Executive Summary

INTRODUCTION

The Khoraghat Extension ML Block part of Assam-Arakan Basin is located in Golaghat District of Assam. Oil and Natural Gas Corporation Limited (ONGC) plans to drill three development wells in Khoraghat Extension ML Area. ONGC already has existing facilities like production wells, two Group Gathering Stations (GGS) and interconnecting pipelines in the Block.

SENES Consultants India Pvt. Ltd. (SENES) a NABET-QCI Accredited firm has been entrusted to conduct an Environmental Impact Assessment (EIA) for the proposed activities in the Khoraghat Extension ML Block. The EIA study comprised of initial scoping & site visit, environmental monitoring & surveys, preparation of draft EIA-EMP report for Public Hearing (PH).

PROJECT DESCRIPTION

Block Location & Accessibility

Khoraghat Extension ML area is 83 square kilometer and located in Golaghat District, Assam, close to Nagaland Hills. The Block is flanked by Dayang River flowing in the East and Rengma River through the central part of the Block. The confluence of Dayang and Rengma lies at the north of the Block. The Block is topographically represented in Survey of India’s 83 M/3, 83 M/7 and 83 M/11 toposheets. Three wells (KHDD, KHDE and KHDF) are proposed to be located in Haldhibari village. KHDD and KHDE will be drilled at new locations in agricultural fields and KHDF is proposed to be drilled at an existing facility of Khoraghat GGS-1 of ONGC.

The Khoraghat ML Block can be accessed by road from the district town of Golaghat. The route is via NH-36 till Shilanijan and then via rural roads through Barpathar, Sarupathar, Uriamghat and finally to the site. Sarupathar is the nearest railway station (approx. 24 km) and is part of North-East Frontier Railways connecting Guwahati with Dibrugarh. The closest Airport is at Dimapur, Nagaland, approximately 60 km from the Block.

Land Lease

The Khoraghat ML Block is located on forest lands of Dayang Reserve Forest and Rengma Reserve Forest. Approximately 2.25 hectare of land will be required per drill sites and an approximate 0.02 ha is required for approach road for KHDD and KHDE. Both the proposed development wells are located at Rengma Reserve Forest. Entire forest land in the block is encroached and presently used for agricultural practices. As per Forest (Conservation) Act 1980, ONGC will take forest clearance from Center/State for diversion of forest land. ONGC has already obtained permission for the conversion of Forest land for KHDF drill site, which is located within existing Khoraghat GGS-1. Applications for the conversion of forest land for the new development well sites KHDD and KHDE has already been submitted to the Forest Department.
Since the forest land is used for agricultural purpose, ONGC will give the crop compensation as ONGC’s policy of leasing land. On the culmination of the activities, the land will be restored to its original state and returned to their previous users.

**Project Activities**

This activity involves

- well site preparation, construction of access roads,
- Well drilling and testing.
- Site closure and decommissioning of wells not indicative of potential hydrocarbon reserves.

**Construction Drill site**

Both the drill sites are connected with site access road. A small approach road needs to be constructed for KHDE drill site. The construction of drill site will involve top soil scraping and storage for future use, elevating the drill platform by locally available fill material, construction of High Density Polyethylene (HDPE) lined pits for storage of drill cutting, waste mud and drilling wash water, construction of suitable storm water drainage system with oil trap.

**Drilling & Testing**

The drilling of the wells is expected to be up to a depth of 2500 meters. Standard Land Rig or Mobile Land Rig with standard water based drilling fluid treatment system will be used for drilling. Drill cuttings generated will be collected and separated using a solid control system and temporarily stored on-site in HDPE lined pits. Drilling and wash wastewater generated will also be stored at an onsite HDPE lined pit. The water will be adequately treated in a mobile Effluent Treatment Plant (ETP) to ensure conformance to the CPCB onshore oil and gas extraction industry effluent standards before disposal.

**Site closure and decommissioning**

The drill sites will be properly reclaimed and rehabilitated if no commercial reserve has been established. This process will involve decommissioning of rigs and all machineries; disposal of drilling waste as per CPCB guidelines, disposal of fill materials, top soil restoration.

**Project Utilities and Resource Requirements**

**Power**

The power requirement for each drill sites will be met through the DG sets. One DG set of 750 KW will be used during site construction. Two DG sets of 750 KW will be simultaneously operable and one will be kept as standby during drilling operation and one for lighting and other power requirements. It is estimated that 6 KLD of diesel will be required during drilling phase alone. Reserve Fuel will be stored as per Petroleum Rules 2002.
**Water**
Water demand during peak construction period is estimated to be 5KLD for construction and 3 KLD for workers at each well site. During the drilling operation, water requirement at site to meet the industrial requirements is 20 KLD. Total water requirement at each well site during drilling activities is estimated to be 1200 KL, considering a total of 60 days of drilling operation (including testing & contingency period). The water requirement at the drilling sites during construction and drilling phase will be met through procurement of surface/ground water from approved local sources/suppliers and partly through re-cycling of treated water from ETP.

**Manpower**
During peak construction phase (including site preparation), approximately 40-50 personnel will be engaged including skilled and unskilled labour at each well site. Both locals and labours from outside will be engaged depending on skills and project requirements. 25-30 personnel will be employed at the drill site at each shift. Provisions for drinking water and water for other purposes, sewage disposal will be provided at drill site and campsite. Kitchen facility will be provided at the campsite.

**Pollution Sources and Characterization**

**Noise**
Construction equipments and drilling activities generate noise ranging from 79-103 dBA.

**Air Emissions**
DG set, fugitive dust emission and flaring activities are the major sources of air pollution.

**Liquid Waste**
9KLD of Drilling and Wash Wastewater and 2.4KLD of Domestic wastewater will be generated peak drilling period.

**Solid and Hazardous Waste**
The major solid waste generated during peak drilling period will be 212-225m³ of mud cuttings.

**Baseline Environmental Status**
The study of the baseline environmental status helps in assessing the existing environmental conditions and identifying the critical environmental attributes. The study of the physical, biological and socio-economic environment of the Block and an area within a radius of 10 km from two development wells (study area) comprises of the baseline environment. Primary and secondary data were collected for conducting the EIA study.
Physical Environment

Climate and Meteorology
The study area experiences a humid and warm sub-tropical climate throughout the year except for a cold winter in December till February. Hourly micro-meteorological data collected during the pre-monsoon reveals that the pre-dominant wind direction is from South-East with an average speed of 0.80 m/s.

Air Quality
The ambient air quality representing Particulate Matter (PM\textsubscript{10}), Sulfur Dioxide (SO\textsubscript{2}), Nitrogen Dioxide (NO\textsubscript{2}) was monitored at eight different locations for 24 hours twice a week during April-June, 2013. Volatile Organic Carbons (VOCs), Methane (CH\textsubscript{4}), non-methane hydrocarbons (NMHCs) were monitored once a week for the same period. All the parameters were found to be below the National Ambient Air Quality Standards (NAAQS), 2009. The average 24 hourly PM\textsubscript{10} at the monitoring locations ranged between 50.21-70.07 µg/m\textsuperscript{3} (NAAQS-100 µg/m\textsuperscript{3}). The average 24 hourly NO\textsubscript{2} at the monitoring locations ranged between 19.79-24.21 µg/m\textsuperscript{3} (NAAQS-80 µg/m\textsuperscript{3}). The average 24 hourly SO\textsubscript{2} at the monitoring locations were found to below 4 µg/m\textsuperscript{3} (NAAQS-80 µg/m\textsuperscript{3}). Mean values for methane and non-methane hydrocarbon ranged between 1.29-2.9 ppm and 0.2-0.7 ppm, respectively. Mean values of VOC varied between 0.55-2.9 ppm.

Noise Quality
The noise quality was monitored for 24 hours at eight locations close to the drill sites. The ambient noise quality at day and night was in compliance to the Noise Limits set for the residential area as per Noise Pollution (Control and Regulations), 2000. The maximum daytime noise level was detected at 46dBA and the maximum nighttime noise level was detected at 37dBA.

Physiography
The Khoraghat Block lies in the Brahmaputra Valley, drained by Dayang and Rengma rivers. The Block comprises of alluvial deposits of the rivers that flows down from Naga Patkoi range. The land slopes from South to North. A continuous belt of piedmont and foothills extends all along the southern margin of the study area that is undulating in nature.

Geology
The Block lies on different formations of Neogene (Moran, Tipam and Bokabil) and Paleogene (Barails, Kopili, Sylhet and Tura) sequences. The pay sands are mainly confined between Barial top conformity and an erosional surface above lower Bokabil.

Hydrogeology
The unconsolidated formations of the sandstone, shale, limestone including conglomerate of the Coenozoic, Mesozoic and Upper Paleozoic era in the Brahmaputra Basin are significant
ground water reservoirs. The cumulative thickness of aquifer zones has the tendency to increase towards the North and southeastern parts. The potential yield of groundwater from tubewell extending to a depth of 30-50m ranges from 30 to 35m³/hr. and the yield from the deep tubewell varies from place to place depending on the aquifer. As calculated by Central Ground Water Board, the total annual groundwater draft is 22143 of which 19751ham is expended for irrigation and 2391ham for domestic and industrial purposes.

**Groundwater Quality**

Groundwater was collected and analysed as per IS: 10500 from four locations in the study area. All the parameters analysed was under the acceptable and permissible limit of IS: 10500 except turbidity and iron that was found to be high in all the samples. Heavy metals were found to be below detection limit. Faecal coliform was detected in the two samples collected from dug wells.

**Watershed and Drainage**

The Block lies in the watershed of Dhansiri River. River Dayang (tributary of Dhansiri River) and Rengama (tributary of Dayang River) are the Principle Rivers that drains the Block.

**Surface Water Quality**

Surface water was sampled from upstream and downstream of Dayang and Rengama Rivers. The water samples were analysed and compared with the Designated Best Use Classification of Surface Waters as per CPCB. The quality of Dayang River (upstream and downstream) was found suitable for Class A as the total coliform ranged between 9-14 MPN/100ml, pH ranged between 6.8-7.4, DO ranged between 3.5 and 6.7 mg/l and BOD was less than 2mg/l except for 1 sample of Rengama river. The water quality of River Rengama upstream is suitable for Class B as DO is less than 5.4 and total coliform count is 80 MPN/100ml whereas water quality at downstream is suitable for Class E as pH is 6.8, EC is 137.75 micromhos/cm, SAR is 0.64 and Boron is less than 1mg/l.

**Land Use**

The Khoraghat ML Block is included under the Dayang Reserve Forest and Rengma Reserve Forest. Currently the forested areas are deforested and used for agricultural activities and human habitation.

The Block land cover data showed majority of the land (about 64%) in the area is used for agriculture purpose with paddy as the primary produce. Settlements comprise about 33% of the total area of the Block. River Rengma and Dayang comprise of 1.3% of the total Block area. Drill pads, GGS etc. facilities of ONGC comprise 0.05% of the total area.

**Soil Quality**

Primarily two types of soil – Inceptisol (Old alluvial) and Entisols (Recent Alluviums) can be seen in Golaghat District. The primary analyses of the soil sampled from agricultural field at 5 locations in the study area shows that the soils are acidic in nature, either sandy loam or
clayey, high in available nitrogen content. The micronutrient levels observed in the soil samples do not indicate any extraordinary enrichment of metals or contamination from any external sources.

**Natural Hazards**

The study area lies in Zone V of the Bureau of Indian Standard (BIS) 2000 which might encounter earthquakes of maximum intensity. Floods are common in the few parts of the Khoraghat Extension ML Block but not at locations proximal to the proposed activities.

**Biological Environment**

The Khoraghat Extension ML Block lies in the Rengma, Dayang and Nambor Reserve Forest areas. The reserve forests within the Khoraghat Extension ML Block have totally lost its tree cover due to extensive deforestation. Presently the whole area is under cultivation and not a single tree will be felled for the proposed activities. However, Golaghat district is rich in biodiversity and has a number of ecologically sensitive areas like wildlife sanctuaries, National Parks and Elephant Reserves. None of these ecological habitats lie within the study area and hence will not be impacted by the Project.

**Socioeconomic Environment**

Golaghat District in Assam has 1125 villages under eight administrative Blocks. As per 2011 Census, the total population of the district is 1,058,674 with a percent decadal growth rate of 11.88. The sex ratio of is 961 and the population density is 305.

**Socioeconomic profile**

Twenty three villages within the study area were selected for developing the socioeconomic profile of the area. It was seen from the Census Data of 2001, Bidyapur Village has the highest population (1555 persons). The overall demography shows that the 0.02% and 14.65% of the population of the study area villages belong to Scheduled Caste and Scheduled Tribe, respectively. The highest literacy rate (74.68%) was observed in Majgaon and the least was found in Madhupur No.2 (14.31%). The total working population varies from 15.60% (Chetiagon No.2 Village) to 69.77% (Majhgaon Village). Mono-cropping is practiced in the study area where 74% of the population depends on agriculture.

**Socioeconomic Infrastructure**

The socioeconomic infrastructures of the Golaghat district as per 2011 District Handbook have been outlined here. There is 1 Civil Hospital, 1 sub-divisional hospital, 38 Primary health Centers, 1 first Referral Units, 5 Community Health Center and 144 sub centers. There are 864 Primary, 194 Middle and 173 Secondary and 23 Senior Secondary Schools. Drinking water facility exists in the premises of 46.1% of households. Power supply is present in 36.6% of households.
On consultation with the local people, the following facts were revealed:

- Primary schools are present in almost all the villages in the study area.
- Majority of the people are farmers, the area is mostly monocropped and paddy is the major crop.
- Electrical connection is present in all the villages though frequent power failure has been reported.
- Dugwell forms the major source of groundwater.
- Villagers are not satisfied with the health facility as the tertiary referral center is less in this District.

**ENVIRONMENTAL IMPACT ASSESSMENT**

The potential impacts of the project on different components of the environment was systematically identified and evaluated for significance. The principal concerns that emerged are:

**Impact on Air Quality**

The operation of DG sets, movement of vehicles and machineries during construction and drilling at drill sites will result in the generation of air pollutants viz. PM, NOx and SOx which may affect the ambient air quality temporarily. Air pollutants like NOx will also be generated as a result of flaring of natural gas.

**Impact on Noise Quality**

Operation of heavy machinery/equipments and vehicular movement during site preparatory and road strengthening/construction activities may result in the generation of increased noise levels. Operational phase noise impacts are anticipated from operation of drilling rig and ancillary equipment viz. shale shakers, mud pumps and diesel generators.

**Impact on Soil Quality**

Stripping of top soil will affect the soil fertility of the well sites. Potential impact on soil quality may result from storage and handling of fuel, lubricants and from storage and handling of drilling mud and drill cuttings.

**Impact on Topography and drainage**

Elevating the land to about 1 m from the ground level during site preparation may lead to alteration of onsite micro-drainage pattern. This might lead to the flow of untreated waste water and excess rain water to the adjoining agricultural land thereby adversely impacting the fertility of the soil.

**Impact on Water Quality and Hydrology**

The surface run off from drilling waste (cuttings and drilling mud), hazardous waste (waste oil, used oil etc) and chemical storage facilities on open soil is likely to contaminate if
allowed to flow into nearby water bodies viz. natural drainage channels, ponds etc. Possibility of contamination of subsurface and unconfined aquifers may exist if the casing and cementing of the well is not carried out properly leading to infiltration or seeping of drilling chemicals or mud into porous aquifer region.

**Impact on Biological Environment**

There is no demarcated and sensitive wildlife habitat or Schedule I species within the Block or its adjacent area. The area is free from any migratory route or corridors (daily and seasonal movement) for animals. However, noise generated from drilling activities, lighting at well site, traffic movement will cause of disturbance to local fauna.

**Impact on Socio economic Environment**

The proposed well site KHDD and KHDE is located in land currently used for agricultural (monocropped) purpose. ONGC will take this land through private negotiation. Necessary payments will be made against purchase and crop compensation to concerned land owners. As the proposed well KHDF will be located within the existing GGS land procurement would not take place. The proposed project would not require any displacement of villagers.

The project will benefit the people living in the neighboring villages by giving preference to them in relation to direct & indirect employment associated with the various project activities and boosts the local economy. The proposed project will therefore involve the improvement of existing road and/or bridge condition thereby enabling the transportation of drilling rig and ancillary equipment.

**Quantitative Risk Assessment**

The quantitative risk assessment has been done to provide a systematic analysis of the major risks associated with onshore development drilling activities in Khoraghat Extension ML Block. Oil spills, loss of well control/blow-out and process leaks constitute the major potential hazards of onshore drilling. Based on Frequency Analysis Method, it has been estimated that the likelihood of a blowout is Occasional/Rare at a rate of $2.25 \times 10^{-2}$.

Even on blowout, the probability of ignition is approximately 0.0015% i.e. negligible. The consequence analysis of Blowout assessed by using ALOHA shows settlements like Chetanapur and part of Haldhibari that are close to KHDE and KHDF might be impacted by pool fire and natural gas release.

**ENVIRONMENTAL MANAGEMENT PLAN**

Site-specific Environment Management Plans (EMP) has been developed to prevent and mitigate significant adverse impacts and accentuate beneficial impacts will be implemented by ONGC for the proposed project. The key mitigation measures specific for each management plan have been discussed in the Table below:
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<tr>
<th>Sl. No</th>
<th>Environment Management Plan</th>
<th>Key Mitigation Measures</th>
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| 1      | Pollution Prevention and Abatement Plan | • The top soil generated from site clearance activities will be stored in designated area and stabilized to prevent fugitive dust emissions  
• Preventive maintenance of DG sets to be undertaken as per manufacturers schedule to ensure compliance with Sl No 95 GSR 371(E) dated 17.5.2002.  
• All vehicles, equipment and machinery used for construction will be subjected to preventive maintenance as per manufacturer norms.  
• Flaring will be undertaken in accordance with the *CPCB Guidelines S No. 72 B. for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry*.  
• High combustion efficiency, smokeless flare/burner will be used.  
• Installation of acoustic enclosures and mufflers on engine exhaust of DG sets to ensure compliance with generator noise limits specified by Sl No 94 GSR 371(E) dated 17.5.2002.  
• Effective noise barrier at the fence-line of the sites.  
• Install and maintain effective run-off controls, including silt traps, straw barriers etc so as to minimize erosion.  
• Fuel and chemical storage areas will be paved and properly bunded.  
• Proper casing and cementing of drilling well will be done to prevent contamination of sub-surface aquifers.  
• Water based mud to be used as a drilling fluid or else eco-friendly synthetic based mud in necessary conditions |
| 2      | Waste Management Plan       | • Use of low toxicity chemicals for the preparation of drilling fluid.  
• Management of drill cuttings, waste drilling mud, waste oil and domestic waste will be made in accordance with S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005Necessary spill prevention measures viz. spill kit will be made available at the hazardous material storage area  
• The hazardous waste (waste and used oil) will be managed in accordance with Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008  
• The hazardous waste so stored (not more than 3 months) to be periodically sent to ASPCB registered used and/or waste oil recyclers/ facilities.  
• Proper manifest as per HWMH Rules, 2008 to be maintained during storage  
• The kitchen waste will be disposed in nearest municipal dumping site on a daily basis through approved waste handling contractors  
• The sewage generated will be treated in a combination of septic tank and soak pit.  
• Used batteries will be recycled through the vendors supplying lead acid batteries as required under the Batteries (Management &
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<td>• Recyclables will be periodically sold to local waste recyclers.</td>
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<td>3</td>
<td>Wild Life Management Plan</td>
<td>• The drill site will be properly fenced (chain-linked) to avoid straying of any outsider as well as wildlife;</td>
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<td>• No temporary electric supply connection line from the grid will be laid for the proposed project activity. All electric requirements will be supplied from the internal DG sets.</td>
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<td>• Noise Levels at the drill site will be controlled through selection of low noise generating equipment and installation of sufficient engineering controls viz. mufflers, silencers etc.</td>
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<td>• Movement of heavy vehicles will be restricted at night time</td>
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<td>4</td>
<td>Road Safety &amp; Traffic Management Plan</td>
<td>• Project vehicular movement involved in sourcing and transportation of borrow material will be restricted to defined access routes.</td>
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<td>• Precautions will be taken to avoid damage to the public access routes including highways during vehicular movement.</td>
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<td>• Clear signs, flagmen &amp; signal will be set up at major traffic junctions and near sensitive receptors viz. primary schools in discussion with Gram Panchayat and local villagers.</td>
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<td>• Movement of vehicles during night time will be restricted. Speed limits will be maintained by vehicles involved in transportation of raw material and drilling rig.</td>
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<td>• A Traffic Management Plan will be formulated and implemented by the contractor to control construction and operational phase traffic.</td>
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<td>• Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.</td>
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<td>• Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with concerned authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.</td>
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<td>5</td>
<td>Occupational Health &amp; Safety Management Plan</td>
<td>• All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the site Engineer.</td>
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<td>• Contractor workers involved in the handling of construction materials viz. borrow material, cement etc. will be provided with proper PPEs viz. safety boots, nose masks etc.</td>
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<td>• No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day. Provision of ear plugs, ear muffs etc. and rotation of workers operating near high noise generating areas.</td>
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|       |                             | • All chemicals and hazardous materials storage container will be properly labeled and marked according to national and
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<td>internationally recognized requirements and standards. Materials Safety Data Sheets (MSDS) or equivalent data/information in an easily understood language must be readily available to exposed workers and first-aid personnel.</td>
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<td>• The workplace must be equipped with fire detectors, alarm systems and fire-fighting equipments. Equipments shall be periodically inspected and maintained to keep good working condition.</td>
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<td>• Adequate sanitation facilities will be provided onsite for the operational workforce both during construction and operational phase of the project.</td>
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<td>• Training programs will be organized for the operational workforce regarding proper usage of PPEs, handling and storage of fuels and chemicals etc.</td>
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<td>6</td>
<td>Management of Social issues and concerns</td>
<td>• People from adjoining areas especially given job preference through local contractors according to the skill sets possessed.</td>
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<td>• Prior to the commencement of the proposed activity, a consultation program will be conducted by ONGC with the target groups and local authorities. The primary objective of such consultation will be to share with the concerned villagers/stakeholders the objective of the proposed project associated impacts and their mitigation.</td>
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<td>• ONGC will give more emphasis and priority on periphery development, development of health facilities and provision for drinking water facility as per Corporate Social Responsibility (CSR) Plan.</td>
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<td>• During the drilling phase and for the rest of the project activities proper safety measures will be undertaken both for transportation as well as the other operations.</td>
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<td>• The drill site would be fenced and gates would be constructed so that the children are refrained from straying into the site.</td>
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<td>7</td>
<td>Emergency Response Plan</td>
<td>• Drilling rig and related equipments to be used for development drilling will be conformed to international standards specified for such equipment.</td>
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<td>• Blow-out preventers and related well control equipment shall be installed, operated, maintained and tested generally in accordance with internationally recognized standards.</td>
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<td>• Appropriate gas and leak detection system will be made available at each of the drilling location.</td>
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<td>• Adequate fire-fighting equipment shall be provided at each drilling site.</td>
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The EMP has been designed with a flexibility so that it can be monitored and adapted to future changes in project design, scope, or the environment and be seamlessly integrated and implemented by ONGC.
Project Cost

An estimated Rs.75 Crore INR will be expended for the drilling of three development wells. The budget for implementation of the Environment Management Plans is 0.34 crores.