



Executive Summary

Block No: AA-ONHP-2017/1

Prepared For:

Vedanta Limited

(Division: CAIRN Oil & Gas)

Prepared By:

AECOM India Private Limited

Introduction

Vedanta Ltd. (Division: Cairn Oil & Gas), formerly known as Cairn India Limited has been allocated hydro-carbon Block namely AA-ONHP-2017/1 by Government of India under the Revenue Sharing Contract (RSC) for exploration and exploitation of hydrocarbons. Revenue Sharing Contract (RSC) was signed between the Government of India (GoI) and Vedanta Ltd on 1st October 2018. Vedanta Limited (Division- Cairn Oil & Gas) proposes to carryout exploration & appraisal (20 nos. of wells) and setting up of early production units in the block. Block encloses an area of 715 Sq. Km.

Vedanta Limited (Division Cairn Oil & Gas) proposes to carry out exploration and appraisal well drilling and early production of oil and gas in the Block. In case of a discovery (ies), the exploratory and appraisal well(s) would be tested for extended duration by flowing hydrocarbons to ascertain the reservoir parameters and assess the quality and commercial viability. The exploratory and appraisal wells would be drilled to explore the reservoirs in the range of 1750m to 5000m.

The proposed exploratory and appraisal drilling activities fall under category 1(b) of the EIA Notification, 2006 and require Environmental Clearance (EC) from the Ministry of Environment and Forests and climate change (MoEF&CC). The Terms of Reference for the Project have been approved by MoEF vide letter File No. IA-J-11011/95/2019-IA-II(I) dated 20th April 2019.

AECOM India Private Limited, a NABET-QCI Accredited firm has been entrusted to conduct the Environmental Impact Assessment (EIA) for the proposed Block AA-ONHP-2017/1. The EIA study comprised of initial scoping, site visits, environmental monitoring and surveys, conduct of Public Hearing (PH) and the preparation of draft and final EIA-EMP reports.

Block location and Accessibility

AA-ONHP-2017/1 block is located in Karbi Anglong and Golaghat districts of Assam & Wokha district of Nagaland. Total area of AA-ONHP-2017/1 block is 715 sq. km. The nearest cities from the block are Dimapur (3 km-in SW direction). National Highways 39 (Within Block) connects the block to other cities like Jorhat and Bokajan.

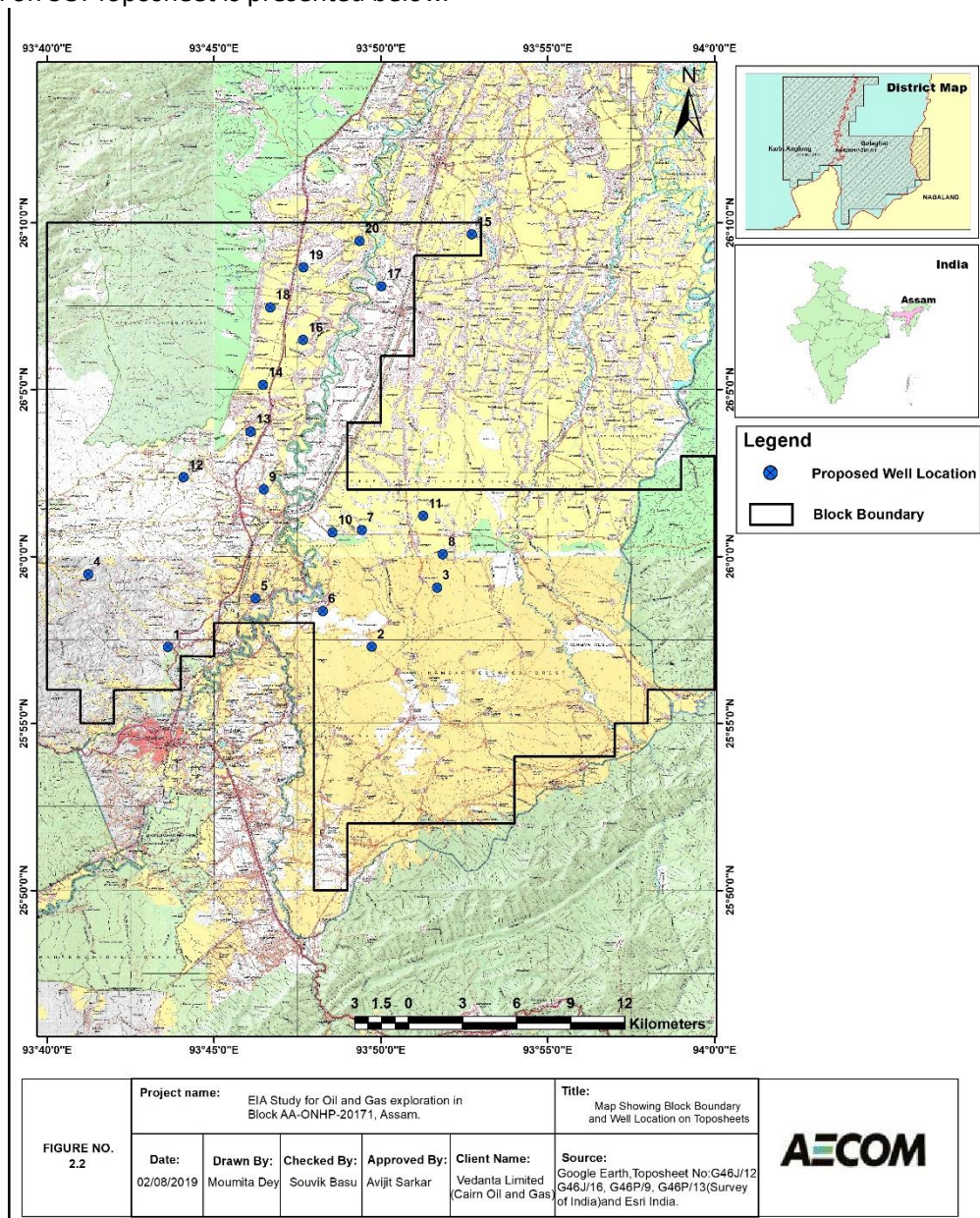
Land Requirement

During the site selection process, all legal requirements would be considered and surface location of the exploratory well would be finalized. Once surface drilling location is finalized, short term lease of the land would be taken from concerned owners. If well location falls in agricultural lands or other private lands, land and crop compensation would be provided to the land owner, and in case of govt. land, land allotment from Govt. to be applied. Initially temporary short-term lease would be taken for 3 - 5 years for exploration purpose and in case of commercially viable discovery of hydrocarbon resources; the land lease would be converted into long term lease up to life of the project. The estimated land required per drill site is approximately 9ha. Total 38648 ha, forest area is located within the AA-ONHP-2017/1 block however none of the proposed well location is located within forest land;

Description of the project

The proposed project includes drilling of 20 onshore exploratory and appraisal wells and Setting up of Early Production Units (EPUs)/ Quick Production Units (QPUs) for produced well fluid processing and

production of up to 12000 BOPD crude oil and up to 2.4 MMSCFD associated natural gas. Block Location on SOI Toposheet is presented below.



Drill Site Preparation

Drill Site Selection –

An initial assessment of the exploratory well site would be carried out through analysis of satellite imageries. Field surveys would be carried out to earmark the drill site location maintaining maximum possible distance from any settlement and sensitive receptors. Ease of accessibility to the site would also be considered.

Site Preparation –

Detailed site surveys would be carried, and the boundary of the drill site to be earmarked. Site leveling, and excavation works would be carried out for site preparation. Individual sites would be duly fenced. New approach roads to drill sites would be constructed or existing village roads would be

strengthened to provide access for the drilling equipment and machinery. If the earmarked site has vegetation cover, clearance of vegetation is the first activity that would be undertaken during drill site construction. Following this, the preparation and construction of drill site would involve top soil scraping and storage for future use, elevating the drill platform by excavated material from the drill site and authorized quarry area. Reinforced Cement Concrete (RCC) would be used for the construction of foundation system. For making foundations of the main rig structure, cast in-situ bored under-reamed piles of specified lengths would also be used.

Rig Mobilization - After completion of the construction activities and with the provision of the basic facilities, drill rig would be transported to the site. The drill equipment's are designed as standard land rig or a "Mobile Land Rig" type, which facilitates quick mobilization and demobilization. Rig essentially comprises of a Drilling mud system, Effluent Treatment Plant (ETP), Cuttings disposal, Drill Cementing equipment along with utilities to supply power (DG sets), water and fuel (HSD).

Drilling Operation

A rig would be installed at the potential site of drilling after thorough inspection for its working capability and quality standards. Well spudding shall be the start of drilling activity. Wells would be drilled in sections, with the diameter of each section decreasing with increasing depth. Before commencing the actual drilling, large diameter pipe (Conductor) would be lowered into a hole and cemented/grouted. Top-hole section would be drilled to a desired depth based on well design. After drilling top-hole section, it would be cased with a pipe called "Casing". Once each section of the well is completed, the drill string is lifted, and protective steel pipe or casing lowered into the well and cemented into place. The lengths and diameters of each section of the well would be determined prior to the starting of the drilling activities and are dependent on the geological conditions through which the well is to be drilled. This process of drilling and casing the hole section continues until the final well depth (target) is achieved.

Drill cuttings generated from the drilling activity, would be collected and separated using a solid control system and temporarily stored on-site in HDPE lined pits. Drilling and wash wastewater generated would also be stored at an onsite HDPE lined pit. The water would be adequately treated in a mobile ETP to ensure conformance to the S No. 72 A (ii) Schedule I - Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB.

Hydraulic Fracturing Activity-

Hydraulic fracking may be conducted in wells with low permeability formation and the wells with low pressure. Fracking fluid would typically be 99% water and sand (or other granulated material) and approximately 1% gelled chemicals that would be pumped at a high rate (in excess of 20 bpm) and high pressure (up to 5000 psi) to fracture the formation and improve the well deliverability. Sites for the wells with more than 2 fracs per well (multi-stage fracturing) would have provision of additional space for water storage for better continuity of operations.

Well Testing & Flaring-

During the exploration and appraisal drilling, where a hydrocarbon formation is found, initial well tests (generally about one month of duration) would be carried out to establish flow rates, formation pressure and other parameters. However, depending on the need, based on nature of the reservoirs, the exploratory and appraisal wells would be tested for longer/extended durations to ascertain the reservoir parameters.

Associated Facilities –

Each drill site would be provided with facilities such as drilling rig foundation and cellar pit, waste and water storage pits, chemical storage area including fuel storages, drill cutting disposal pit, flare pit and mobile STPs. The drill cutting and spent mud disposal pits would be provided with a HDPE lining for temporary storage. Adequate drainage and wastewater conveyance system also would be installed.

Liquid Mud Plant (LMP)-

The Liquid Mud Plant (LMP) shall be located at suitable locations of the fields to prepare synthetic/ water-based mud for the drilling operations. Water Base Mud (WBM) will be used as drilling fluid for initial, shallower sections where massive shale not encountered. The deeper and difficult to drill geological formations will be drilled using Synthetic Base Mud (SBM) as drilling fluid.

Appraisal –

When, exploratory drilling is successful, more wells (termed as Appraisal wells) would be drilled to determine the size and the extent of the field. The technical procedures and activities in appraisal drilling would be the same as those employed for exploration wells. Deviated or directional drilling at an angle from a site adjacent to the original discovery well may be used to appraise other parts of the reservoir

Quick Production Unit (QPU) –

In case of commercially viable discovery, QPUs would be installed for the processing of produced well fluid processing and early production of up to 12000 BOPD crude oil and up to 2.4 MMSCFD associated natural gas. A QPU would be a packaged/ modular mobile unit and would mainly consists of a three-phase separator & production heater or heater-treater, oil storage tanks, oil tanker loading system, produced water (PW) separation and disposal system, power generation (GEG or DG), utility systems such as fuel gas, flare & Inst. Air packages, firefighting equipment, etc. Each QPU capacity would be ~2,000 BFPD (Barrels of Fluid per Day).

Accommodation and Camp Site:

Temporary camp site (porta cabin) for the drilling of exploratory (including) appraisal wells are envisaged, which would be dismantled after drilling of the wells. At any point of time, it is anticipated that about 50 personnel per shift would be housed in the campsite during the well drilling campaign.

Well Decommissioning

After the completion of the drilling activity, partial de-mobilization of the drilling rig and associated infrastructure would be initiated. As discussed earlier, well testing may be carried out immediately after the drilling is completed. The complete de-mobilization of the facilities at site would happen once well-testing completed successfully. In case of commercially viable discovery (s) of hydrocarbons in the Block and having established the size of the hydrocarbon field (s), proposes to immediately bring the field (s) into production using one or more of the appraisal wells for the production of crude oil by setting up of QPU (Quick Production Unit). All other equipment, materials, fuel and wastes would be removed from the drilling site and reused for other drilling activities or disposed as per the applicable regulatory requirements.

If hydrocarbons are not found, a full abandonment plan would be implemented. All concrete or steel installations would be removed to at least 1m below ground level, to ensure that there would be no protruding surface structures. All waste at the site would be removed and the pits would be closed. The drill sites and associated sites (for camps and liquid mud plant) would be restored to its original conditions or as required by the landowner.

Utilities and Resource Requirement

Water – Total of 102 m³ per day fresh water would be required per well. From the total water, 22 m³/day water would be used for mud preparations, 50 m³/day would be required for drilling activities and 30 m³/day freshwater would be used for domestic purposes including drinking, washings and domestic use. The water requirement for all the project activities would be sourced locally through approved/authorized sources of surface water and/or ground water (e.g. PHD bore wells, privately owned bore wells, irrigation Department/water resources Dept. Of State Govt.). In case, required water would not be sourced locally available approved sources, ground water will be extracted after obtaining permission from CGWA/State Govt.

During early production, the installation of typical EPU/QPU unit water requirement for process, domestic consumption, greenbelt and miscellaneous use would be 15-18 m³/day.

Power – For a drill site, the power would be provided through diesel generator (DG) sets (Camp site - 2x350 KVA (including one as standby), Drilling site - 3x1000 KVA (including one as standby) or 2x1850 KVA (1 Working + 1 Standby) depending on the rig capacity & availability during E&A drilling phase and Radio Room - 2x100 KVA (including one as standby).

For each early production unit power requirement would be met through the State Electricity and or installation of Diesel/Gas Engine Generator (GEG) of 1 MW output using produced natural gas and a 500 KVA DG would be used as backup in emergency conditions for each early production unit.

Labour– It is anticipated that, at any given time, there would be about 80 - 100 personnel working on site including technical staff, drilling crew, security staff etc.

Project Cost

The cost of the project has been estimated to be about INR 584 Crores.

Pollution Sources

Air emissions: Point source air emissions would be generated from DG sets. Fugitive emissions would occur from vehicles involved in the drilling operations and from windblown dust from storage and staging areas within the drill site. During Early production stage emission would be generated from GEG/DG sets and Flaring.

Noise & Vibrations: Noise and vibration would be generated due to operation of drilling rig, DG sets and vehicles.

Liquid wastes: During the drilling phase, approximately 30-40 m³ per day of waste water would be generated from the drilling activity and 16-25 m³ per day of domestic waste water would be generated from each drill site. Produced water would be generated from early production units during EP stage.

Drill cuttings & spent mud: Approximately 500-1500 Tons/well of drill cuttings from SBM, 250-750 Tons/well of drill cuttings from WBM and 250-500 Tons/well of spent mud would be generated per site.

Existing Baseline Environment of the Project Area

Baseline information about the Block was collated by review of other published literature, site surveys, stakeholder interactions and primary monitoring carried out during the period of March-May 2019 by Mitra S. K. Private Limited (NABL Accredited Laboratory).

Sub-surface Geology-

The South Assam Shelf is a part of Assam & Assam-Arakan basin and situated in the Dhansiri valley separated from North Assam shelf by a major E-W trending Jorhat fault. The area represents a part of foreland basin flanked by NE-SW trending Naga Schuppen belt on the East & Southeast and Mikir Massif in the West. The area is sparsely exhibiting intra-cratonic graben filling sediments from Permian age to basaltic flows of Early Cretaceous age. The extensive Late Cretaceous-Oligocene sequence deposited in Passive margin setting witnessed differential erosion at places and overlain by a thick pile of Miocene to Recent sediments deposited in a foreland setting.

Drainage - The River Brahmaputra flowing in east-west direction in the extreme northern parts of the district and its tributaries flowing in northerly direction, control the entire drainage system of the district and plays an important role in the ground water occurrence and control of the district. Important Rivers of the district are Dhansiri and Dayang. These rivers have meandering courses with abandoned channels in the form of bils and ox-bow lakes along their courses

Hydrogeology- The entire Karbi Anglong district can be divided into Consolidated formations comprising oldest granite rock, gneisses etc, semi-consolidated rocks constituting the Tertiary rocks and unconsolidated alluvial sediments. In the consolidated formation, ground water is confined to the top weathered zone and the fractures and fissures of the fresh hard rock.

The Golaghat district is underlain by Quaternary formation followed by Archaean group of rocks. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the south eastern parts, the thickness reverses considerably. Hydro-geologically, the district is proved to be very potential. Ground water occurs under water table to confined conditions.

Groundwater Quality-

Total of 8 nos. ground water samples have been collected and analysed for parameters as per IS: 10500:2012 standards. The colour of the samples was found <1 hazen units and with agreeable odour. The pH of water samples ranged from 7.05 to 8.44. Turbidity of all the samples varied from 3.1 to 18.0 NTU. The TDS in the water samples varied from 42 mg/l to 318 mg/l. The total alkalinity of the samples varied from 16.0 to 280 mg/l which falls within their corresponding permissible limit of 600 mg/l. Total hardness of the samples varied from 20 to 130 mg/l and was within the permissible limit of 600 mg/l. The concentrations of heavy metals such as Aluminium, Manganese, Iron, Nickel, Copper, Zinc, Arsenic have been found to be below their corresponding permissible limits. Cadmium, Mercury, Lead and other parameters like Residual Chlorine, Cyanide, Hexavalent Chromium, Phenol, Total Phosphorus, Free Ammonia, Cyanide, polychlorinated bi-phenyls, PAHs have been found to be below detection limits.

Climate and Meteorology - As per climatological table of 1971-2000 of Indian Meteorological Department (IMD) nearest weather station to AA-ONHP_2017/1 is located in Lumding city which is located approximately 54 km in south west direction of the block. As per the data, temperature reaches around 42.0°C during the month of June. Summer is generally wet in nature with very humidity in the air. Whereas, winter experience very low temperature. The lowest temperature recorded in the month of January which reaches up to 2.2°C. Annual mean rainfall is 1239.2 mm throughout the year

Ambient Air Quality-Ambient air quality was monitored at 8 locations (for a period of 12 week - March to May'19). PM₁₀ concentration in the study area varied from 79.36 µg/m³ to 84.59 µg/m³. The monitoring location at AAQ 3, observed the maximum concentration of PM₁₀ i.e 84.59 µg/m³, whereas minimum PM₁₀ concentration was observed at AAQ 7, i.e 79.36 µg/m³. The PM_{2.5}, NO_x, SO₂, and NH₃, values were in the range of 41.71 µg/m³ to 49.73 µg/m³, 35.52 µg/m³.to 29.45 µg/m³, 8.4 to 7.4 µg/m³ respectively and well within the National Ambient Air Quality Standards (NAAQS). Other parameters such as lead, CO, Benzene, VOC, HC, Ni, As and [Ba(p)] were observed to be below their detectable limits.

Ambient Noise Levels - Noise levels were monitored at 8 locations within the study area. The locations for the noise levels are selected on the basis of locations of sensitive receptors such as health centre, educational centres, market place etc. The day time noise levels and night time noise levels were found to be higher than the prescribed standards of 55 and 45 dB respectively during day and night time for rural areas.

Soil Quality -Soil samples were collected from 8 locations. The soil in general indicates saline to slightly alkaline properties in the study area. Soil texture at all locations was observed to be sandy. pH of the soil samples ranged from 4.48 to 8.32. The concentrations of heavy metals namely cadmium, mercury, antimony was observed to below detectable limit. The values for Zinc, Lead, Cadmium, Copper, Nickel were found to be much below soil remediation intervention values.

Ecology-Karbi Anglong and Golaghat district of Assam was conducted for assessment of biological diversity of the area and probable impacts on it due to development of exploratory as well as appraisal well. The study was carried out in pre-monsoon season during month of May, 2019. Total 7 transects, 16 quadrats, 5 PBZ locations and 5 primary productivity sampling locations were selected within the block based on topography, land use, habitat and vegetation pattern. For assessment of floral species, quadrats of size 10m x 10m for trees, 5m x 5m for shrubs and 1m x 1m for herbs were plotted and qualitative and quantitative analysis of the same was carried out. Faunal species were assessed by transect method by traversing a known distance and noting observed faunal species along the length. The different habitats observed were forest, wetlands, agricultural fields, tea estates. The floral diversity was high, 45 trees, 15 shrubs, 33 herbs, 14 climbers and 6 aquatic plant. Simpson's and Shannon's index indicate medium to high biodiversity – with respect to the flora. The Shannon's index value varied 2.044 – 3.265, whereas Simpson's index value varied from 0.8273- 0.9619. Among trees, Tectona grandis, Streblus asper, Sterculia viollosa and Pongamia pinnata were found to be the dominant tree species. The phytoplankton diversity of the region is rich; the Shannon's index value ranged from 0.78 -0.954, Simpson's index value ranged from 1.75 - 2.71. Elephant corridors falls within the study area. Primary productivity in the study area varied from 14.687 to 23.4375 gC.m³.hr-1.

Socio- Economic Conditions- A total number of 27 villages are coming under core zone area, where the proposed wells are located. According to Census 2011, As per census 2011, the sex ratio of the villages was found to be 964 whereas that of Golaghat and Karbi Anglong district is 964 and 951 respectively. The sex ratio of the villages in the block is more than the sex ratio of Assam, i.e, 958. As per Census 2011, 41 villages had more than 80% ST population, among which 13 had 100% ST population. In contrast, only one village (Samukjan) had more than 80% SC population.

Impact Assessment and Mitigation Measures

Site Selection & Land Requirement –

Impact

An area of approximately 300m X 300m would be taken on temporary short-term lease basis for the construction of well pad (drill site) for exploratory and appraisal wells and the Quick Production unit/ Early Production unit. For the preparation of suitable access roads connecting to well pads, accommodating OHL and other utilities in future, a width of 30m (approx.) RoU would be required. The drill sites are planned to be located in agricultural land. Their procurement for project purposes would result in loss of landowner's income for the lease period. The procurement of land on lease can lead to moderate impact mainly due to expectations on compensation package.

Mitigation Measures

- During the construction of the access road adequate cross drainage structures to be provided considering the topography of the alignment.
- Consultations to be carried out with land owners for finalizing compensation packages;
- The excavated material from the drill site should be stored (temporarily /permanently) in uncultivated land and should be away from any drainage channel.

Site Preparation

Impact

The site preparation works at campsite and drill site may result in clearance of vegetation, dust generation and loss of topsoil. The earthworks to be carried would typically involve excavation, levelling / grading; and rolling and compaction.

Mitigation Measures

- Water sprinkling to be carried out, while working in proximity of agricultural fields or settlements/habitations;
- Runoff from drill sites would be channelized properly.
- If tree felling is involved, permission from the concern department to be undertaken.

Construction / site preparation of Drill Site / well pad

Impact

Construction of cellar pit, water storage pit and drilling waste storage pits would result in excavation of soil from each site. Noise from construction activity would be generated from bull dozer, DG sets and concrete-mixing plant.

Mitigation Measures

- Temporary storage sheds to be provided for storing of construction material.
- Excavated soil to be used for construction at other project sites;
- Detailed Health & Safety Plan to be provided to all civil contractors, as part of their contract with Vedanta Limited (Division: Cairn Oil & Gas) .

Campsite Installation

Impact

The campsites would be located in the vicinity of the drill site. A typical campsite would require portable cabins to accommodate about drilling crew and the contractor personnel. Installation of porta-cabins with associated facilities would involve Health and Safety issues pertaining to transportation, loading - unloading of cabins and installation of cabins.

Mitigation Measures

- Crane to be is equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights; and
- Surface conditions to be examined prior to movement of crane.

Transportation of Drilling Rig and Other Components –

Impact

Transportation of drilling rig, drilling equipment, materials and manpower would involve movement of about trailer through the use of existing roads till they reach the access road for each well site. The potential impacts may include congestion of roads, wear and tear of existing roads and oil leaks from vehicle maintenance areas

Mitigation Measures

- Movement of rig & associated machinery to be avoided to the extent possible during peak traffic hours
- All vehicles (light, medium and heavy) to be required to have valid PUC (Pollution under Check) certificate.
- Periodic maintenance of all project vehicles and machinery to be carried out.

Drilling and Well Testing

Impact

During drilling operation Water for WBM preparation would be 600 to 1000 m³/Well, for SBM preparation would be 150 to 300 m³/Well, for drilling water consumption would be 25-50 m³/day/well and water for domestic use would be 20-30 m³/day/well.

Mitigation Measures

Water requirement for all the project activities would be sourced locally through approved/ authorized sources of surface water and/ or ground water (e.g. PHD bore wells, privately owned bore wells, Irrigation Dept./ Water Resources Dept. of State Govt.). In case, required water could not be sourced from locally available approved sources, ground water would be extracted after obtaining permission from CGWA/ State Govt.

Handling, transport and storage of Chemicals and wastes

Impact

The drilling operations would involve generation of spent drilling mud, drill cuttings, waste oil, used containers, etc. The drill site would also involve storage of hazardous chemicals and fuels which has the potential to contaminate soil and groundwater.

Mitigation Measures

- Separate drill cutting disposal pits to be provided for WBM and SBM
- Drill pits to be provided with HDPE lining on bottom and side surfaces
- The drill cuttings from the drilling operations associated with water-based mud would be used for filling low lying areas as a sub grade construction material in construction of well pads, etc.,. Synthetic base mud would be re-used in further drilling activities.
- Used hazardous chemical barrels and waste oil to be sent to SPCB authorized vendors
- Fuel tanks to be provided with secondary containment facilities and maintained as per statutory requirements.
- All mixing tanks and chemical storage area to be paved and provided with secondary containment.

Air emissions

Impact

The drilling activities would lead to emissions from operation of diesel generator sets and flaring during well testing. Fugitive dust emissions due to the proposed project would be principally associated with emissions of dust during the site preparation. The dust generated would be primarily from the handling and transportation of fill material and re-entrainment of dust during movement of the vehicles on unpaved roads

Mitigation Measures

- DG set emissions shall be as per CPCB standards
- In case of ground flaring to minimize the effects of flaring, the flare pit will be designed meeting the CPCB / MoEF requirements.
- In case of elevated flaring system: this would be designed with proper enclosure height;
- Location of the flare stack to be decided at the design stage taking into consideration nearest habitations, vegetation, public amenities or any sensitive locations
- Efforts will be made to avoid flaring of crude oil, and crude oil to be effectively separated at the drill site and stored in barrels/tankers for transportation to the nearest terminal for management; and
- No cold venting of natural gas would be resorted instead flaring would be done with combustion efficient elevated flare tip; and
- Location of flare stacks to be chosen considering the sensitive receptors adjoining the site

Noise Generation

Impact

The noise generation sources would include DG sets, pumps for rig and other miscellaneous equipment's.

Mitigation Measures

- Installation of adequate engineering control on equipment and machinery (like mufflers & noise enclosures for DG sets and mud pumps) to reduce noise levels at source, carrying out proper maintenance and subjecting them to rigid noise control procedures.
- The DG set would be kept in an acoustic enclosure.
- Providing Personnel Protective Equipment (PPEs) like ear plugs/muffs to workers at site.
- Undertaking periodic maintenance of vehicles to reduce noise levels

Surface water quality

Impact

Site clearance and stripping of top soil during site construction would result in an increase in soil erosion potential leading to an increased sediment load in the surface run-off during monsoon. Also, surface run off from drilling waste (cuttings and drilling mud), hazardous waste (waste oil, used oil etc) and chemical storage areas may lead to the pollution of receiving water bodies viz. natural drainage channels etc.

Mitigation Measures

- Proper treatment of all wastewater and produced water and any water discharge from well site should comply with CPCB Inland Water Discharge Standards for Oil and Gas Industries
- Waste mud to be stored in the HDPE lined pit
- Drainage and sediment control systems at the well site would be efficiently designed
- All chemical and fuel storage areas, process areas would have proper bunds so that contaminated run-off cannot escape into the storm-water drainage system.

Ground water

Impact

In absence of supply of surface water resource, the potential impacts on groundwater resource would be due to ground water abstracted for domestic needs and for civil construction activities.

Mitigation Measures

- All water storages in the drill sites would be kept covered and leakage prevented;

Soil Quality

Impact

During the site preparation stripping of soil would be happened during the construction phase. Site preparatory activities would involve the sourcing of earth-fill from borrow areas. Since in most of the cases efforts would be made to procure the fill material from nearby existing borrow areas. Storage of drill cuttings associated with WBM, spent drilling mud and sludge containing oil and other waste are likely to be generated, would be stored at HDPE lined pit. Fuels, lubricants and chemical used for the drilling operations (especially daily consumption) would be stored at site.

Mitigation Measures

- The top soil would be stored properly
- Manage spills of contaminants on soil using spill kits;
- Storage of MSW in designated areas within drill sites/production facilities;
- Adopt best practices e.g. use pumps and dispensing nozzle for transfer of fuel, use drip trays etc.

Road and Traffic

Impact

During various phases of projects like construction, drilling, early production and decommissioning various types of vehicle / equipment movement would be involved. The vehicular movement is expected to be more in construction phase due to movement of machinery & manpower.

Mitigation Measures

- Speed limits would be maintained by vehicles involved in transportation of raw material and drilling rig.
- Regular supervision would be done to control vehicular traffic movement along defined traffic routes.
- Entry of vehicles into the drilling site area is prohibited except for material movement.
- Adequate parking would be provided outside the drilling location.

Terrestrial Ecological environment

Impact

The Potential Impacts on the existing floral and faunal diversity may arise due to following activities

1. Vegetation Clearance.
2. Illimitation from Site.
3. Generation of Noise

Mitigation Measures

- The working area would always be kept minimum.
- For felling of trees prior approval from concern Department shall be obtained;
- Appropriate shading of lights to prevent unwanted scattering.
- Fencing would be done on the camp site to avoid any unfortunate encounter with faunal species.

Socio economic environment

Impact

Road infrastructure could be damaged due to heavy traffic movement. Influx of population is anticipated in all stages of the project cycle particularly during exploratory drilling. The drill site would involve the operation of about 50 onsite workers during drilling phase. Interaction between workers with villagers of nearby areas might give rise to various issues like conflict of workers with the local population, nuisance caused by workers due to improper sanitation facilities, etc.

Mitigation

- The shortest distance as far as available / feasible would be considered for access road.
- The village road identified for accessing proposed project footprints, would be strengthened and widened as per requirement.
- Appropriate awareness program on grievance redressal mechanism, would be designed and implemented for local community around proposed project footprints;

- Concerns of local panchayat regarding any impact on their common property resources (like of use of village road, water resource etc.) due to project activities, would be proactively identified and addressed;

Occupational Health & Safety Risks

Impact

The health and safety risks associated with drilling operations may include well kick or blow out, crane failure, fire Hazards and radiation hazard from well logging tool handling and storage.

Mitigation Measures

- Blowout preventers to be provided;
- Flare pit to be placed at a safe distance from the well head and fuel storage areas;
- Fire-fighting measures to be provided.

Operation of Campsites

Impact

It is anticipated that, at any given time, there would be about 80 - 100 personnel working on site including technical staff, drilling crew, security staff etc. who would be accommodated at each campsite associated with drilling. Water for domestic use would be 20-30 m³/day/well. Each campsite is anticipated to generate 25-30 kg/day/well of domestic waste. Inadequate disposal and handling of waste would pollute the surroundings.

Mitigation Measures

- Safe drinking water to be provided at campsite.
- Segregation of waste at the source of generation to be put in practice.
- Food waste to be collected and disposed appropriately
- The sewage from each porta-cabin to be connected to a mobile STP.

Demobilization and Abandonment

Impact

If hydrocarbons are not found, a full abandonment plan would be implemented. The impacts from decommissioning of drill sites may include noise generation and soil contamination due to demolition of cutting pits and chemical storage areas.

Mitigation Measures

- All the wastes to be removed from the site and sent to designated authorized disposal facilities prior to commencement of demolition work.
- Prior to commencement of any demolition, a planned programme of site clearance would be formulated. All pits, cellars and holes would be removed, and filled to ground level, any oil or otherwise contaminated soil would be removed and disposed properly.
- Roads and other paving would be removed to sufficient depth to allow soil replacement and revegetation.
- Any remaining topsoil that has been stocked during the site clearance would be re-spread over appropriate portions of the site.

Environment Management and Monitoring Plan

A comprehensive environmental monitoring plan has been developed for the project. Monitoring of ambient air quality, noise levels, soil and groundwater quality to be carried out by MoEF&CC/NABL/Assam SPCB recognized laboratories for pre and post drilling operations to assess the effectiveness of the environment management plan and adopt appropriate corrective measures if it found that those are not functioning properly.

HSE Organization Structure

Vedanta Limited (Division: Cairn Oil & gas) has an existing established Health, Safety and Environment (HSE) management system for its operations. The HSE structure comprises of a corporate HSE team based in Gurgaon office and an on-site team.

Vedanta Limited (Division: Cairn Oil & Gas) shall ensure that the contractual documentation emphasizes on the need to comply with all legal requirements and Environment Management and Monitoring Plan (EMMP). Vedanta Limited (Division: Cairn Oil & Gas) shall either directly or through its contractors, to arrange for periodic trainings of the project crew on legal requirements and EMMP. Vedanta Limited (Division: Cairn Oil & Gas) shall undertake regular inspections of the drill and camp sites and document them to ensure compliance to legal requirements and the EMMP.

Proposed CER (Corporate Environmental Responsibilities) Strategy

As per MoEF&CC office memorandum number F. No 22-65/2017-IA-III dated 1st May, 2018, Corporate Environmental Responsibility requirement would be fulfilled.