sup>1</sup> bcf/y = billion cubic feet per year; 1 bcf = 0.03 billion Nm<sup>3</sup>



associated gas within the foreseeable future is to use the available gas transport, treatment and export systems, i.e. LNG and LPG facilities.

### 3.2 Project benefits

The combination of Nigeria's considerable under-utilised, low-cost, natural gas reserves, and projections of a growing demand for imported natural gas in the industrialised countries around the Mediterranean and the Atlantic Basin clearly demonstrate the national economic benefits to be gained from the production and export of LNG.

The production of LNG is also an issue of global environmental significance. Part of the feed gas to the LNG plant will increasingly consist of associated gas that is currently flared during the production of crude oil in the Niger Delta. Flaring of gas does not accord with the principle of sustainable development – because of its effect on global warming - and, for this reason, measures to minimise flaring are urgently needed. In addition, implementation of Agenda 21 of the 1992 Rio Conference further required the reduction of flaring.

There will also be significant local benefits from the NLNG*Six* project in terms of employment, especially during construction, and development of skills and training. The programme for community involvement in areas of health, education and infrastructure that was a part of the **Base** project and subsequently the **Expansion** and **Plus** projects will also continue. In addition to the direct benefits of employment, the project will also maintain indirect economic benefits in the local area, due to supplies of food, fuel, domestic goods and services.

### 3.3 Design details

The Basis of Design (BOD) for the project covers an air-cooled liquefaction train with supporting LPG fractionation and condensate stabilisation processes along with accompanying storage and loading, common and general facilities; see Figure 2. The BOD does not cover gas gathering but does cover the slug catcher and pressure control station. This slug catcher is meant to receive, separate and distribute the two-phase gas/condensate mixture delivered by the GTS-2/4 system. The new facilities will be the following:

- **Storage**
  - One 77,000 m<sup>3</sup> LNG storage tank (carbon copy of tanks 1, 2 & 3) (LNG tank 4).
  - Two 65,000 m<sup>3</sup> LPG storage tanks (carbon copy of tanks 1 & 2) (LPG tanks 3 & 4).
  - One 36,000 m<sup>3</sup> condensate storage tank (carbon copy of tanks 1 & 2) (Condensate tank 3).
- **Condensate stabilisation facilities**
- **One LPG chilling module**
- **Utilities**
  - Fuel gas booster compressor.
  - Nitrogen storage.
  - Instrument air system expansion.
  - Gas turbines for power generation.

The resulting six-train LNG plant will have an overall total hydrocarbon production capacity of approximately 25.7 million tonnes per annum (Mtpa) of LNG, LPG and condensate.

In the BOD for the project a section with the Health, Safety and Environmental (HSE) Premises is presented. The requirements detailed in the Premises will ensure that the design is in line with currently accepted social (including health), safety, environmental, and Human Factors Engineering (HFE) standards applicable to this project.



During the detailed engineering phase of the Project appeared a potential power management problem for the whole LNG plant associated with the requirements for dry low-NO<sub>x</sub> burners (DLN). Hence, only the frame-7 gas turbines for train 6 will have dry low-NO<sub>x</sub> burners and the frame-6 power generators non-DLN. This is the only way to satisfy the flexibility requirements for power management. Once the utilities are in place for train 6 (about 6 months before the turbines are started up (on current estimates around October 2006), trains 4/5 gas turbines will be retrofitted with DLN.

### 3.4 Construction phase

Construction of the sixth LNG train is expected to begin by mid/end 2004. The project will be completed by end 2007. The construction of the slug catcher will begin mid 2004 and will last till end 2005. During this time period a large number of temporary, short-term construction jobs will be created. These will range in duration from several months to two or three years. The actual number of positions available in part depends upon the number of work-hours and rotations cycles instituted by construction contractors. Nigerian labour for train six is expected to increase during the 'major civil works' (August 2004 - July 2005) to about 4000. During the 'major mechanical works' (May 2005 – November 2006) the overall workforce for train six will peak at around 4500. The Nigerian content will be at least 84% of all man-hours worked on site. For the construction of the slug catcher the peak will be at 650 workers in January-March 2005.

The required space and temporary facilities for all construction activities will be contained within the existing area leased by NLNG and the additional (for the **Plus** project newly acquired but temporary) lay-down area along the eastern perimeter of the site.

The existing labour camps will be utilized to support the project. However, the current TCN (Third Country Nationals) camp will need to be relocated to the temporary lay-down area. This means that the NLNG**Six** project will be developed without additional land take.

Primary HSE management responsibilities during construction will rest with the Engineering Procurement and Construction (EPC) Contractor(s). NLNG will monitor the performance of the Contractor on health, safety and environmental issues through compliance with the HSE Premises and the Health Safety and Environment Management System (HSE-MS).

### 3.5 Operations phase

Although the NLNG**Six** project is a stand-alone project and the associated ESHA process is aiming for formal approval for a single - the sixth - train, the baseline situation for this ESHA does include the operation of trains 1 to 5. As a consequence, the potential impacts of the sixth train are to be superimposed on the existing baseline and, hence, the potential impact of the other trains. This means that the scope of this ESHA is not limited to the sixth train, but looks at all hazards, issues and potential effects caused by the operation of the full six-train LNG plant.

### 3.6 Risk management

The overall potential risk posed by the LNG plant operation to third parties and the wider environment is managed through a number of methods including various levels of control of areas within close proximity to the LNG plant. A Quantitative Risk Assessment (QRA) has been carried out as part of project development. Based on the calculations the range of the Safety Zone and the Sterile Zone has been identified:

- The **Safety Zone** (bounded by the  $10^{-5}$  risk contour) is defined as an area where no other activities should take place. No public access is allowed and the area shall be directly within control of NLNG.
- The **Sterile Zone**, bounded by the  $10^{-6}$  risk contour, is an area in which other activities (i.e. other than LNG production) are allowed if the area is controlled. Such an area can include an industrial activity without access to this site by the general public. No housing and no extensive office facilities facilitating large gatherings of people are allowed.



The Safety Zone lies outside the current site boundary fence. Access control over the safety zone will be enforced through fencing and (re)placement of gates on the roads.

The current projected area for the Sterile Zone takes in areas that are outside the fenced plant site and outside NLNG's leased land. Adequate control of housing will therefore be implemented and maintained for the lifecycle of the project in the swamp area south-east of the LNG site, where migrant settlement is not acceptable.

#### 4 The natural and social environment

The area of interest for the NLNGSix project comprises the Bonny Local Government Area of Rivers State and specifically those aspects of the environment that could be affected by the project.

Bonny Island has a relatively flat topography and consists of a mosaic of degraded freshwater swamp forest and dryland rainforest, with areas of mangrove around creeks and to the east of Bonny Town, next to the Opobo Channel. The southern coast of Bonny Island comprises a beach ridge barrier, with a sandy beach on the Atlantic Ocean. The main urban centres on the Island are Bonny Town in the north and New Finima in the south. Between these two centres is an industrial area, located on the eastern bank of the Bonny River tidal inlet, about 3 km north of its confluence with the Atlantic Ocean in the Bight of Bonny. These areas are clearly indicated in Figure 1, which shows the location of the NLNG project in relation to neighbouring industrial and residential areas.

Including Bonny Town and New Finima, there are over 120 towns and villages on Bonny Island. The majority of these are small fishing villages, connected only by water transportation. Residential areas associated with NLNG's operations are located i) east of the plant site - camp for TCN construction workers, ii) north-east of the site – the camp for Nigerian labour, and iii) south-east of the plant site – the Residential Area for operational and managerial staff.

The environmental baseline was compiled by reference to previous studies, supplemented by a review of recently published literature and ground-truthing surveys and studies. This work was carried out by SGS Environment between 1992 and 1999, Ecosphere Nigeria Ltd. and Babsal & Co. in 1998 and 2001 as part of the **Base**, **Expansion** and **Plus** projects of NLNG. Apart from these studies additional data collection activities were undertaken in 2003 to fill gaps in information on specific environmental, social and health aspects in the Sterile Zone, i.e. the area immediately east of the NLNG plant site (see section 3.6. above). In addition, social information was collected in the New Finima and the shanty towns, as well as data on NLNG's community investment projects.

As was the case for previous projects, a number of specialist studies on noise and air quality were commissioned, including *in situ* noise and air monitoring and predictive dispersion modelling.

The purpose of the baseline description is to identify key aspects of the receiving, physical, natural, social and health environment that are considered to be most sensitive and which must be included in assessment of project impacts, together with a description of issues brought forward by stakeholders.

##### 4.1 Natural environment

The natural environment of the Niger Delta forms an integrated mosaic of aquatic, semi-terrestrial (mangrove, freshwater swamps) and terrestrial habitats. The delta forms one of the largest wetland areas in West Africa and is an area of international importance for its wetland environments, notably inter-tidal mudflats, mangrove and freshwater swamp forest and associated freshwater rivers. Under the Ramsar Convention, recently (in 2001) signed by Nigeria, the Niger Delta undoubtedly qualifies as a wetland of major international importance.



Bonny Island is relatively flat and consists of a series of shallow sand ridges that indicate regular seaward accretion in the past. Soils are generally sandy or sandy loams and the natural soils are uncontaminated. Hydrogeological study has revealed that rainwater percolation through the sand has created a bulb of freshwater beneath the island, displacing saline water. It is this freshwater resource that supplies borehole water for the Bonny populace. Bonny Island experiences a seasonal climate (dry season and wet season), with high humidity all year and a high annual average rainfall of about 4000 mm.

Air quality on Bonny Island is generally good, although industrial activity and all different forms of road and river traffic have increased in recent years. Air quality monitoring data from 2003 suggest that existing air quality is well below relevant standards for ambient air quality.

Noise measurements on Bonny Island showed that in the residential areas the noise levels during the day are fully determined by traffic and local noise sources (e.g. generators and a/c units) and that during the night the levels often exceed the 45 dB(A) World Bank noise limit, but that typical plant noise radiated from NLNG cannot be discriminated. The contribution of NLNG plant noise was considered to be several dB(A)'s below the 45 dB(A) noise limit.

Bonny Island contains all the main coastal habitat types found in Nigeria, including open coast, sand beaches, mudflats, marine creeks, mangroves, freshwater swamp forest, dryland rain forest and bush. The LNG plant site and residential area were cleared of vegetation and covered with fill material in 1991 as part of the **Base** project. The main vegetation types on the Island are mangrove, freshwater swamp forest, including areas of galloping swamp with dryland rain forest vegetation on the drier ridges, mixed mangrove/swamp forest vegetation and some bush fallow on cleared areas. The freshwater swamp forest includes areas of "galloping swamp", which has dry-land rain forest on the drier ridges and swamp forest in between. In addition there are areas of open coast, sand beaches, inter-tidal flats and creeks. There are no nationally designated nature reserves or other statutorily protected conservation areas on Bonny Island. However, NLNG, in consultation with the Bonny Island communities, has established a Nature Park near Finima of about 700 ha. The main habitats included in the proposed reserve are freshwater swamp forest with areas of galloping swamp. A nature reserve management committee is in the process of being set up (Finima Nature Park; see Figure 1).

The natural environments on Bonny Island have considerable ecological value for their wildlife and contribute to the international nature conservation importance of the Niger Delta, particularly for aquatic and terrestrial birds. The freshwater swamp forests support a diverse avian migrant population, including Nigerian species, intra-African migrants and a significant number of palaeartic migrants. As well as birds, the mangrove habitats on Bonny Island support a diverse range of important reptiles and amphibians, including crocodiles, turtles, lizards, and numerous species of snake.

The Sterile Zone area, which is covered by freshwater and rainforest trees, shrubs, herbs and grasses, belongs to a formation made up of a chain of sandy "islands" known as the Beach-Ridge Barrier soils supporting fresh water vegetation. The untouched areas are natural freshwater swamp forest, including areas of "galloping swamp". The ground is irregular with frequent patches of open water even in the dry season; it is flooded in the rainy season. The forest is very irregular and superficially resembles broken or secondary forest caused by human disturbance

No comprehensive survey of fauna has been carried out for Bonny Island. The IUCN (International Union for Conservation of Nature) have ranked the Niger Delta as having one of the highest conservation values in the region - being of regional and global significance.

The fauna of the Sterile Zone is typical for the swamp forest. Evidence was found of only two threatened species in the area. These are the carnivores Cape Clawless Otter (*Aonyx capensis*) and the Ungulate Sitatunge (*Tragelaphus spekei*). The vegetation and animals present are expected to be a subset of those found elsewhere on Bonny Island, as it is likely that many animals have already been driven out of this area by the encroachment of humans.



## 4.2 Social environment

The main population centre on Bonny Island is Bonny Town some 5 km from the LNG plant site. As at the 1991 census, Bonny Town, Finima and Bonny LGA as a whole had populations of 22,989, 5,590 and 76,124 people, respectively. Bonny Town alone accounted for about 30% of the LGA's population, while Finima contributed about 7.3%. Projections show that the population (derived from the exponential growth model, assuming an average annual growth rate of 5%) of Bonny Town will be 41,285, 60,997, 161,842, and 429,416 in 2003, 2011, 2031 and 2051, respectively. The population figures for Finima will be 10,039, 14,845, 39,389 and 104,510 for the years 2003, 2011, 2031, and 2051, respectively. The typical pyramidal (i.e. bottom – heavy) age-sex structure found for Nigeria, as a whole is absent in the Bonny LGA. Population is rather loaded almost evenly in all age cohorts. This pattern, no doubt, has arisen because of recent waves of immigration into the area, swelling the younger productive age cohorts.

At the peak of the NLNG **Base** project construction in 1998-9, over 17,500 construction workers (excluding dependants and camp followers) were present on Bonny Island. Since then - with the influence of continuing projects of NLNG and other companies – the number of immigrant and temporary workers has varied but it is likely that Bonny Town and Finima now account for higher proportions of the LGA's population but accurate data are not available.

Bonny Island has been an important trading centre since the 16<sup>th</sup> century and this is reflected in the complex ethnic mix of its people. The major indigenous ethnic group is the Ibani. The socio-cultural aspects of the local population are highly dependent on their ethnic background and religion. At Bonny, Christianity predominates, although there are strong influences from traditional religious beliefs. The social and cultural fabric of local societies is centred upon the household, attitudes to gender, and the traditional authority structures that exist. Monarchy has survived in Bonny to this day. So has the *house* (extended family) system of traditional governance. At the head of traditional governance is the paramount ruler or king, known as the *Amayanabo*, who presides over thirty-five houses, headed by chiefs. Below the king and chiefs, society is stratified into age groups. Women are excluded from the institution of chieftaincy, and paramount rulership. Their roles in society have hitherto been bound by cultural norms that have tended to relegate them to purely household chores. However, with modernisation and increased education, they are playing wider roles, and are now active in community and even regional and national affairs. Youths are also becoming increasingly active in both modern and traditional governance.

The influx of workers for the construction activities and associated traders and service workers placed pressure on accommodation and services on Bonny Island. As a result, a number of *ad hoc* shanty towns have become established, particularly around the Nigerian labour camp and along the road to the LNG plant site. The migrant communities of interest are Agalanga, and Monkey Villages I, II and III. The estimated populations amount to about 2.5 thousand people. Areas of forest have already been cleared by these settlements.

The socio-cultural characteristics of the community are under quite some pressure because of the influences from outside and changes in lifestyle and cultural values as a consequence thereof.

Traditionally, the main occupations of people on Bonny Island have been fishing, subsistence farming, and trading, but with the increasing industrialisation of the area, the proportion of people involved in construction work and trading has increased. Unemployment levels were high in Bonny Town before the first NLNG project (up to 50% for males and 40% for females) and although current figures are not available for the LGA as a whole, the current situation in the shanty towns has improved: amongst the males it was found that 82% have a structural income as against 72% for females. Amongst the males, craftsmen/technicians are dominant (53.4%), followed by traders (28.4%), and labourers in multi-national companies (6.8%). Among the females, traders are dominant (73.2%) followed by technicians/craftswomen (19.5%) and labourers in private organizations (4.9%).

Existing levels of housing on Bonny Island are good, with most houses being single-family detached, constructed of cement blocks with corrugated iron roofing. The majority of houses have



water closet facilities (60%), with rainwater collection providing the main source of water supply (57%). However, as of 2003, the NLNG has improved the situation, such that households in Bonny Town and Finima now receive potable water supplies from the company's water tankers while awaiting completion of the Joint Industry Committee (JIC) sponsored water project.

There is a general low level of provision of social infrastructure such as schools, medical facilities or recreational facilities. There are currently 44 operational schools in Bonny LGA, providing education for about 14,448 students. They offer classes at all levels from nursery to secondary. Seven schools offer classes up to secondary level, 31 up to primary level and 1 offers classes up to nursery level. The majority of these schools (32) are located in the Bonny urban area and the inner core area (as defined in the Bonny Master Plan) Needs expressed regarding schools and education relate to the provision of staff accommodation, a staff retirement scheme, staff salary increase, libraries, basic services such as electricity and water, recreational and sports facilities, more classrooms, more teachers, and better furniture such as chairs and benches. As part of the educational infrastructure provided on the Island, the NLNG has completed the Bonny Vocational School. The school is now being equipped. NLNG has also employed an administrator to man the programme of vocational training.

The Local Government of Bonny manages 11 health centres, the biggest one of these being the Bonny General Hospital. This meets only 42 % of the local community needs, according to the survey of health status and health infrastructure in the Niger Delta Region (March 2000). The most heavily used centres are within the urban areas of Bonny town and Finima. It appears that not all the health centres are easy accessible and not always located in relation to the needs determined by population distribution. There is a general shortage of drugs at all health centres. The transfer of patients from the rural villages to the main facilities in Bonny Town can be very slow and therefore dangerous for patients. These health centres provide a total of 37 beds. The Local Government has 52 health care workers, including four doctors, running all these facilities.

The major companies operating on Bonny Island have their own health care facilities for their staff and dependents. NLNG operates a modern very well equipped 25-bedded hospital staffed with a relatively large number of medical specialists and nursing staff that far supersedes the health facilities available to the residents of Bonny Island in terms of quality and quantity.

With regard to the people living in the shanty towns, most of questionnaire respondents used medical facilities outside their settlements. Some medicine stores were located in the settlements.

During the health baseline survey for the NLNG**Plus** project a number of resources were screened to get an impression of the health status on Bonny. It was found difficult to get a precise idea about the health status. By combining different statistics it was possible to identify a pattern in which the following 10 causes of illness occurred as being the most common on Bonny Island: malaria, acute respiratory infections, diarrhoea and food poisoning, intestinal parasites, sexually transmitted diseases (STDs), problems related to alcohol and drugs, asthma, hypertension, skin infections, typhoid and paratyphoid fevers. In addition to these, the private clinics had in their top 10 muscular-skeletal diseases and injuries from road traffic accidents.

Malaria is the most common cause of morbidity according to the statistics in the **Plus** baseline report. Between 20-50 % of the cases seen in Bonny Island clinics were attributed to malaria. However, the diagnosis was seldom confirmed by a laboratory examination. A recent assessment of data on malaria from the NLNG hospital in the years 2000-2002 showed a general decrease of positive malaria cases in non-immunes during these three years. There are indications that there is a potential to draw back malaria on Bonny with appropriate measures and focused efforts.

In the Bonny Area, HIV/Aids is a very sensitive subject because of social exclusion of any known or suspected cases. In 2001, anecdotal reports from the private clinics admitted to only 7 cases in the study period of 3 years. This is likely to be highly under-estimated, particularly when the STD rate was known to be about 12 per 1,000 in the year 2000. In addition, everyone recently interviewed gave as a personal impression that HIV/Aids on Bonny Island has become a major public health issue. Hospitals on Bonny are not able to treat HIV positive patients. Patients have to leave the Island to look for treatment elsewhere.



Only 37% of the population has access to safe water. This is very much restricted to people living in the main towns.

### 4.3 Sensitivities

Sensitivities are those characteristics of the receiving environment (including a mixed suite of natural, physico-chemical, social and health characteristics), which support and sustain nature and society. Two broad categories of sensitivities were identified, relating to the:

- Natural environment
- Social environment

Within these broad categories the key processes and characteristics are recognized which define (a) the ecology, productivity and biodiversity/wildlife of the area and support and sustain man's use of it and (b) society and the social-economic and socio-cultural character/structure of the local community of the area.

Within the natural environment there are two groups of processes and characteristics which support ecology, productivity, wildlife and biodiversity. These are:

- Physico-chemical characteristics
- Biological characteristics

The social environment has been divided into two parts in the sensitivities framework:

- Socio-economic
- Socio-cultural

During a number of meetings, workshops and during field surveys for NLNG*Six*, local stakeholders have identified a number of issues which they feel are of general public concern. Most issues raised by local people are outstanding problems and cumulative issues from previous phases of the NLNG project. There are no new issues which relate to NLNG*Six per se*.

All 67 different sensitivities resulting from the baseline studies and the 7 issues which emerged from the stakeholder consultation process are presented in Table 2.

Table 2. List of sensitivities for the NLNG <i>Six</i> Environmental Impact Assessment						
Natural environment	Physico-chemical environment		Air quality		E,H	
			Light/Solar radiation		E,H	
			Level of Noise and Sounds		E,S,H	
			Water quality (Estuary and fresh water)		E,H	
			Ground water table (surface) / Depth of flooding		E,H	
			Soil / Sediment quality		E,H	
	Biological environment	Protecting the production function	Household water provision	Household water quality		E,S,H
				Access to household water		E,S,H
			Estuary and Sea fisheries	Availability of fish markets		E,S,H
				Availability of breeding grounds and food for fish		E
				Access to fishing grounds		E,S
				Forestry (mangrove, (non-) timber products, firewood)		E,S
			Mixed subsistence farming	Availability of markets for forestry products		E,S,H
				Access to farming lands		E,S
		Protecting integrity	Ecosystem components	Availability of markets for agricultural products		E,S,H
				Quality of habitat		E
			Water ecosystem function	Biodiversity / Genetic resource		E
				Estuary / Marine substrate complex		E
			Land ecosystem function	Mangrove complex		E
				Swamp forest complex		E
Dry forest complex		E				
Social system function	Farmland complex		E			
	Sense of place		E,S,H			
	Traditional value of land		E,S			
Social	Socio-economic	Supporting economic	Access to ancestral and culturally significant sites		S	
			Safeguarding traditional occupations		S,H	



Table 2. List of sensitivities for the NLNGSix Environmental Impact Assessment						
environment	environment	development	Safeguarding level of local income and financial flows		S	
			Cost of living / Inflation		S,H	
			Opportunities for contracting and procurement		S	
			Opportunities for local and national employment		S	
		Protecting resources	Protecting and supporting the built infrastructure	Access to housing		S,H
				Access to transport		S
				Access to roads and waterways		S,H
				Access to electricity		S
				Access to communication facilities		S,H
			Protecting and supporting the social infrastructure	Access to learning and education facilities		S,H
				Access to recreational facilities		S,H
				Access to sanitation and waste management		E,S,H
				Balance in gender		S,H
				Balance in age		S,H
		Protecting health	Protecting and supporting health determinants	Healthy, safe and clean housing and living conditions		S,H
				Access to clean drinking water		H
				Access to a nutritious and healthy diet		H
				Exposure to nuisance (dust, noise, etc.)		S,H
			Direct health protection	Level of disease vectors		S,H
				Access to primary health care		H
				Access to secondary health care		H
	Access to traditional medicine			H		
	Socio-cultural environment	Supporting social equity	Access to emergency services		H	
			Access to voluntary health organizations		H	
			Respect for human rights		S,H	
			Respect for labour rights		S,H	
			Promoting equal opportunities		S,H	
		Supporting health awareness	Promoting opportunities for representation		S	
			Social exclusion abatement		S,H	
			Poverty abatement		S,H	
		Protecting integrity	Lifestyle (sexual behaviour, recreational behaviour, smoking, etc.)		S,H	
			Alcohol and drugs abuse		S,H	
	Physical activity		H			
Hygiene			H			
Morals and family values			S,H			
Stakeholding environment	Issues raised (that were not already identified as sensitivities)	Cultural values and languages		S,H		
		Religious / Traditional structures and customs		S		
		Occupational readjustments		S		
		Employment opportunities		S		
		Health Status and Infrastructure		H		
		Outstanding issues		E,S,H		
		Fisheries		E,S		
		Degradation of Language and Culture		S		
Emergency Response Plan		S,H				

## 5 Impact assessment methodology

The methodology of this impact assessment follows the enhanced approach of NLNG’s Technical Advisor. This process is visualised in Figure 2 and follows in fact the main steps of the Hazards and Effects Management Process (HEMP):

### 1. Identify project hazards, issues and environmental/social sensitivities

The project information is translated into “hazards”, being the inputs from and outputs to the natural and social environment; the yellow boxes in Figure 2.

The existing environment of the project area is described in terms of the physical, chemical, biological and social aspects of the environment, including health, cultural and economic aspects. From the baseline description of the environment, the environmental processes and components that are critical for maintaining the integrity of the environment, and protecting its functions are identified and termed "sensitivities" (Table 2); the blue boxes in Figure 2.



An inherent part of the impact assessment process is the involvement of stakeholders. Hence, one of the first steps is the identification and mapping of stakeholders. These stakeholder groups are then linked to the issues that are of main concern to each stakeholder group; the green boxes in Figure 2.

2. Assess (the nature and significance of) impacts

In the next step of the ESHA the sensitivities are brought together with the hazards and issues to identify any interactions, where there is a potential for an impact. These impacts are subsequently qualified and quantified as far as possible so that a rating is achieved of the significance of the impacts. This is reflected by the pink boxes in Figure 2.

3. Control of hazards and effects through mitigation measures

Where significant adverse effects occur, appropriate mitigation measures are identified. These may be preventive, repressive, curative or compensative. A system for implementing mitigation measures and managing environmental effects on an ongoing basis is an essential element of the enhanced approach; the grey box in Figure 2.

In the case of positive effects, opportunities for enhancement measures are identified and maximised.

The key feature of the ESHA process as practiced by NLNG is that it is iterative (i.e. cyclic and repetitive) where required. This is illustrated by the loops via the white circles in Figure 2. The iterative process is complex but in summary entails going through a cycle of data collection, design, consultation and impact assessment in order to screen and eliminate non-optimal solutions and finally arrive at the preferred single design, construction and operation solution.

There are three key milestones in the production of the environmental, social and health impact assessment. These are:

- The Impacts Table
- The Mitigation Table
- The Environmental, Social and Health Management Plan (ESHMP)

A vital starting point in the impact assessment exercise is the bringing together of data concerning project 'hazards' and 'sensitivities' of the receiving environment to estimate the nature, likelihood and significance of the actual impacts. The first part of this process is the use of an interaction matrix with project hazards on the Y-axis and the sensitivities along the X-axis. All matrix intersections where theoretically there could be an interaction between a hazard and a sensitivity, are marked. Each interaction is assessed and professional judgement, combined with detailed knowledge of the project hazards and the real conditions of the sensitivity, is used to determine whether it is an impact or not. This interaction matrix and the interaction identification process provide a structured way to list all relevant impacts, making sure that no major issues are missed.

Next, to simplify the impact identification process, interactions between similar hazards and their respective sensitivities are grouped together into a single impact. In the interaction matrix, interactions grouped in this way are given the same impact number, which is then entered into the Impacts Table. Once all impacts for construction and operation phases have been identified, there are specific steps which are followed in order to describe and ascribe the final significance rating of each impact.

Subsequently, the impacts table is drawn up, which identifies each impact, along with the hazard which causes it, and the sensitivities of the receiving environment which are impacted. In addition, each impact is described, the likelihood and potential consequence given and the final impact rating attributed. In the same table, each identified stakeholder issue is described, along with the hazard which causes it and the sensitivities of the receiving environment to which the issue relates. When all impacts and stakeholder issues are identified and classified, mitigation measures are designed and implemented to minimise the adverse effects of the project and to maximise the benefits to the community. Mitigation measures are identified in the Mitigation



Table, which links each impact to its proposed mitigation. The key requirement for sustainable development is that mitigation measures proposed to prevent, minimise or compensate for any adverse impacts will be incorporated into the Environment, Social and Health Management Plan (ESHMP), together with any enhancement measures. In the ESHMP, each proposed mitigation measure is described in terms of its required actions, responsible persons, any required monitoring, reporting and timescales.

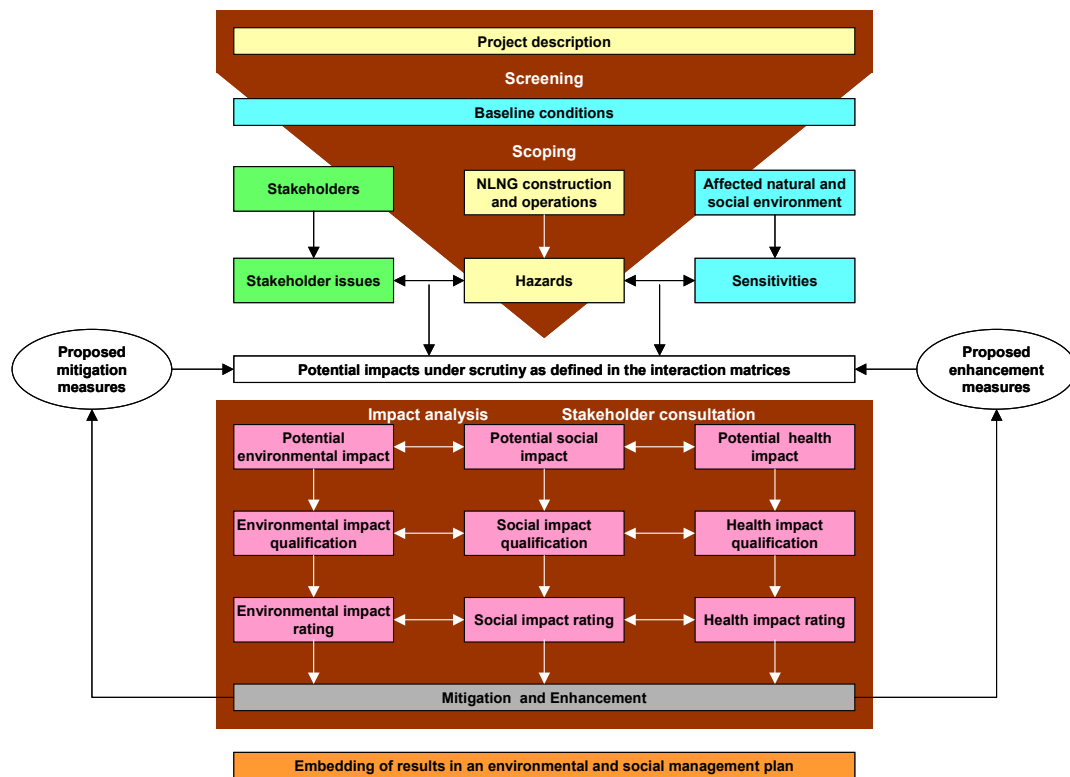


Figure 2. The Environmental, Social and Health (impact) Assessment (ESHA) process.

Consultation with local communities and other stakeholders is a key feature of NLNG’s corporate policy, as shown in Figure 2. The aim of consultation is to gather information on issues, concerns and successes by dialogue with the local communities and other stakeholders. The Company then looks towards working with the stakeholders to identify methods of addressing any negative impacts and to identify ways of maximise the positive benefits. This allows NLNG to maintain good public relations in the areas of operation and has, in the context of the NLNGSix project, helped to give a focus to the ESHA itself. The public consultation for the NLNGSix was planned as a continuation of the NLNGPlus stakeholder consultation which was a comprehensive process.

The time schedule associated with the ‘fast track’ EIA for NLNGSix did allow for formal and informal stakeholder engagement, but because the scope of the baseline studies was significantly less than for NLNGPlus, the stakeholder consultation was also envisaged to be less wide ranging. It was intended to have stakeholder engagement meetings on the ESHA process as well as on the outcomes of the process – i.e. the EIA report. Stakeholder engagement meetings have been held with:



- Government agencies
- Local communities and their representatives
- NGOs and SIGs

All stages of the stakeholder engagement process for NLNG**Six** have highlighted the fact that local people are primarily concerned with issues which date from the **Base** project and previous expansion phases of the NLNG site. There are no significant impacts which relate uniquely to the NLNG**Six** project. The majority of impacts and associated mitigation for NLNG**Six** relate to on-going or outstanding issues.

## 6 Potential environmental, social and health impacts

Three different types of impacts have been identified for NLNG**Six**:

- New impacts unique to Train 6
- Impacts which are incremental, due to increases in the project's hazards
- Impacts which are incremental, due to changes in the sensitivity of the receiving environment.

The main impacts of the LNG project have already occurred as a result of the construction of the **Base, Expansion** and **Plus** projects. The additional potential impacts of the NLNG**Six** project are generally of lesser magnitude and significance than those of the earlier projects. Only one new impact has been identified which is due uniquely to the development of a sixth train. This is the extension of the "sterile zone", bounded by the  $10^{-6}$  risk contour, to include land outside the fence line of NLNG. All other impacts are in fact incremental impacts; impacts which have already been identified in previous phases of the NLNG projects, which will increase as a result of Train 6.

A summary of the main predicted effects is provided below. For each identified impact, the text provides information on its characteristics, the likelihood of its occurrence, its consequence and the risk rating. Each impact will be briefly described below.

### 6.1 Potential impacts during the construction phase

#### *C1 - Land Take*

Likelihood	High	Consequence	None	Rating	No impact
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The NLNG plant area will be extended by a few metres in order to accommodate NLNG**Six**. However, the NLNG**Six** project does not result in additional land take. The road to the east of the plant which currently runs through this area will need to be moved by several metres. This will involve slight re-alignment of an existing drainage ditch. These re-adjustments to road and ditch are adjudged not to have any overall discernible effect on the environment.

#### *C2 - Health and General Well-being*

Likelihood	Medium high	Consequence	Considerable	Rating	Positive
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Since the days of the base plant (trains 1 and 2), NLNG has been carrying out mitigation measures and has undertaken social investment programmes aimed at minimizing negative impacts and maximizing benefits to the community. These programmes and projects, that cut across various social sectors (e.g. education, infrastructure, transport, health facilities, water and electricity supply and the local economy), mean that NLNG's presence has had an overall positive effect on the quality of life for local people generally. This has led to an improvement in health status and general well-being of people on Bonny Island.

#### *C3 - Health Implications of the Presence of a Large Construction Workforce and Other Migrants*

Likelihood	Medium high	Consequence	Extreme	Rating	Major
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At the peak of construction of the **Base** project there was a large construction workforce of up to 17,500 persons. A much smaller number, approximately half, was required for the construction of train 3. These have largely remained for the construction of trains 4 and 5 and a subset will subsequently be retained for the construction of train 6. The presence of this kind of predominantly male population, with access to money, together with their dependants and other fortune seekers, has encouraged a growing number of commercial sex workers. All of these factors heighten the risk of spread of sexually transmitted diseases (e.g. HIV/AIDS), despite the existence of NLNG's HIV/Aids awareness and prevention programmes.

#### **C4 - Uncontrolled Urban Development (Growth of Shanty Towns)**

Likelihood	Medium high	Consequence	Considerable	Rating	Moderate
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The presence of NLNG serves as a magnet attracting not only a large construction workforce, but also other migrants and fortune seekers, including commercial sex workers. Not all in-migrants can be accommodated in labour camps or find accommodation in the formal housing sector. Rents are very high at Finima and Bonny, starting at about ₦ 3,000 per room per month. Since formal housing is largely unaffordable even if available, in-migrants resort to the shanty towns where rents are much cheaper (₦ 700 - ₦ 1,000 per room). Such settlements are therefore havens for commercial sex workers, drug and alcohol addicts, and criminals. Because these settlements are uncontrolled and unmanaged, they represent an enduring risk to morals, health and safety both of the local indigenes and of people in the shanties. There is also social tension because local community leadership in New Finima is not in favour of these shanty towns being present on what is traditionally regarded as Finima land.

#### **C5 - Degradation of Forests, Fisheries and Agricultural Land**

Likelihood	Medium high	Consequence	Little	Rating	Moderate
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The presence of a large (even if decreasing) workforce since the days of the Base plant means that there has been a sustained increase in food demand (above pre-NLNG levels). This has had a cumulative impact, over time, on fisheries, forest products and agricultural products, such that food, fish and other forest products are now being obtained from further away. This has resulted in degradation of areas of forest increasingly further away from both the NLNG plant and from Bonny and Finima towns. Degradation has been caused by a number of activities, including clearing forest for cropping (mainly cassava, yams and African spinach), hunting bushmeat, collection of firewood etc. Forests close to the NLNG plant, labour camp site and shanty villages are degraded, with significantly lower biodiversity than pre-**Base** plant conditions.

#### **C6 - Natural and Social Environmental Degradation**

Likelihood	Medium low	Consequence	Hardly any	Rating	Negligible
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The presence of construction workers, other in-migrants and fortune seekers in the shanty towns contributes substantially to social and environmental degradation. The most common method of disposing of household refuse in these settlements is direct dumping by water courses close to the settlements, while the predominant way of disposing of human wastes is direct defaecation into surrounding water bodies. NLNGSix will not lead to increased generation of untreated sewage and dumping of solid waste. However, in and around the shanty towns, the continuing effects on the receiving environment will be cumulative (e.g. building-up of residues in soil and sediments; accumulation of waste in areas close to villages). This continues to have the potential to propagate water-borne and food-borne diseases such as cholera, typhoid, polio, meningitis, hepatitis A and E and diarrhoea, etc. due to the possibility of raw sewage or faeces and subsequently tainted runoff getting into streams used for washing and bathing.

#### **C7 - Decommissioning of Camps Leading to Economic Burst**

Likelihood	Medium high	Consequence	Great	Rating	Major
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After the construction of train six, most of the construction workers, followers and fortune seekers will leave Bonny Island and the labour camps while the contractor areas must be decommissioned. The economy of Bonny Island is enjoying a relative boom because of the presence of construction workers and their followers because they patronise the restaurants, bars, hotels, purchase groceries, textiles, etc. Any out-flow of people will therefore lead to an economic burst – because of loss of patronage and loss of income in the form of rents, opportunities for contracting, etc.

**C8 - Decommissioning of Camps Leading to Reduced Pressure on Infrastructure & Cost of Living**

Likelihood	Medium high	Consequence	Considerable	Rating	Positive
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After the construction of train six, most of the construction workers, followers and fortune seekers will leave Bonny Island and the labour camps and contractor areas must be decommissioned and the land reinstated. Decommissioning will lead to an outflow of people, thus reducing pressure on existing physical, social and economic institutional infrastructure, whose carrying capacity is already overstretched. Furthermore, more outflow of people will have an additional positive effect as it will lead to a reduction in the cost of living because food prices, rents etc. will fall.

**C9 - Restoration and Preservation of Traditional Values, Languages, Customs, etc.**

Likelihood	Medium high	Consequence	Little	Rating	Positive
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The outflow of construction workers and their followers, generally people from different parts of Nigeria, as a result of decommissioning, has another positive impact: that of leading to the restoration and preservation of traditional values, languages, customs, etc. Most of the construction workers and their followers are not Ibani people but belong to a mix of other Nigerian ethnic linguistic groups. They brought to Bonny various different cultural norms, practices, taboos, religions, etc., not typical of Bonny Island and in the process of interacting with the indigenous Ibani people, they influence the culture in many ways. One example is the use of the Ibani language. The various ethnic groups usually communicate in English, thereby relegating to the background the use of Ibani language, which the indigenes are anxious to propagate. When the “strangers” leave, threats of extinguishing or adulteration of Ibani culture will also be removed.

**C10 - Decommissioning of Land, Leading to Land Reinstatement**

Likelihood	Medium High	Consequence	Little	Rating	Positive
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After the construction of train six, the temporary labour camps as well as the contractor camp and the contractor areas must be decommissioned and the land reinstated. This is a positive impact because the facilities can either be handed over to the local community for their own use, or new land will become available for other developmental projects or the land can be allowed to regain its natural state.

## 6.2 Potential impacts during the operations phase

**O1 - Reduction of Gas Flaring in the Niger Delta**

Likelihood	High	Consequence	Considerable	Rating	Positive
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The Nigeria LNG **Six** project will result in substantial further economic benefits for Nigeria by the creation of revenues from the sale of Nigeria’s considerable under-utilised, low cost, gas reserves. The project takes advantage of the projected growing demand for imported natural gas in the industrialised countries in the Mediterranean and around the Atlantic Basin.

There is currently no alternative means of utilising the natural gas produced. In the absence of a significant local market or distribution system, liquefaction is the only feasible option for exploiting the area’s natural gas reserves.



An item of global environmental significance, the flaring of natural gas, will be addressed by the project since the project's feed gas suppliers will deliver associated gas, which was formerly flared, to the project. Nigeria has a target of eliminating gas flaring in the Niger Delta by 2008; therefore the operation of NLNGSix is in consonance with this policy objective. This gas "capture" will remove significant amounts of feed gas from flaring thus reducing methane and carbon dioxide from the Niger Delta as well as reducing greenhouse gas (GHG) contribution to global warming.

### ***O2 - Increase in Number of NLNG Vessels***

Likelihood	Medium	Consequence	Considerable	Rating	Moderate
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During the operation of train six there will be an increase in the number of NLNG vessels using the approach channel and NLNG jetties, leading to potential discharge into the estuary. Increased movement of NLNG ships will continue to restrict fishing in that area of the channel. Ballast and other discharges from NLNG vessels and incidental spillage could have some effect on aquatic water quality. In addition, ballast discharges could import species alien to the Niger Delta. Both of these could damage the natural environment and could reduce the level of income and financial flows for local fishermen. These issues will be dealt with in a separate environmental impact assessment undertaken specifically for the channel deepening project associated with NLNGSix.

### ***O3 - Extension of the Safety/Sterile Zone***

Likelihood	Medium low	Consequence	Hardly any	Rating	Negligible
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The construction of train six requires the extension of the existing safety zone ( $10^{-5}$  risk contour) and sterile zone ( $10^{-6}$  risk contour). Some activities by Finima people take place in the area designated as the safety/sterile zone. Activities include fishing, hunting, farming, snail picking, palm-wine tapping, and gathering of firewood. The extension of the safety/sterile zone will restrict these activities and therefore lead to a loss of livelihoods and possible hardship for a few local people.

### ***O4 - Denial of Access to NLNG Private Roads***

Likelihood	High	Consequence	Little	Rating	Moderate
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The construction of train six requires the extension of the existing safety zone ( $10^{-5}$  risk contour) and sterile zone ( $10^{-6}$  risk contour). People currently use the NLNG private roads bordering the current lay-down area for the construction of trains four and five. These roads will be inside the new safety zone. These roads are a short-cut between New Finima, the shanty towns and Bonny Town. Since these roads around the current lay-down area on the eastern site boundary are within the sterile zone, people using them would be exposed to potential danger and for that reason people will no longer be allowed to use these roads.

### ***O5 - Opportunities for Contracting and Procurement***

Likelihood	Medium	Consequence	Hardly any	Rating	Positive
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The NLNGSix project will also result in the continuation of localised economic benefits which have arisen from:

- The local acquisition of materials used during the construction and operational phases of the project, which have resulted in increased financial flows and indirect employment within the local community.
- Employment opportunities for local labour, particularly during the construction phase of the project. The continued increase of financial flows will benefit the local economy generally.
- Continued increased demand for food, including fish, fuel and other goods in the local markets, during the construction phase of the project. This will continue to support markets for farmers and fishermen and other producers.



When train six becomes operational more operational staff will be required than for the existing trains. With increased production there could be an increase in opportunities for contracting and employment for local people.

#### **O6 - Increased Emissions**

Likelihood	High	Consequence	Hardly any	Rating	Moderate
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When train six comes on stream – with dry low-NO<sub>x</sub> burners installed for the gas turbines (not on the power generators) to minimise the emissions - there will be a small increase in gas emissions (including nitrogen oxides and sulphur dioxide) from the plant, e.g. from power generation, acid gas incinerator and waste incinerator. Emissions specifications for train six were used, together with air quality monitoring of current, existing ambient air quality, to predict the effect that emissions from the six-train LNG plant will have on future air quality.

Computer modelling of a single plant like this NLNG plant allows the contribution of that plant to be determined at any location on or off-site. The modelling study was used to estimate the maximum impact of the emissions from the NLNG plant and the impact at the ambient air quality monitoring points. By modelling the impact of trains 1-3, 1-6 and train 6 separately it was possible to estimate the maximum impact of NLNG trains 4-6 (i.e. the trains that are not currently operational) and obtain an indication of the likely resultant ambient air quality if other sources and influences on air quality remain unchanged.

The maximum predicted contribution to off-site annual mean ground level concentration of nitrogen dioxide due to emissions to atmosphere of nitrogen oxides from trains 1-3 is 9.4 µg/m<sup>3</sup> (24% of the relevant annual mean criterion). The maximum predicted contribution from trains 1-6 is 11.9 µg/m<sup>3</sup> (30% of the relevant annual mean criterion). The small incremental increase predicted for trains 1-6 compared to the maximum predicted for trains 1-3 is because the emissions from each of the trains do not overlap significantly. The impact of other pollutants considered in the assessment is less significant than that for nitrogen dioxide. Predicted effects at other locations on land, particularly to the north east, as a result of the predominant wind direction, are much less than the above figures for areas close to the plant site.

Emissions from shipping (LNG carriers, etc) were also considered in the modelling and the maximum impact was predicted to exceed relevant ambient air quality standards. However, these concentrations occur over the sea.

The main conclusions of the air quality assessment are:

- Existing concentrations of NO<sub>2</sub> and SO<sub>2</sub> are below the relevant standards:
- Existing emissions from trains 1-3 and trains 1-5 are not predicted to exceed of relevant standards
- Train 6 emissions are not predicted to measurably increase existing air quality
- Emissions from tugs and carriers are the most significant sources of NO<sub>x</sub> and SO<sub>2</sub>.

In conclusion, the air quality modelling has predicted that the effect on air quality of the additional emissions from train 6 operations are insignificant compared to existing emissions from trains 1-3 and projected emissions from trains 1-5. The predicted and measured ambient air quality around the LNG plant, including the additional emissions from train 6, are below WHO, EU and Nigerian air quality standards.

#### **O7 - Additional Operational and Traffic Noise**

Likelihood	Low	Consequence	None	Rating	No impact
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During the operations phase, the plant will produce additional noise. The projected noise levels, including additional noise from train 6 will not exceed WHO noise guidelines. Theoretically, additional plant noise could disturb animals and birds in the sterile zone and cause them to avoid



forested areas close to heavily used roads and the plant site. However, this is not a real effect since many animals have already been scared away from this area of forest by the presence of people, vehicles and heavy plant noise.

Results of the noise survey have been considered in the context of the design standards for each LNG train and the noise limits applicable at the nearest communities. These limits are the World Bank standards, adopted by NLNG. The conclusions from the survey and the noise modelling show that the applicable limit is completely filled up, so that once train 6 comes on stream, there is no “noise-space” available for further expansion at this LNG site. Any expansion in the form of a train 7 and/or 8 will require either a complete relocation of the nearest village (New Finima) or fundamental design changes with noise-reduction measures.

#### ***O8 - More Frequent Marine Lighting***

Likelihood	Medium low	Consequence	Hardly any	Rating	Negligible
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The increased number of ships during the NLNG*Six* operations phase will result in more light over coastal areas on more days of the week and for a longer period of time. Theoretically such light has the potential to disturb fish in the near coastal environment, and thereby adversely affect the quality of the estuarine habitat. In reality, this is not a real effect since the waters are sediment laden and light penetration is poor. In addition, certain fish are attracted to night light rather than scared by it.

### **6.3 Stakeholder Issues**

#### ***X1 - Outstanding Issues both in New Finima and Implementation of Past Mitigation Measures***

At the inception of the NLNG project the people of Finima had to move from the site of their old village and were resettled at New Finima. As part of the resettlement package some promises were made to the Finima people and agreements reached. NLNG has since executed a number of projects in Finima, including construction of houses, electricity and water provision.

In addition, a number of mitigation measures resulting from earlier Environmental Impact Assessments have previously been agreed to by NLNG but the local people do not feel that these have been fully implemented. These include provision of jobs for graduates, semi-skilled and unskilled people from Bonny Kingdom, upgrading health facilities, monitoring health conditions and ensuring that local Bonny companies benefited from contracts with NLNG. To solve these outstanding problems, agreements to fulfil earlier promises were formalised in 2000 in “The Agreement” signed by NLNG and the Amayanabo of Grand Bonny Kingdom. NLNG has since executed a number of projects in Finima, including construction of houses, electricity supply and water provision. However there are still certain issues which are outstanding, for instance construction of more houses, supply of potable water, and improvement of power supply. Disappointment with NLNG stemming from the foregoing could lead to resentment and alienation.

#### ***X2 - The Exclusion Zone and Fishing***

From the time of the Base plant, a 500 m exclusion zone has been maintained for around NLNG’s jetties to ensure the safety of jetty facilities and ships. Fishermen are not allowed to fish within the exclusion zone. The fishermen see this as an unacceptable restriction of access to “their” fishing grounds.

An independent fish catch study has been carried out to assess the size and structure of fish caught and landed at many villages bordering the Bonny Estuary. This study has shown that the loss of fish catch associated with the area of the Exclusion Zone is likely to be small. However, the fish catch study did not identify which fishermen currently fish in the area of the exclusion zone, nor whether this area is the sole or major fishing area for particular, local fishermen. Until these details are forthcoming, it is possible that just a few individual fishermen are being unfairly



treated. For NLNG **Six**, resentment is likely to continue to linger since the issue has not yet been sufficiently clarified and mitigated.

With increased vessel movements associated with train 6, access to fishing grounds surrounding the lower Bonny Estuary could be adversely affected. These issues will be part of a separate environmental impact assessment carried out specifically for a channel-deepening exercise associated with NLNG's sixth train.

### ***X3 - Occupational Readjustments***

Over six to seven years since the start of construction of the NLNG **Base** project, the influx of a large number of construction workers and their followers has increased demand for food and other products that are sourced from the local area. It has become increasingly difficult for people to carry on their traditional occupations and to make an income due to over-exploitation of land, forest areas and waters closest to Bonny and Finima Towns.

In addition, when labour camps are decommissioned after the construction of train six and the workforce leave Bonny Island, local people and businesses could suffer an economic slump. They will have to adjust their occupations and livelihoods to cope with these demographic changes.

### ***X4 - Pressure on Health Facilities***

Local people are worried that changes in population structure, and resultant changes in immunity and hygiene, due to the large influx of workers and followers over 6-7 years since the **Base** plant construction, has increased the incidence of diseases and has made the local population more sensitive to communicable diseases such as malaria, tuberculosis, waterborne diseases etc. This has put extra pressure on local health facilities (both infrastructure and staffing), making it even more difficult for local people to obtain good health care. The local hospital in Bonny Town is under-funded and the vast majority of people cannot afford to use private health clinics and facilities.

### ***X5 - Degradation of Ibani Culture, Language and Customs***

Local people are very concerned that the influx of the large numbers of workforce, their families and other fortune seekers from other parts of Nigeria over 6-7 years since the **Base** plant construction, has altered the local customs, practices and traditionally held standards, beliefs and morals. In-comers speak English or pigeon English and the Ibani language is declining in use. Bonny indigenes want their children to retain the Ibani language and customs and to uphold traditionally held beliefs and attitudes. They are concerned that their heritage has been degraded and that their language will not recover from its current decline.

### ***X6 - Job Opportunities for Local People***

Both construction and operation of NLNG plant and additional trains has generated many jobs, amounting to over 17,500 workers at the peak of construction of the Base Plant. Local people feel very strongly that NLNG has not employed sufficient local indigenes, either at graduate level or semi-skilled and un-skilled workers. They also feel that local companies have not benefited adequately from contracting opportunities. Local people feel that Bonny people should benefit from any new job opportunities within NLNG and that all new job vacancies, including those associated with the operation of train 6, should specifically consider the appointment of suitably qualified Bonny people.

### ***X7 - Emergency Response Plan***

There has been doubt amongst people in Bonny communities about what to do in case of an emergency incident at the NLNG plant. Local people are worried that if there is a major incident, such as an explosion, they do not know if they would be affected, nor how they should respond.



Since NLNG has not discussed their Emergency Response Plan with local people, they fear that NLNG has not made the proper arrangements to evacuate people and that the emergency services could not cope. People fear the worst because they are unprepared.

## 7 Mitigation, enhancement and management plan

Mitigation measures have been identified and are designed for all potential impacts listed above. The last step in the ESHA process involved the translation of the measures into an action plan, i.e. the Environmental, Social and Health Management Plan (ESHMP). This ESHMP provides a complete list of all actions committed by NLNG in relation to the **Six** project. However, as many construction and operation activities will be similar to the development of the **Plus** project, the Plan does not duplicate all relevant/applicable actions, which are already listed in the ESMP for the NLNG**Plus** project, such as on-going monitoring. Only impacts rated either moderate or major are mitigated. For some items rated minor, negligible or of “no impact”, there are enhancement actions and these are included in the Management Plan as well. Other items will be managed through continuous improvement in NLNG’s performance.

The ESHMP for Train 6 demonstrates that virtually all actions refer to outstanding actions from the past or are ongoing and continuous management activities. Only one new impact was identified which is due uniquely to the development of a sixth train of the NLNG project. This is the extension of the “sterile zone”, bounded by the  $10^{-6}$  risk contour, to include land outside the fence line of NLNG. All other impacts are incremental impacts; impacts which have already been identified in previous phases of the NLNG project, which will increase as a result of Train 6. In the following table, all mitigation actions resulting from this ESHA are presented. The numbering in the first column refers to A for action, followed by a unique indication for the potential impacts listed in section 7 above.

Action number (A: Action C: Construction O: Operations, X: Stakeholder issue)	Mitigation and enhancement actions
<b>AC3-1</b>	Rewrite the NLNG policy on sexually transmitted diseases, to include HIV/Aids, using the newest industry guidelines and extend the HIV/Aids awareness programme to include all surrounding communities.
<b>AC3-2</b>	Review NLNG’s health promotion programme and strengthen where needed in line with NLNG’s adjusted policy, so that it consists of at a minimum: <ul style="list-style-type: none"> <li>• Annual awareness survey to determine the impact of ongoing HIV/AIDS prevention programme</li> <li>• Training of trainers of HIV/AIDS/STD education</li> <li>• Regular updating of knowledge of trainers</li> <li>• Support of training of HIV/AIDS counsellors</li> <li>• Assist the government with the medical approach of those suffering from STI and HIV/AIDS. Increase in frequency of general awareness campaigns (at least twice a year)</li> <li>• Sustenance of the ongoing HIV/AIDS/STD prevention campaigns in secondary schools</li> </ul>
<b>AC4a-1</b>	Assess NLNG’s current informal relationship with Monkey Village and discuss what the company’s attitude should be in light of the Bonny Master Plan and the sentiments of the Finima leadership.
<b>AC4a-2</b>	Develop its policy with regard to rural developments in the area designated in the Bonny Master Plan as industrial zone, which should recognise people in the shanty towns as a stakeholder group, even if NLNG cannot formally acknowledge Monkey Village as a community that has a right to be there.
<b>AC4b-1</b>	Draft a management plan on uncontrolled rural development alongside the Mobil air strip road together with the Joint Industry Committee and in close co-operation with the local authorities as well as the Finima community. Dismantlement of the Monkey Villages will be examined as one of the options for this plan since this area is zoned as industrial land in the Bonny Master Plan.
<b>AC4b-2</b>	Identify actions in relation to Monkey Village which are in line with both the newly developed policy and international guidance on human rights. These actions should balance the rights and interests of the Finima community and the people living in the shanty towns.



<b>Action number</b> (A: Action C: Construction O: Operations, X: Stakeholder issue)	<b>Mitigation and enhancement actions</b>
<b>AC4c</b>	Review NLNG's health promotion programme and strengthen where needed so that it incorporates the shanty towns.
<b>AC5a</b>	Further stimulate community involvement in the nature park by defining related actions and incorporating these in the community relations plan.
<b>AC5b-1</b>  <b>AC5b-2</b>	Negotiate and agree with JIC partners and competent authorities how to assert control over the sterile zone (within the $10^{-6}$ risk contour).  Commission a biodiversity survey of the sterile zone one and three years after imposing restrictions of public access. The survey will include terrestrial flora and fauna as well as biodiversity in water bodies in order to establish whether limited access has enabled regeneration of the forest.
<b>AC6a-1</b>  <b>AC6a-2</b>	Assess the extent of the generation of untreated sewage and the dumping of solid waste in and around the shanty towns and analyze its negative implications.  Discuss the results of the assessment with the Finima Development Committee, as the representative body of the Finima people.
<b>AC6b-1</b>  <b>AC6b-2</b>	Actively lobby Local Government to improve sewage and waste management in Bonny LGA, particularly in Bonny Town and New Finima.  Actively promote solutions for cleaning up existing waste sites and putting in place measures which are in line with the Bonny Master Plan, and examine possibilities for practical and/or financial support.
<b>AC7a</b>	Before the start of the construction of train 6 and the Slugcatcher, NLNG will draft a decommissioning plan to arrive at decisions on the future of the construction camps. This plan should include a time schedule which allows amongst other things for a timely ESHA for decommissioning. Options to consider from the outset include abandonment and hand-over to the community.
<b>AC7b-1</b>  <b>AC7b-2</b>  <b>AC7b-3</b>  <b>AC7b-4</b>  <b>AC7b-5</b>	Increase community awareness of likely economic changes accompanying future disabandonment of the construction workforce at the end of the project construction. Incorporate awareness raising activities in the community relations plan.  Through vocational schools, enhance skills of indigenes.  Through scholarship schemes, enhance levels of education in the local communities  Through the micro-credit scheme assist in development of sustainable businesses.  Assist in occupational readjustment of indigenes as elaborated in relation to AX3.
<b>AO2</b>	Incorporate all elements of marine operations into the scope of the impact assessment that will be undertaken for the channel deepening project.
<b>AO4a</b>	Put security measures around the safety zone where feasible (like gates, fences, video cameras, patrols or other measures) to effectively discourage people from accessing the safety zone.
<b>AO4b</b>	Engage in dialogue with the NLNG partners in the Joint Industry Committee to establish control over the sterile zone ( $10^{-6}$ risk contour), either by acquiring the land or by agreeing on control measures.
<b>AO6a</b>  <b>AO6b</b>	NLNG, in conjunction with BECC, will continue its existing air quality monitoring programme, which includes areas remote from the plant site (including Bonny Town and New Finima).  The results of the air quality monitoring will be assessed regularly to ensure continuing compliance with WHO, EU and FEPA guidelines.
<b>AO8</b>	Incorporate the effect of lighting within the estuary on the estuarine habitat from all elements of marine operations into the scope of the impact assessment that will be undertaken for the channel deepening project.



<b>Action number</b> (A: Action C: Construction O: Operations, X: Stakeholder issue)	<b>Mitigation and enhancement actions</b>
<b>AX1a-1</b> <b>AX1a-2</b> <b>AX1a-3</b> <b>AX1a-4</b> <b>AX1a-5</b> <b>AX1a-6</b> <b>AX1a-7</b> <b>AX1a-8</b> <b>AX1a-9</b>	Establish NLNG information centres in Bonny, New Finima and Abalamabie. Upgrade the New Finima buildings, built by NNPC at the time of the resettlement, so that they will contain four rooms at a minimum. Develop a plan for 2004 and run a programme with regard to sustainability forestry (including reforestation and forest regeneration) in and around Finima to replace the die-off of trees planted by NNPC. Provide kerosene stoves to women as part of the programme to reduce dependency on wood for cooking fires. Explore the possibilities of reinstating the pigmy hippopotamus, but only if suitable habitat can be found and secured on Bonny Island Explore the possibilities of introducing (eco) tourism on Bonny Island in cooperation with appropriate bodies. Support the transition of the management of the Finima Nature Park from the Niger Delta Wetland Centre to a management board of local trustees, leaving both NDWC and BECC as advisors to the new management. Conduct road maintenance in Finima as triggered by BKDC. In future meetings with FMEnv., involve BECC at all times.
<b>AX1b-1</b> <b>AX1b-2</b>	Work with community representatives appointed by the Bonny Chiefs Council, to align NLNG's efforts in implementing agreed mitigation measures, giving the Technical Committee the opportunity to monitor progress. Strengthen ongoing stakeholder engagement through regular meetings with a broad range of stakeholders, which should be aimed at updating the community on NLNG's projects as well as gathering feedback in general.
<b>AX2a</b>	Support the local fishermen and the local fisherwomen by providing supplies and materials through BECC and other recognized bodies.
<b>AX2b-1</b> <b>AX2b-2</b> <b>AX2b-3</b>	Commission a feasibility study to include aquacultural techniques, appropriate technology and required training. Assess whether using treated sewage sludge from NLNG's plant site can be used as a food source for fish in aquaculture. Promote the (revived) micro-credit scheme as a particularly helpful instrument in developing these fish culture techniques.
<b>AX2c-1</b> <b>AX2c-2</b>	Develop a regular, six-monthly dialogue programme, through BECC, with the Bonny Indigenous Fishermen cooperative, to share knowledge with fisherfolk (e.g. of fish catch studies) and to keep them well informed of NLNG's activities. Engage BECC or other recognized bodies to organize and run the programme
<b>AX3a</b> <b>AX3b</b> <b>AX3c</b>	Evaluate the functioning of the micro credit scheme with the Bonny Kingdom Development Committee. Adjust the micro credit scheme in light of AX3a and modify its criteria, so that it provides better opportunity for necessary occupational readjustments as well as for projects that have a specific positive effect on the sustainable development of Bonny Kingdom. Set up a supporting structure, consisting of both NLNG and BKDC representatives, that will make the micro credit scheme more effective by screening applicants and by providing business advice to the communities.
<b>AX3b</b>	Start a supporting programme after exploring the best way of providing training and business support to the agriculture, fisheries and forest products sector by using the new micro credit support structure.
<b>AX4a</b>	Select relevant health indicators, set up a monitoring programme and make arrangements for running it.



Action number (A: Action C: Construction O: Operations, X: Stakeholder issue)	Mitigation and enhancement actions
<b>AX4b-1</b>	Determine a Terms of Reference for the Health Facilities survey, commission the survey and monitor progress.
<b>AX4b-2</b>	Design and implement intervention programmes based on the outcomes of the survey, where appropriate and in consultation with community representatives.
<b>AX4c-1</b>	Engage with the appropriate bodies in the community to determine the appropriate scope for NLNG's assistance.
<b>AX4c-2</b>	Develop and run a sustainable Health Assistance programme
<b>AX5a-1</b>	Engage with the appropriate bodies in the community to determine the extent of Ibani teaching supported by NLNG.
<b>AX5a-1</b>	Develop and run the Ibani Teaching project.
<b>AX5b-1</b>	Engage with the appropriate bodies in the community to determine the location, scope and organisation of the Ibani cultural centre.
<b>AX5b-2</b>	Design, construct and refurbish the Ibani cultural centre and support the staffing and running of the centre.
<b>AX6-1</b>	Continue, and strengthen where possible, the existing policies on contracting and hiring of indigenes.
<b>AX6-2</b>	Increase pressure on existing contractors to hire indigenes and monitor the supply chain performance.
<b>AX7-1</b>	Reassure the local people about the remote chances of gas accidents happening and the possible consequences if such an accident occurred, and inform them about NLNG's emergency response plan through an one off enlightenment event.
<b>AX7-2</b>	Explore the possibility of organising this event in conjunction with the Joint Industry Committee.

## 8 Conclusions and recommendations

The NLNG*Six* project represents the further expansion phase in the development of the LNG plant and will consist of the construction and operation of an additional (air-cooled) LNG train bringing the total number to six process trains. The new train will be integrated with existing facilities wherever practicable so that the site is operated as a co-ordinated 6-train complex.

NLNG has carried out this Environmental, Social and Health (Impact) Assessment (ESHA), parallel to the project development. It was envisaged that the resulting report should be an addendum to the NLNG*Plus* report. This was possible, because the Federal Ministry of Environment consented to making use of the baseline studies that were conducted for NLNG*Plus*. Hence, the ESHA for NLNG*Six* could become a fast-track process.

The ESHA process was started as early as possible and in such a way that any implications resulting from the assessment could be included in the design and operation. The current report reflects the outcome of this impact assessment process and takes into account in an integrated manner the natural environmental, human health, social, trans-boundary and global environmental aspects. The sustainability principle "engage and work with stakeholders" entails that NLNG, during the ESHA, has consulted project-affected groups and local non-governmental organisations (NGOs) about the project's environmental and social aspects and has taken their views into account. These stakeholders will be involved in the follow-up activities on a continuing basis.

The mitigation actions adopted by NLNG are presented in the ESHMP and will be implemented through the existing Health, Safety and Environmental Management System.



## 8.1 Conclusions

Main conclusions from this impact assessment are:

- The NLNG**Six** project will add to the substantial economic benefits for Nigeria from the liquefaction and export of gas in the form of generation of revenues from the sale of Nigeria's considerable under-utilised, low cost, natural gas reserves.
- The sixth LNG train will also utilise oil-associated gas, which is currently wasted by flaring in the Niger Delta. The further reduction of emissions of methane and carbon dioxide is of global environmental significance and contributes to the realisation of the national Nigerian targets of cutting out flaring.
- Employment opportunities will continue, as for the **Expansion** and **Plus** projects, in particular during the construction phase of Train six. The increased financial flows and spending will have continuing benefits for the local economy.
- The hazards of the NLNG**Six** project are similar to those of the earlier projects and particularly of the **Plus** project. However, the baseline situation of Train 6 is different, as it includes also the earlier projects. There is only one NLNG**Six** specific impacts, namely the extension of the safety and sterile zones; all other impacts are extensions or add-ons to existing impacts and issues. The same applies to actions in the ESHMP.
- Construction. The majority of construction impacts are a continuation of existing interactions due to the introduction of large numbers of workforce with original inhabitants. These impacts - uncontrolled urban developments, health implications, food demand, and environmental degradation - are being managed through consultation with stakeholders affected.
- After completion of the construction, all (temporary) lay-down and construction areas will be decommissioned, as well as the camp of the Nigerian workers. This decommissioning and possible re-use of the camp will become subject to a separate ESHA.
- Land take. The LNG site itself represents a permanent and long-term claim land with an industrial function that cannot be used for other purposes. The construction and operation of the NLNG**Six** project facilities will, however, be within the existing fence and 'no additional land take' is needed. However, control over additional space at the eastern side of the plant is required to enforce the safety and sterile zone. Compensation for the loss of natural habitat has been realised in the past through the designation of the Finima Nature Park nearby.
- The quality of the NLNG**Six** discharges – such as emissions, effluents, noise, etc. – fully comply with the HSE Premises which were part of the project design process, similar to the **Plus** project. The Project therefore fully complies with the applicable Nigerian and international, including World Bank, standards. The emissions from train 6, additional to those from trains 1-5, will not result in an unacceptable ambient air quality around the LNG plant, which is also owing to the application of dry low-NOx burners in the gas turbines of trains 4, 5 and 6. The conclusions from the noise survey and the noise modelling show that the applicable limits will not be exceeded once Train 6 comes on stream. However, any further expansion in the form of additional trains or other activities will require special focussed mitigation for the nearby villages, as more “noise-space” is hardly available.
- The construction and operation of the GTS-2/4 slug catcher will not result in hazards, which could lead to environmental and/or social impacts that require mitigation.
- During the consultation process, several outstanding issues have been brought up by stakeholders. NLNG has promised to fulfil its earlier promises to representatives of the local communities by implementing all previously agreed mitigation and enhancement measures. Nigeria LNG - in consultation with their stakeholders – will continue and improve their activities



regarding long-term investment in community development in terms of Sustainable Development.

- Any potential impacts on the marine environment from the 6-train LNG plant will be addressed in the forthcoming ESHA for the Channel Deepening Project for NLNG**Six**.

## 8.2 Recommendations

- Continue the public consultation process through regular meetings in which concerns, perceptions, observations and potential solutions are shared by all parties. All relevant NLNG departments, including External Affairs, Community Relations and Environmental Affairs should attend.
- Special attention is required for the position of the Shanty Towns on Bonny Island, as many environmental, social and health aspects related to their locations, social integration and economic perspective are currently not sustainable.
- Integrate the ESHMP resulting from the ESHA for NLNG**Six** in the existing long-term management plans of the Company under responsibility of the Sustainable Development Coordination Committee.
- Integrate the reporting of the implementation of Management Plans in the annual public reporting on Sustainable Development.
- Risk assessment and access management. The present ESHA report starts from risk contours based on a 6-train operation. An integrated risk assessment (taking neighbouring operators also into account) should be carried out, so that the current risk contours and access management in the surroundings can be updated.
- Although a “Bonny Master Plan” exists - an initiative of the Joint Industry Committee (JIC) with the Bonny Kingdom - there is currently no formal “zoning plan” or “land use plan” that takes an overall vision on industrial and social developments with associated impacts. The Nigerian authorities do recognise the need for such a “strategic assessment” as a basis for master planning. However, such a tool is not available in Nigerian law, nor are the authorities capable do such an assessment. NLNG should, in collaboration with its partners in the JIC, promote such an assessment.