Vol. 2: Environmental and Social Impact Assessment Report for Proposed Kutubdia LNG Terminal Project

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BAN: Reliance Bangladesh LNG Terminal Limited

Prepared by Environmental Resources Management (ERM)

491. This section identifies and assesses the potential impacts in the environment that could be expected from the proposed LNG terminal off *Kutubdia* Island in Bangladesh. The impacts due to the Project activities across different phases have been identified and assessed. The Project activities will impact the physical, social and ecological environment in two distinct phases:
   a. Construction[1]
   b. Operation

492. Impacts are identified and predicted based on the analysis of the information collected from the following:
   - Project information (as outlined in ***Section 3***);
   - Baseline information (as outlined in ***Section 4***).

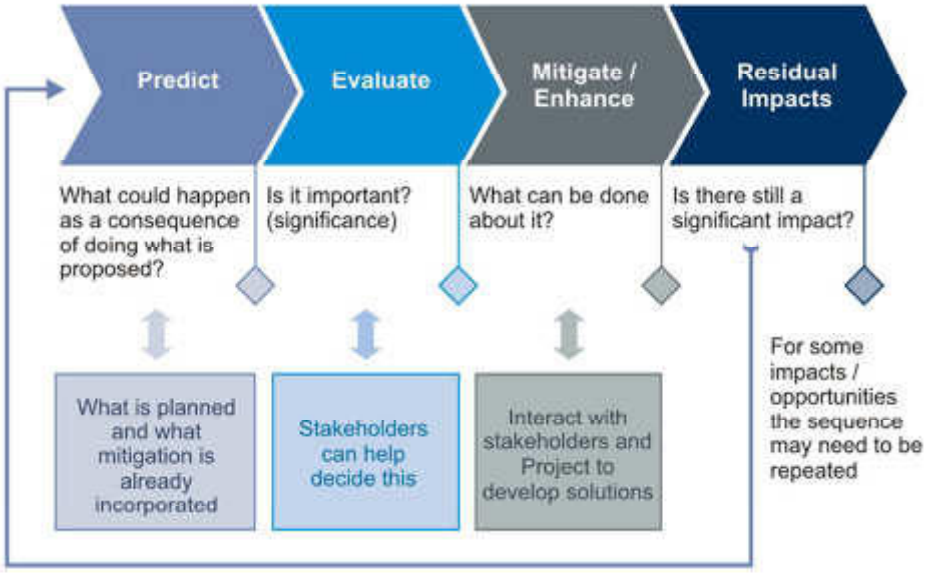
493. The identification of likely impacts during construction and operation phases has been carried out based on likely activities having their impact on environmental and socio-economic parameters. The impact assessment methodology; identification of potential impacts due to the LNG Project related activities and their potential impacts have been worked out in the following sections.

5.1 IMPACT ASSESSMENT METHODOLOGY AND APPROACH

494. Impact identification and assessment starts with scoping and continues through the remainder of the impact assessment process (IAP). The principal impact assessment (IA) steps are summarized in and comprise:
   - **Impact prediction**: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;
   - **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;
   - **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts;
   - **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

[1] Note: Social impacts associated with the pre-construction phase of the Project have also been covered under the construction phase.

Figure 5.1 Impact Assessment Process



5.1.1 Prediction of Impacts

495. Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the Project and the baseline environment are identified. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques. The nature and types of impacts that has been addressed in this ESIA is defined in below.

Box 5.1 Nature & Types of Impacts Considered for Impact Assessment

Negative: when impact is considered to represent adverse change from the baseline or introduced a new undesirable factor;
Positive or beneficial: when impact is considered to represent improvement to baseline or introduced a new desirable factor;
Direct: impacts that result from a direct interaction between the project and a resource/ receptor;
Indirect: impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment; and
Induced: impacts that result from other activities (which are not part of the project) that happen as a consequence of the project.

5.1.2 Evaluation of Impacts

496. Evaluation of significance of an impact is assessed by ascertaining a) magnitude and b) sensitivity/vulnerability/importance of resource/receptor likely to be impacted as defined in the following description:

a) Determining Magnitude of an Impact

497. Magnitude, i.e. severity of an impact or degree of change caused by a project activity is a function of interaction characteristics of Scale, Extent and Duration. The criteria that have been evolved for each of these key elements resulting in degree of change with correspindinig ranking/level of impacts (low, medium and high) on the environmental component are presented in ***Table 5.1.***

Table 5.1 Impact Prediction Criteria

Impact Elements	Criteria	Ranking
Scale: Degree of damage that may be caused to the environmental components concerned	▪ **Irreversible damage to natural environment** and/or likely difficult or may not to revert back to earlier stage with mitigation; ▪ **Major changes in comparison to baseline conditions** and / or likely to regularly or continually exceed the standard;	High
	▪ **Reversible damage to natural environment** but likely to easily revert back to earlier stage with mitigation; ▪ Perceptible change from baseline conditions but **well within acceptable norms**.	Medium
	▪ Effect is **within the normal range** of natural variation; ▪ **No perceptible or readily measurable change** from baseline conditions;	Low
Extent: Spatial or geographical extent of impact due to a project and related activities	▪ Project site and the entire study area i.e. beyond Project influence area (10.0 km from Project components in this case FSRU, gas spur pipeline and land based CTMS facility)	National
	▪ Project site & its surroundings (2.0 km from Project components FSRU, gas spur pipeline and land based CTMS facility)	Regional
	▪ Project site & its immediate vicinity (0.5 km from Project components FSRU, gas spur and CTMS facility)	Local
Duration: Temporal scale of the impact in terms of how long it is expected to last	▪ Spread beyond the lifecycle of the project	Long term
	▪ Spread across several phases of the project lifecycle	Medium term
	▪ Only during particular activities or phase of the project lifecycle	Short term

498. Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. The magnitude combines the impact characteristics of Extent, Duration and Scale and is a multiplicative factor of these three criteria set. Based on the above understanding magnitude of impact is assessed as per ***Table 5.2***.

Table 5.2 Assessing Magnitude of Impact

Scale	Extent	Duration	Magnitude
Low	Local	Short Term	**Negligible**
Low	Regional	Short Term	**Small**
Low	Local	Medium term	
Medium	Local	Short Term	
Low	National	Short Term	
Low	Local	Long term	
High	Local	Short Term	
Low	Regional	Medium term	
Medium	Regional	Short Term	
Medium	Local	Medium term	
Low	National	Medium term	**Medium**
Medium	National	Short Term	
Low	Regional	Long term	
High	Regional	Short Term	
Medium	Local	Long term	
High	Local	Medium term	
Medium	Regional	Medium term	
Low	National	Long term	
High	National	Short Term	
High	Local	Long term	
Medium	National	Medium term	**Large**
Medium	Regional	Long term	
High	Regional	Medium term	
Medium	National	Long term	
High	National	Medium term	
High	Regional	Long term	
High	National	Long term	

499. Magnitude of impact is assessed as negligible only when no discernible impact is assessed.

b) Determining Sensitivity/ Importance/ Vulnerability of Receptor

500. In addition to ascertaining magnitude of impact, the other principal step necessary to assign significance for an impact is to define the sensitivity/ vulnerability/ importance of the impacted resources/ receptor. There are a range of factors to be taken into account when defining the sensitivity/ vulnerability/ importance of the resource/ receptor, which may be phisical, biological, cultural or human as per the following understanding:
    - Where the resource is physical (for example, fresh water body) its quality, sensitivity to change and importance (on a local, regional, national importance) are considered;
    - Where the resources/ receptor is biological or cultural (for example, sea turtle habitat and nesting site), its importance (for example local, regional or national importance) and its sensitivity to the specific type of impact are considered;
    - Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

501. Definition as defined in has been adopted to determine sensitivity/ importance/ vulnerability of environmental resources or receptor.

Table 5.3 Sensitivity/Importance/ Vulnerability Criteria

Sensitivity	Contributing Criteria
High	▪ Existing physical environment quality is already under stress; ▪ Ecologically sensitive/ protected area, provides habitat for globally protected species; ▪ Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the project. ▪ Human receptors/ vulnerable community are located within the project footprint and directly affected by the project ▪ Resource exclusive for community use
Medium	▪ Existing physical environment quality shows some sign of stress; which is sensitive to change in quality or physical disturbance; ▪ Natural habitat provides habitat for wildlife, which are protected under National regulations; ▪ Some, but few areas of vulnerability; still retaining an ability to at least in part adapt to change brought by the project. ▪ Human receptors/ vulnerable community are located adjacent the project site and likely to be affected by the project ▪ Alternative resource available with community
Low	▪ Existing physical environment quality is good; ▪ Modified habitat provides habitat for common species; ▪ Human receptors are located away and are not likely to be affected due to the project related activities

Evaluating Significance of Impacts

502. Based on interaction of magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor likely to be impacted, the significance of impact is assigned for each impact using the matrix shown in ***Figure 5.2***.

Figure 5.2 Assessing Significance of Impact due to Proposed Project Related Activities

		Sensitivity /Vulnerability / Important Resource / Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

503. The context of various impact significance ratings is defined in ***Box 5.2***.

Box 5.2 Context of Impact Significance

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

5.1.3 Identification of Mitigation and Enhancement Measures

504. Once the significance of an impact is assessed, the next step is to evaluate what mitigation and enhancement measures are warranted. In this ESIA, following Mitigation Hierarchy has been adopted:
   - **Avoid or Reduce at Source:** avoiding or reducing at source through the design of the project;
   - **Abate on Site**: add something to the design to abate the impact;
   - **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site;
   - **Repair or Remedy:** some impacts involve unavoidable damage to a resource and these impacts can be addressed through repair, restoration or reinstatement measures;
   - **Compensate in kind, compensate through other means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate.

505. The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

5.1.4 Residual Impact Evaluation

506. Once mitigation and enhancement measures are declared, the next step in impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

5.1.5 Management & Monitoring

507. The final stage in the impact assessment process is to define the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

508. Environmental Management Plan summarises all actions (including mitigation/enhancement and compensatory measures) which the Project Proponent has committed to executing with respect to environmental/social/ health performance for the Project, is also included as part of the ESIA report. The Plan aslo includes monitotring measures to assess performance of the actions.

5.1.6 Risk Assessment & Disaster Management Plan

509. An initial Risk Assessment with Disaster Management Plan of the proposed LNG Project is presented in ***Annex 13.*** This study covers salient features of the Project, objectives and methodology of the risk assessment, identification of major hazards, hazard screening and ranking, frequency and consequence assessment for major hazards. The hazards have been quantitatively evaluated through a criteria base risk evaluation matrix. Risk mitigation measures to reduce significant risks to acceptable levels have also been recommended as a part of the risk assessment study.

5.2 IDENTIFICATION OF POTENTIAL IMPACTS

510. The potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors. In addition to the project components like the FSRU, subsea gas pipeline, onshore gas spur pipeline from *Kutubdia* CTMS till *Napura* Valve Station and CTMS facility (with utilities like power plant of 0.5 MW, etc.), (an associated facility for this Project) has also been considered for the purpose of this current assessment. The interaction matrix enables a methodical identification of the potential interactions each Project activity may have on the range of resources/ receptors within the Area of Influence i.e. the study area for the Project.

Table 5.4 Impact Identification Matrix for LNG Terminal (with FSRU) off Kutubdia Island

Project Activity/ Hazards	Environmental Resources											Ecological Resource				Social-Economic Resources							
	Aesthetic & Visual Impact	Land Use	Soil/ Sediment Quality	Air Quality	Ambient/Underwater Noise & Vibration	Topography & Drainage	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Traffic (road & river)	Terrestrial Flora & Fauna	Aquatic Flora (Inland & Marine)	Aquatic Fauna (Inland & Marine)	Migratory Route/ Corridor	Job & economic opportunity	Economy & Livelihoods	Social & Cultural Structures	Land Use (Economic Displacement)	Infrastructure & Services	Cultural Resources	Community Health & Safety	Occupational health & safety
Construction Phase																							
Construction of FSRU																							
Setting up of FRSU including initial discharge of ballast water																							
Construction of land based facilities																							
Land Purchase/ Acquisition																							
Site Clearing																							
Filling of land																							
Building of structures including temporary structures																							
Laying on Onshore pipeline and testing																							
Construction of subsea pipeline																							
Associate Activities																							
Heavy equipment operations																							
Storage, handling and disposal of waste																							
Generation of sewage and discharge																							
Influx of construction workers																							
Transportation of manpower, equipment & materials over water or by road																							
Storage and handling of chemicals (unplanned release)																							

Project Activity/ Hazards	Environmental Resources											Ecological Resource				Social-Economic Resources							
	Aesthetic & Visual Impact	Land Use	Soil/ Sediment Quality	Air Quality	Ambient/Underwater Noise & Vibration	Topography & Drainage	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Traffic (road & river)	Terrestrial Flora & Fauna	Aquatic Flora (Inland & Marine)	Aquatic Fauna (Inland & Marine)	Migratory Route/ Corridor	Job & economic opportunity	Economy & Livelihoods	Social & Cultural Structures	Land Use (Economic Displacement)	Infrastructure & Services	Cultural Resources	Community Health & Safety	Occupational health & safety
Operation Phase																							
Fugitive emission from FSRU																							
Emission from captive power plant																							
Emission from LNG carrier ship																							
Illumination from FSRU and CTMS Facility																							
Physical presence of FSRU (Safety zone)																							
Noise generation due to operation of plant and auxiliaries																							
Discharge of return cold water from FSRU																							
Generation and discharge of Ballast & Bilge water from FSRU/ LNG Carrier ship																							
Generation of domestic waste water and discharge from FSRU, onshore facility																							
Industrial and domestic water demand for operation of facilities																							
Wastewater discharge/ disposal																							
Wastes – domestic waste and other non-hazardous wastes handling, storage																							
Hazardous material and waste storages																							

= Represents "no" interactions is reasonably expected

= Represents interactions reasonably possible but none of the outcome will lead to significant impact impacts

= Represents interactions reasonably possible with one of the outcomes may lead to potential significant impact

5.3 POTENTIAL IMPACTS

5.3.1 Potential Impact on Aesthetics & Visual Quality

Construction Phase

511. Impact Sources: The sources of aesthetics and visual impacts can result from:
   - Grading of land at site for CTMS facility;
   - Storage of construction materials;
   - Storage and disposal of construction waste, municipal waste;
   - Physical presence of labour camp; and
   - Earth work (including drill cuttings from HDD drilling) along the spur pipeline route.

512. Embedded Control Measures: The embedded control measures i.e. measures that are inbuilt in the Project design include:
   - Provision of storage facility for construction materials within the site for CTMS facility;
   - Setting up of labour camp within the site for CTMS facility with provisions of basic amenities and sanitary for the construction labour. Provision of temporary storage of solid waste and collection will also be made at the site for CTMS facility.
   - The pipeline laying will be done through horizontal directional drilling (HDD) technique, thus no excavation in the beach area will be done due to pipeline laying. The bow shaped pipeline from FSRU will exit at *Kutubdia* Island ~100 m from shore from where it will again run as subsurface below 2 m from ground level. The depth of pipeline in the beach area will be maintained below 3 m from ground level.

513. Impact Assessment: There will be potential visual and aesthetic impacts for the households residing nearby settlement due to storage of construction materials in sheds as well as in open stockpiles and labour camp for the Project at the CTMS site.

514. Further it is estimated that ~20 kg/day of municipal solid waste (MSW) will be generated from the labour camp/ construction site. The disposal of MSW in open area around the village can create nuisance.

515. Stacking of pipelines and earth work comprising of excavated soil in some trenches and drill cutting related stacking along the pipeline route in the northern part of *Kutubdia* Island and across *Kutubdia* Channel up to *Napura* will have visual impacts.

516. The environmental setting of the area reveals that the *Kutubdia* Island has a typical rural setting with flat terrain (agricultural land and salt pans) with small settlements and homestead plantation. The people have never experienced large scale industrial / developmental activity on the island. The laying of pipeline through northern part of the *Kutubdia* Island will create temporary changes of the environmental setting. Its impact will be short term activity and visual

impacts are expected to be limited within 0.5 km area either side along the pipeline route. The aesthetics and visual impact significance for short construction period (~12 months) with HDD drilling for pipeline laying in the rural set up with scattered settlements (i.e. low number of receptors) is assessed to be **Minor**.

517. *Mitigation Measures*: The mitigation measures to minimize the above mentioned impacts are as follows:

- Fencing of land for CTMS facility with bamboo mat or tin sheets;
- Sections excavated for pipeline route will be barricaded with tin sheets;
- Stacking of sections of pipeline to be done away from settlements with provision of wedges to ensure that rolling or movement of pipeline do not pose risks to passers-by
- All the construction activities will be restricted within the designated site;
- Fugitive dust will be suppressed with periodic water sprinkling;
- On completion of work, all temporary structures, surplus materials and excavated soil and drill cutting wastes will be completely removed from the site and disposed of at a designated facility;
- Construction and municipal solid waste temporarily stored at the CTMS site will be transported to the designated disposal facility at regular intervals.

Impact Significance	**Aesthetic and Visual Impact during Construction Phase**			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations) i.e. Residual Impact	Significance of impact is considered **Minor.**			

518. *Residual Impact*: Considering the implementation of above mentioned mitigations measures the significance of residual impact is assessed as **Minor**.

Operational Phase

519. *Impact Sources*: The sources of aesthetics and visual impacts can result from:

- Physical presence of the CTMS facility;
- Illumination from the FSRU located 1.5 km offshore from *Kutubdia* Light House.
-

520. *Embedded Controls*: Project embedded control measures include:

- Plantation at the periphery of the CTMS facility to improve aesthetics

521. *Impact Assessment*: Onshore CTMS facility, control building, gas based power plant (of 0.5 MW) with 15 m height stack, will be constructed within the area demarcated for land based facilities. The physical presence of the FSRU and CTMS at *Napura* – each will be visible from 2 to 3 km distance.

522. As the FSRU proposed to be located offshore 1.5 km from *Kutubdia* Light House and CTMS at *Napura* are located away from settlements. The ~16 km spur pipeline will be buried and will not have high illumination along the pipeline corridor. The illumination from the Project facilities is likely to have some changes of environmental settings of the area. The physical presence of such facilities being located away from settlements, impact of aesthetics and visual quality is assessed to be **Minor**.

523. *Mitigation Measures*: The mitigation measures to minimize the above mentioned impacts include provision of appropriate shading of lights to prevent light scattering.

Impact Significance	**Aesthetic and Visual Impact during Operation Phase**			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations) i.e. Residual Impact	Significance of impact is considered **Minor.**			

524. *Residual Impact*: Considering the implementation above mentioned mitigations measures the significance of residual impact is assessed to be **Minor**.

5.3.2 Potential Impact on Land Use

525. *Impact Sources*: The land use impacts can result from:

- Procurement of land for land for CTMS facility;
- Temporary loss of agricultural /saltpan activity during laying of pipeline;
- Restriction of land use along the pipeline corridor.

526. *Impact Assessment*: Land requisition for the pipeline laying is 49.343 acres for ~16 km gas spur pipeline. Once pipeline is laid, ~30 acres of land (including 3.95 acres for CTMS) will be retained as permanently acquired land by Petrobangla. The ownership of land will remain with Petrobanlga, RBLTL will get the land for 15 years from Petrobangla. The width of the pipeline corridor acquired as permanent land will be 8 m and additional ~15 m along the pipeline will be

required for pipeline construction. This requisition of land will be purely for the construction period and is expected to be for one year, after which the lands will be restored and reinstated to the best achievable original conditions and returned to the land owners. With the setting up of the Project, the land use from agricultural and salt pans of the government land/ private land will be permanently meant for industrial use. Although the pipeline will be subsurface, no structural development would be permitted which may lead to loss of value for land.

527. The pipeline laying will be done through HDD technique, thus no excavation in the beach area will be done due to pipeline laying. The bow shaped pipeline from FSRU will exit at *Kutubdia* Island ~100 m from shore from where it will again run as subsurface below 2 m from ground level. The depth of pipeline in the beach area will be maintained below 3 m from ground level. It is envisaged that the laying of the pipeline will not significantly impact in the change of land use along the pipeline route (~26 acres) as it will be subsurface and after construction the land will be restored to the best achievable original condition by growing grass and trees at designated areas. The ownership of permanently acquired land will remain with Petrobangla. No woody shrubs will be planted to avoid their interference with the integrity of the pipeline. This requisition land (49.343 acres) will be purely for the construction period and is expected to be for one year.

528. The impact on land use will primarily be with associated socio-economic impacts on the land looser, and is discussed later in the report in *Section 5.3.11*.

529. *Mitigation Measures*: The mitigation measures to minimize the above mentioned impact include:
- Immediate restoration of permanently acquired land for pipeline (~26 acres) will be brought to its best achievable original state after completion of the buried pipeline laying activity, thus to merge it with the best achievable surrounding land use.
- The requisition land will be restored and reinstated to the best achievable original conditions and returned to the land owners.
- The land for the spur pipeline (~26 acres) will be available to the land owners after construction of the pipeline.
- Remove all wastes from area surrounding CTMS Facility and pipeline corridor.

Impact Singificance	Land Use Impact due Pipeline and CTMS			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations) i.e. Residual Impact	Significance of impact is considered **Minor**			

530. *Residual Impact*: Considering the implementation of above mentioned mitigations measures, the significance of residual impact of permanent land acquisition is assessed as **Minor**.

5.3.3 Potential Impact on Soil Quality

Construction phase

531. *Impact Sources*: The impacts on soil quality can result from:
- Removal of top soil specifically from agriculture fields along the pipeline route and land based CTMS facility;
- Disposal of construction waste/ MSW/ HDD cutting;
- Spillage of chemical/ oil on open soil.

532. *Embedded Control Measures*: The Project embedded control measures are as follows:
- Construction waste will be utilized for filling of site for CTMS facility;
- Municipal solid waste generated from the labour camp and construction site will be transferred to the disposal site in consultation with the Union *Parishad*;
- Fuel, chemical and lubricant will be stored in paved storage areas.

533. *Impact Assessment*: The land use data for the onshore pipeline corridor shows that agricultural land will be utilized for the onshore component of the Project. Any top soil specifically from agriculture field generated during construction activities at CTMS site and some part of spur pipeline route (as in most part the pipeline will be laid through HDD technique i.e. without any excavation) if not properly stripped and stored for future use, the entire volume of top soil will be permanently lost or fertility/soil characteristics will be changed.

534. Fuels, lubricant, paints, etc., would be stored at designated paved areas. Thus the contamination of soil can happen only due to accidental spillage of fuel, lubricants and paints from storage areas and during transfer of fuels and

chemicals. However, in case of a spill, the restoration of top soil is usually difficult and a time taking activity.

535. The primary monitoring results of soil quality results shows that there was no contamination of heavy metals and other soil contaminants in the nearby agricultural land (*Refer Section 4.5.5*). The above mentioned soil quality impacts will be localized within the project site or in the immediate vicinity. The significance of potential impact, without mitigation measures in place, on soil quality is assessed as **Mi**nor.

536. *Mitigation Measures*: The mitigation measures to minimize the above mentioned impacts are as follows:
- Proper stripping of top soil, its conservation for future use in plantation or for reclaiming agricultural land along the pipeline shall be ensured.
- The drainage system at CTMS site will be designed with sedimentation tank and Oily-water Separator to prevent contaminants from entering soils;
- Restrict Project and associated activities within the land acquired and requisitioned land;
- Laying of pipeline with HDD technique with least disturbance to top soil
- Ensure spill control measures are in place and any contaminants of soil is treated as per standard engineering practices.

Impact Signficance	**Impact on Soil Quality during Construction Phase**			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Short Term	Medium Term		Long Term
Impact Extent	Local	Regional		National
Impact Scale	Low	Medium		High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations) i.e. Residual Impact	Significance of impact is considered **Negligible.**			

537. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of impact on soil quality is assessed as **Negligible.**

Operational Phase

538. *Impact Sources*: Potential impact on soil quality can arise due to:
- Accidental spillage of fuel & lubricant from storage facility or from transport vehicles;
- Improper storage and disposal of wastes (garbage and hazardous waste) generated onboard FSRU and CTMS;

- Surface runoff from spillage area into nearby agricultural fields and or open land.

539. *Embedded Controls:* The Project embedded control measures are as follows:
   - All wastes (garbage and hazardous waste), food waste (comminuted to 25 mm size), slop oil, sludge generated from the STP (refer to ***Section 3.7.4*** paragraphs 163 to 166) will be temporarily stored in holding tanks onboard FSRU will be transferred to the waste disposal facility of *Chittagong* Port;
   - Impervious storage area, especially for storage of fuel & lubricant, hazardous waste, etc. will be prepared;
   - Storm water drainage system to capture the surface runoff through properly graded garland drains and finally channelize the runoff into the sea. The drainage system will be designed with sedimentation tank to arrest silt load.

540. *Impact Assessment*: The fuels, lubricant, chemical, etc., would be stored at a designated area within the facility which is paved. Thus the contamination of soil can happen only due to accidental spillage of fuel, lubricants and chemicals from storage areas and during the transfer of fuels and chemicals. The surface runoff from spillage site to nearby agricultural land or open land can lead to contamination of soil. Improper handling and mixing with surface runoff water can lead to contamination of soil in nearby areas. Sludge generated from the STP will be stored in pits and same will be periodically transferred for use as manure. Other industrial and hazardous wastes (including used/spent oil) will be stored in bins and sheds provided with impervious liners underneath the floor. Theses wastes will be sent for the disposal facility of the *Chittagong Port*. Improper handling and mixing with surface runoff water can lead to contamination of soil in nearby area. Contamination of soil can happen only during accidental cases or in case of improper management. The primary soil quality monitoring results shows that, nearby soils were not contaminated (*Refer: Section 4.5.5*) with heavy metals and other contaminants. Considering the Project embedded control measures, contamination of soil can happen only during accidental cases or in case of improper management. The potential impact on soil quality is thus assessed to be **Minor**.

541. Mitigation Measures: The following mitigation measures will be implemented:

- Ensure proper spill control and management at site;
- Monitor and detect any contamination on soil & ground water;
- Good housekeeping to prevent spillage and runoff from site;
- Ensure the disposal of waste into designated storage and disposal area.

Impact	Soil quality impact due to operational activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

542. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, significance of impact on soil quality during operation phase of the Project is assessed as **Minor.**

5.3.4 Potential Impact on Physiography & Drainage

Construction Phase

543. *Impact Sources*: The potential impact on physiography and local drainage may arise due to:

- Grading of land at CTMS site;
- Laying of spur pipeline along the agricultural land; crossing of drainage channels/ nalas (minor drainage streams), etc.

544. *Embedded Controls*: The Project embedded control measures are as follows:

- Storm water drainage structure will be provided to drain all the surface runoff into the sea.

545. *Impact Assessment*: The proposed land based CTMS facility is situated near *Napura, Banshkhali.* The topography of the CTMS site is almost similar to that of the surrounding area. The ~16 km onshore buried pipeline laying will be done through HDD technique with limited excavations at some locations resulting in low and temporary impact on micro-drainage. In the beach area the depth of pipeline will be maintained below 3 m from ground level. The earth work (stacking of soil and drill cutting) involved along pipeline route due to excavation, if are not properly cleared, micro-drainage of the area may be disturbed. Physical presence of land based facility would be for the entire life cycle of the project (long term). The impact on topography and drainage assessed to be **Moderate.**

546. *Mitigation Measures*: The proposed mitigation measures are as follows:

- Provide adequate drainage system for the CTMS land based facility to maintain the micro-drainage of area;
- Reclaim and reinstate the land after completion of the pipeline laying;
- Maintain the cross drainage structure along the pipeline route.

Impact	**Physiography & Drainage Impact during Construction Phase of Onshore Project Components**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

547. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of impact on topography and micro drainage during construction phase is assessed as **Minor.**

5.3.5 Potential Impact on Air Quality

Construction Phase

548. *Impact Sources*: Potential impact on ambient quality could arise due to:

- Emission from construction power generation through diesel generators;
- Site development and emisssions from vehicles and machinery engaged for construction purposes including construction material transport;
- Construction material storage, handling and construction waste disposal;
- Operation of diesel generator (DG) sets.

549. *Embedded Controls*: project embedded control measures are as follows:

- Vehicle, equipment and machinery used for construction would conform to applicable emission norms.

550. Impact Assessment: Power required for construction activities will be sourced from small DG sets (with cumulative capacity of ~1.0 MW spread along the section of the pipeline route). The operation of DG sets will generate the PM, NO_2 and SO_2. Exhaust emission from operation of machinery and vehicles are likely to contribute to air pollutant load (primarily particulate matter (PM),

NOx, SO_2, CO etc.). The pollutants, especially particulate matter, will be settled in areas surrounding proposed project site and this activity will be continuing along the entire duration of the construction phase. The major part of the construction material, i.e. fill material will be transported through water ways. Therefore, fugitive emission due to operation of vehicle will be lower compared to transport of entire construction material through roadways. The dispersion of these air pollutants may affect receptors viz. village settlements located in near vicinity.

551. The baseline air quality monitoring results shows that concentration of PM, SO_2, NO_2 was well within the National Ambient Air Quality Standards (NAAQS) indicating that the environment is not stressed (*Refer Section 4.14*). The generation of PM, SO_2, NO_2 from the above mention activities will not cause significant changes to baseline conditions or result in exceedance NAAQS. The duration of the construction activity will be short term (~12 months). During construction phase, there will be potential fugitive air emission from construction material handling, earth work, and emission from machinery and vehicles engaged for spur pipeline laying and CTMS site development. As HDD technique will be used for laying of pipeline, excavation work will be limited to select locations from where HDD will be performed. The emitted fugitive particulate matter will be generated in localized area which will settled in areas surrounding pipeline corridor, however this activity will be limited during the construction phase only. The impact is assessed to be of **Minor** significance.

552. *Mitigation Measures:* The proposed mitigation measures are as follows:

- The construction materials will be stored away from nearby human settlement so that the maximum possible distance between the stack yard and receptors is maintained. Further efforts will be made to maintain the stockpile against a wall or obstruction so that it works as a windbreak and fugitive emissions during strong winds can be avoided;
- During construction, the approach /access road will be kept clean, free from mud and slurry to prevent any entrainment of dust;
- Waste from construction site will not be burned;
- Location of construction material stockpiles will be sufficiently away from nearby worker's camps;
- All loading and unloading activities to be carried out as close as possible to the storage facilities;
- Proper handling of materials to ensure minimal emission of dust.

Impact	Impact on Air Quality due to Emissions during Construction Phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

553. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on ambient air quality during construction phase is assessed as **Minor**.

Operational Phase

554. *Impact Sources*: The sources of air emission in the offshore region include a) natural gas combustion pollutants from gas engines (1 operating + 1 standby) onboard FSRU of ~10 MW capacity through gas engine (dual fuel fired); 0.5 MW gas engine at jetty with optional diesel generator at the jetty; c) 0.5 MW captive power generation facility at CTMS site through gas engine with optional diesel generator.

555. The emissions from the captive power generation onboard FSRU and at CTMS will be primarily oxides of nitrogen (NOx), particulate matter (PM) and carbon monoxide (CO), considering that the plant will run with natural gas. Other source of air emissions will be Natural gas based Power Plant projects are the least GHG emitting plants and release lower quantities of carbon dioxide, the major greenhouse gas.

556. *Embedded Controls:* The Project embedded control measures are as follows:

- For operation of power plant, cleaner fuel (natural gas) will be utilized and adequate stack height will be provided.

557. *Impact Assessment*: The stack characteristics and emissions from the Project are presented in Table 5.5.

Table 5.5 Emission Estimation (Point Sources) with Stack Characteristics

Source & Location	Fuel Consu-mption kg/hr	Release Height (m) amsl	Exit Gas Velocity (m/s)	Exit Gas Temp (K)	Stack Dia (m)	Exit Gas FlowNm ^{3}/hr	Emission of Pollutants g/s (mg/Nm3)			
							NOx	CO	PM	SO_2
10MW Gas Engine (dual fuel fired) FSRU 378640.00 m E 2417560.00 mN	1175	35	16.7	623	1.5	52,670	2.98 (250)	2.60 (220)	Nil	Nil
Jetty DG Set 0.5 MW (625 kVA) 378673.00 m E; 2417450.00 mN	95.3	14	17.10	498	0.25	1870	0.7 (1350)	0.39 (750)	0.039 (75)	0.13 (250)
0.5 MW Gas Engine at CTMS 391919.00 m E 2425560.00 mN	59	15	17.7	498	0.30	2160	0.15 (250)	0.132 (220)	Nil	Nil

Source: Reliance Power; Note the stack attached to gas engines for onboard power generation is fixed on FSRU as per the currently information available.

558. *Prediction of Impacts:* Impacts due emission of air pollutants due to combustion of natural gas to the operation of onshore facility of the project were assessed by modelling projected emission rates of the proposed project. The assessment was performed by modelling projected emission rates in AERMOD. The terrain pre-processor of ISC-AERMOD View 9.4 model was used for preparation of Digital Elevation Model (DEM) for the entire study area. The output file consists of the x, y locations of receptors, mean sea level (MSL) elevation.

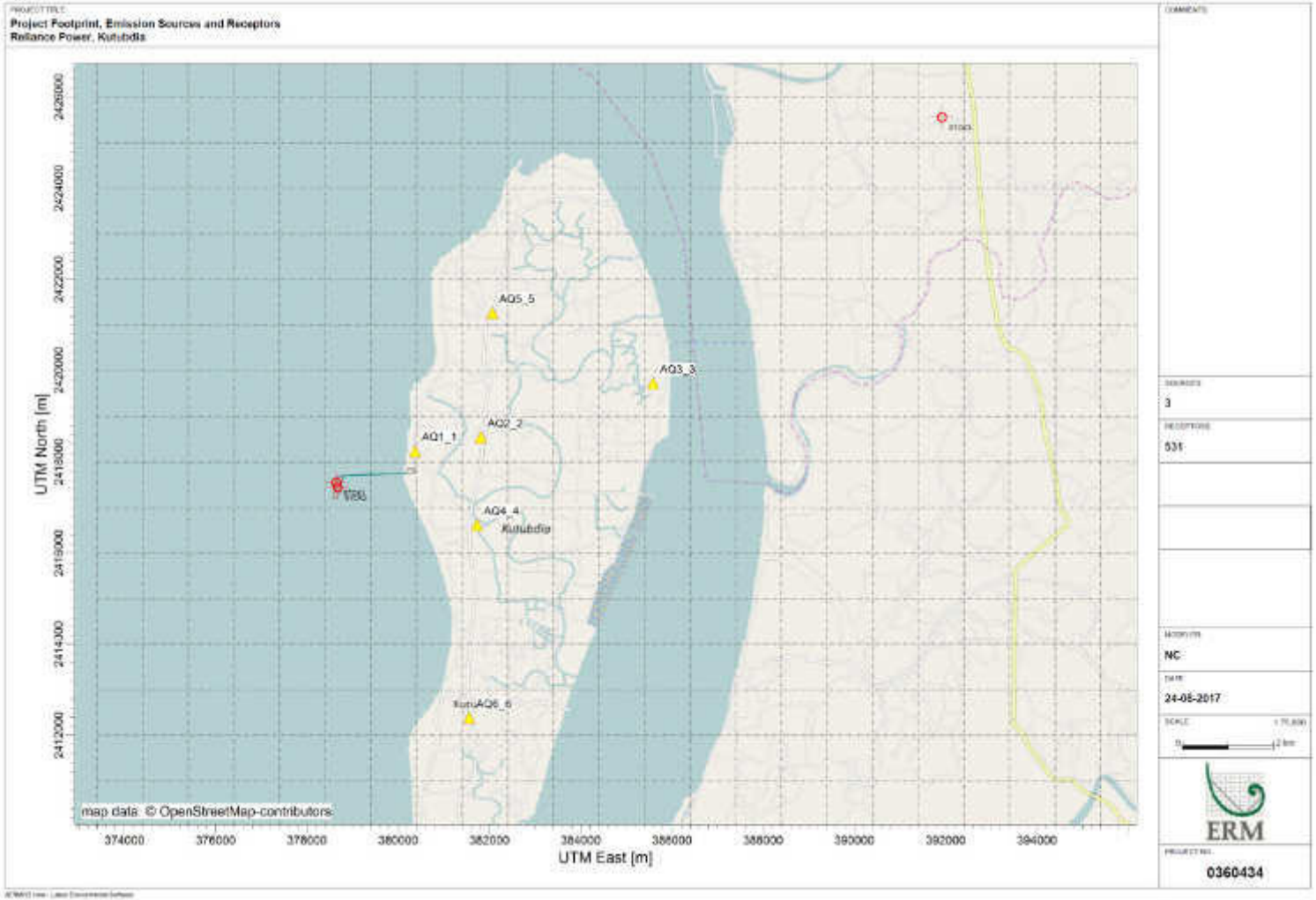
559. ISC-AERMOD View 9.4 model directly reads the output files created by the pre-processing programs and along with source information and predicts ambient air concentrations for a variety of pollutants and averaging periods ranging from 1-hour to annual.

560. **Meteorological Data:** S Surface meteorological data recorded from the *Kutubdia* Station of Bangladesh Meteorology Department (BMD) for year 2015 was used for the modelling exercise along with MM-5 processed data of surface and upper air for the year 2015 was used. The details of the same are presented in the baseline section. In order to develop the meteorological data for the model, AERMET pre-processor of AERMOD was used.

561. **Receptors:** The receptor grid or network, defines the locations of predicted air concentrations used to assess compliance with the relevant standards or guidelines. The following comprehensive fine and coarse receptor network was used for this analysis:
- 100 m x 100 m grid receptors of the entire project study area of 10 km radial zone from project centre; and
- 6 Discrete Cartesian receptors located within the study area, where baseline monitoring was carried out during the study period.

562. This network used Cartesian (X, Y) receptors with UTM coordinates. Base elevation of all the receptors were found using terrain elevations interpolated from SRTM (~30 m) Digital Elevation Model (DEM) data. The 6 discrete Cartesian receptor locations considered in this study are shown in ***Figure 5.3***. All these receptors are located within *Kutubdia* Island.

Figure 5.3 Emission Sources and Receptors



Analysis Results

563. Predicted maximum criteria pollutant concentrations (incremental) due to the proposed project in the study area have been presented in ***Table 5.6*** and shown in ***Figures 5.4 to 5.6.*** Ground level concentration isopleths of NOx are presented from to for short-term and long-term averaging periods.

Table 5.6 Predicted Incremental Ground Level Concentrations

S. No	Rece-ptor	Incremental Short-term Max. Concentration (µg/m³)						Incremental Long-term Max. Concentration (µg/m³)		
		NOx (1 hourly)	NOx (24 hourly)	CO (1 hourly)	CO (8 hourly)	SO2 (24 hourly)	PM (24 hourly)	NOx (Annual)	SO2 (Annual)	PM (Annual)
1	AQ1	23.2	2.2	12.9	2.7	0.33	0.10	0.14	0.009	0.003
2	AQ2	8.7	0.7	6.6	1.1	0. 10	0.03	0.06	0.003	0.001
3	AQ3	5.3	0.6	4.1	1.0	0.10	0.03	0.03	0.002	0.001
4	AQ4	14.4	0.9	8.0	1.3	0.13	0.04	0.08	0.005	0.001
5	AQ5	10.4	1.6	5.8	1.8	0.30	0.09	0.05	0.005	0.001
6	AQ6	10.4	0.9	6.6	1.4	0.13	0.04	0.04	0.004	0.001
7	Max. GLC*	55.1	22.7	30.7	18.6	4.22	1.27	3.66	0.653	0.196

Note: * Maximum GLC in all cases was observed at offshore locations and the nearest residential receptors are located at a distance of ~2.0 km towards east direction of offshore FSRU.

Analysis Results

564. For criteria pollutant (NOx), maximum predicted concentration is defined as:
- NOx short-term averaging (1-hour) – the highest concentration for each receptor and study area;
- NOx short-term averaging (24-hour) – the highest concentration for each receptor and study area;
- NOx -term averaging (annual) – annual average of ground level concentrations at the receptors and study area.

Table 5.7 Resultant Air Quality

S. No	Receptor	Baseline Air Quality of NOx (µg/m³)	Incremental Short-term Max. Concentration of NOx (24-hourly) (µg/m³)	Resultant Air Quality of NOx (µg/m³)
1	AQ1	13.33	2.2	15.53
2	AQ2	21.86	0.7	22.56
3	AQ3	15.21	0.6	15.81
4	AQ4	22.41	0.9	23.31
5	AQ5	28.28	1.6	29.88
6	AQ6	22.88	0.9	23.78

Applicable Standard: Bangladesh is not having any 24 hourly standards for NO_2. Only averaging period covered in the Ambient Air Quality Standard of Bangladesh is Annual Average, and the standard for NOx is 100 µg/m³. The IFC General EHS Guidelines/WHO AQ Guidelines for NO_2 annual average is 40 µg/m³ while for 1 hour it is 200 µg/m³

565. The increment NO_2 level due to air emissions will result in 1-hourly max value of 23.2 µg/m³ at the settlement (AQ-1) which is approximately 11.6% of IFC General EHS AQ standard of 200 µg/m³. The annual average concentration at the same location is 0.14 µg/m3 which is 0.35% of annual standard of 40 µg/m³.

While comparing with the national standards for annual NO_2 air quality, the same is 0.14% of 100 µg/m^3. The nearest human settlement is located at ~2 km from the FSRU location and the results clearly indicate that maximum ground level concentration appears at offshore locations. At onshore locations, where the baseline monitoring was carried out, the predicted concentrations were observed much lower than the maximum ground level concentrations. It is evident from that resultant short term air quality for 24 hours averaging period will be well within the applicable standard, as the resultant impact is much lesser than the annual average of 100 **µg/m^3**. Therefore, it is evident that due to the proposed project there will not be any significant adverse impact on air quality and the impact magnitude will be **Minor**.

566. *Mitigation Measures:* The proposed mitigation measures are as follows:

- The Project will adopt mostly use of natural gas in the gas engines (dual fuel fired) for captive power generation onboard FSRU which has a relatively high energy-efficiency and low polluting per unit of power produced compared to other thermal power plants;
- No onboard FSRU incineration will be taken up complying with the MARPOL requirement;
- Monitor ambient air quality in and around the Project site as per the Environment Monitoring Program formulated for the Project which will comply with National Regulatory requirements.

Impact	**Impact on Air Quality due to Emissions during Operation Phase**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Impact zone remains within 1 km radial zone from emission source.			
	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
	Nearest settlement (Ali Fakir Deil) located ~2 km from FSRU location.			
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

567. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on ambient air quality is assessed as **Minor**.

Figure 5.4 NOx - 1 Hourly Maximum Ground Level Concentration Isopleths

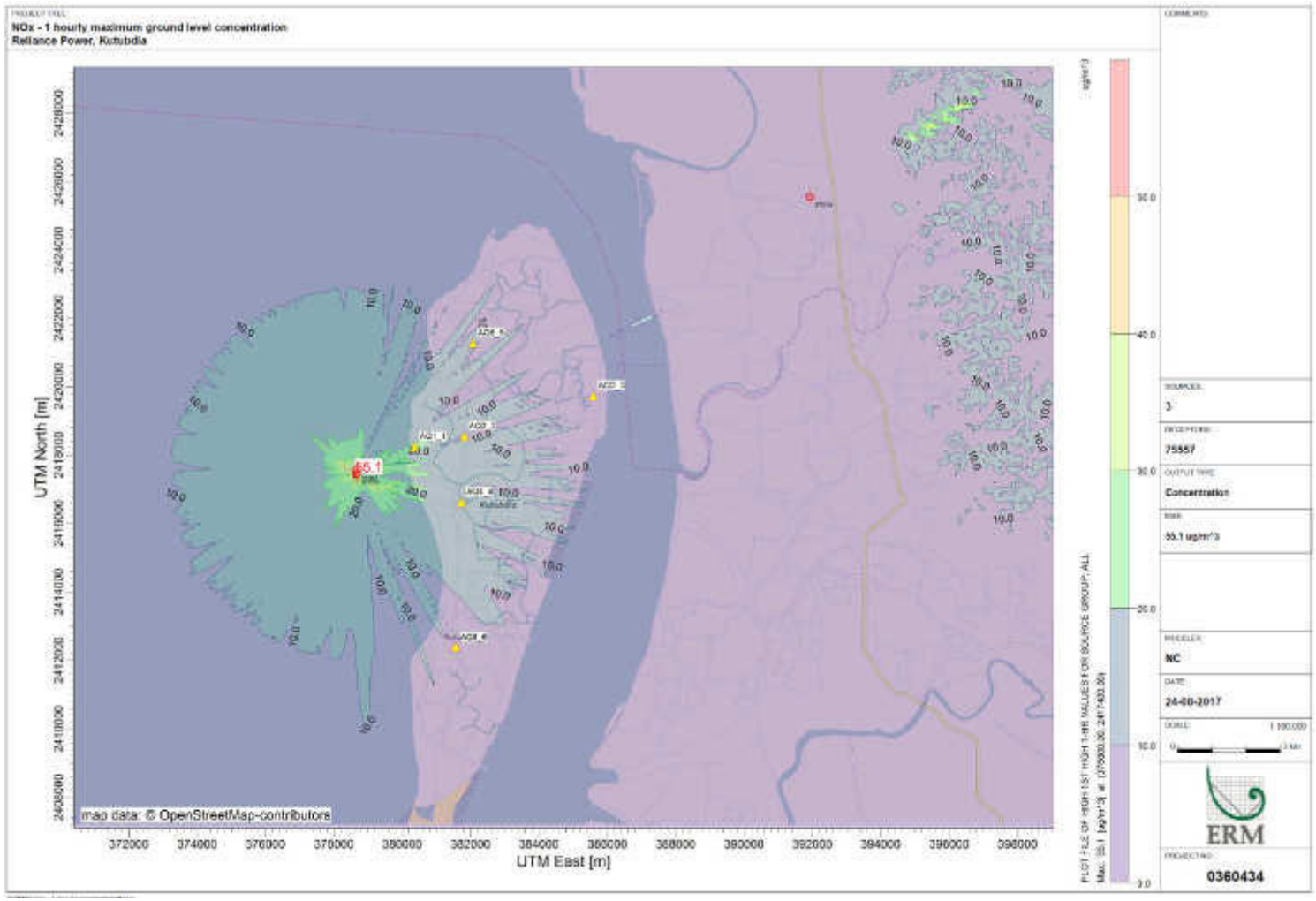


Figure 5.5 NOx – 24 Hourly Maximum Ground Level Concentration Isopleths

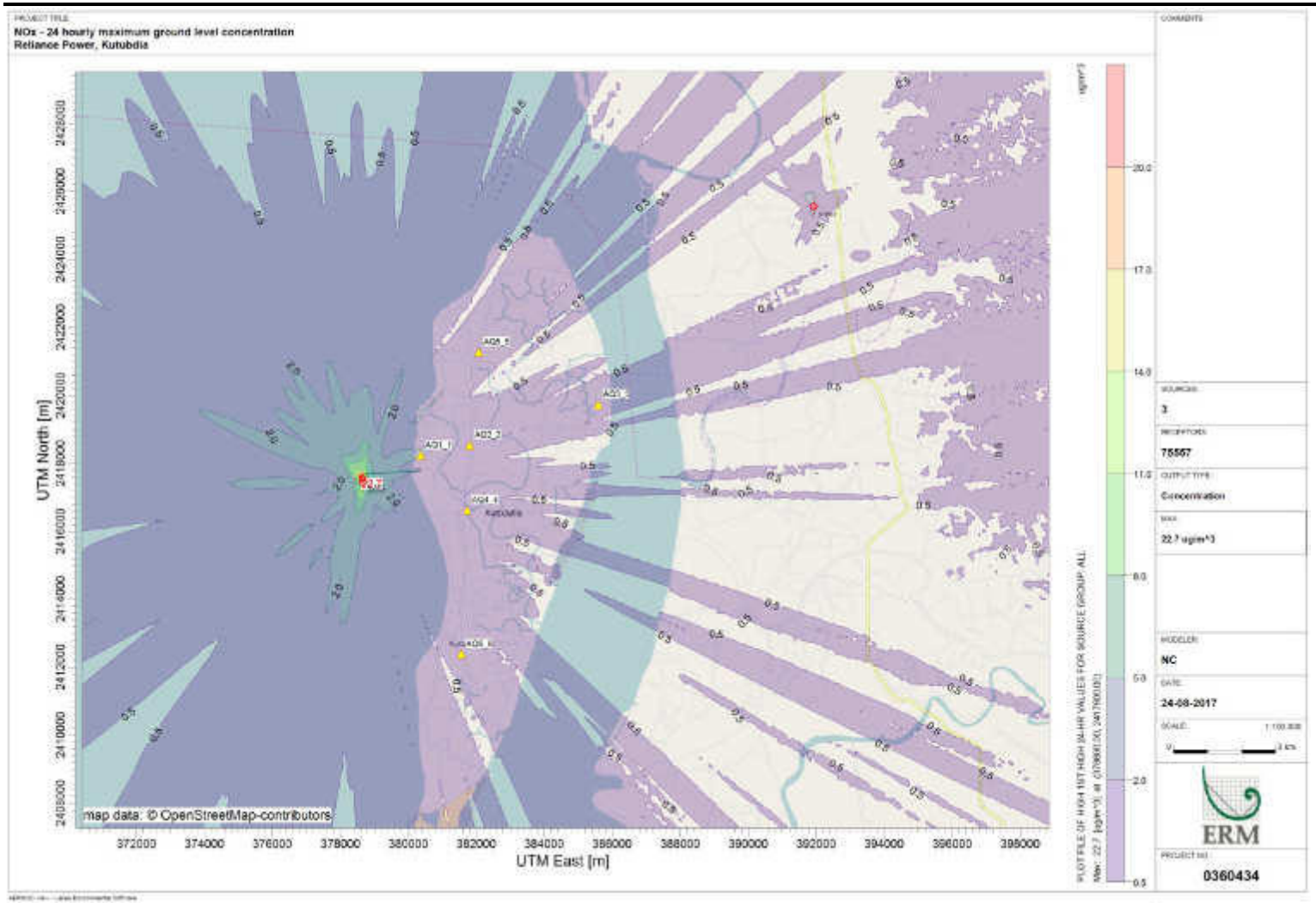
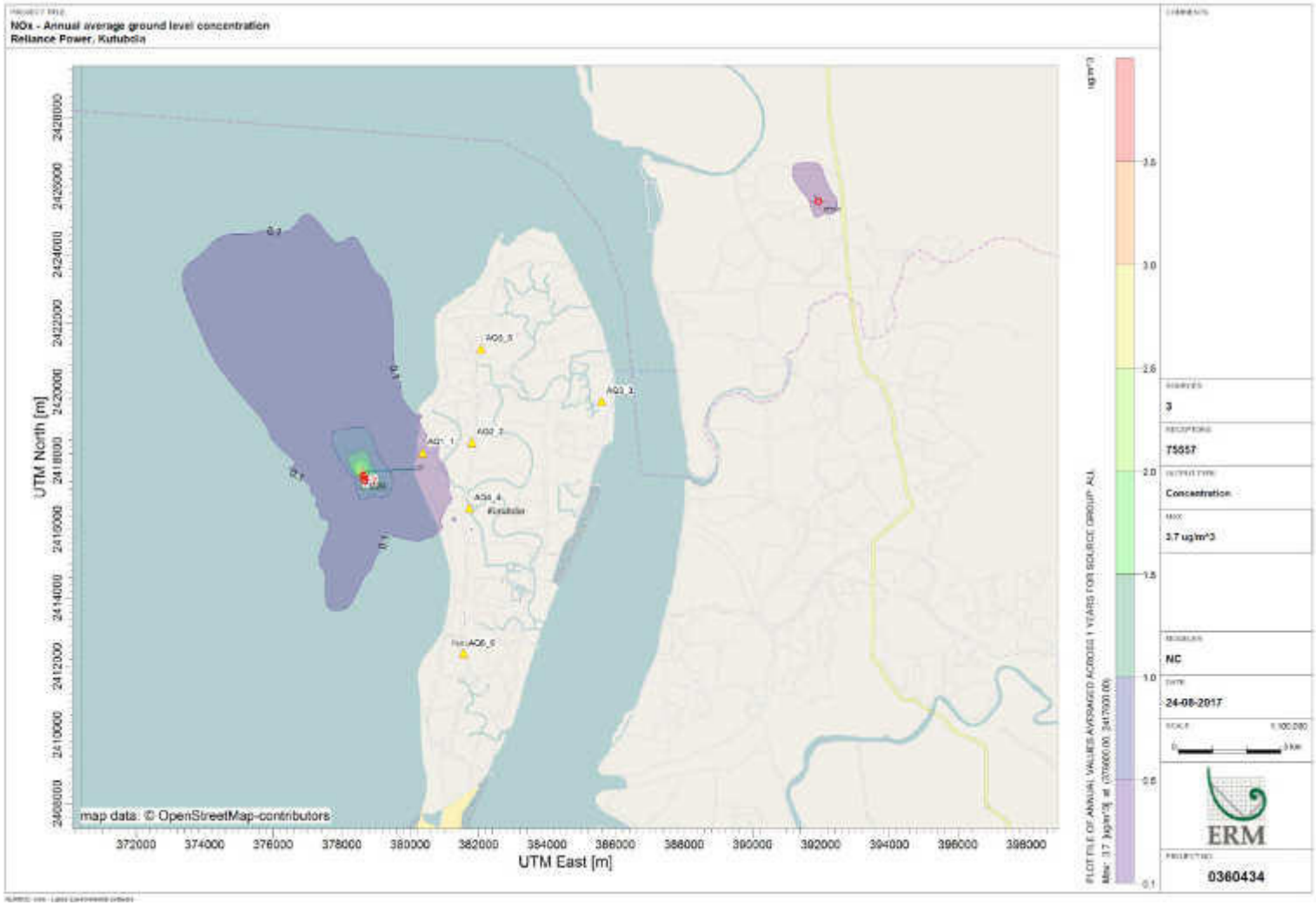


Figure 5.6 NOx - Annual Average Ground Level Concentrations Isopleths



5.3.6 Potential Impact due to Noise Generation (Onshore Project Components)

Construction Phase

568. *Impact Sources*: The potential impacts on noise quality may arise out of the following:
- Machineries and equipment along the pipeline corridor and at CTMS;
- Vehicular traffic;
- Construction power generation through diesel generators along pipeline route

569. Embedded Controls: Project embedded control measures include:

- Vehicle, equipment and machinery used for construction activities would conform to Bangladesh National noise norms.

570. Impact Assessment: The construction activities such as transportation of raw materials for civil works, operation of heavy equipment and construction machinery during laying of ~16 km of pipeline and erection of CTMS facility are likely to cause increase in the ambient noise levels in surrounding areas. The construction activity is a short term activity, i.e. ~12 months. The noise generated from the aforementioned activities may cause discomfort to inhabitants of the nearby villagers. The potential impact on noise quality during construction stage is assessed to be **Minor**.

571. Mitigation Measures: The proposed mitigation measures are as follows:

- Maintenance of vehicles and machineries to maintain the noise level;
- Provide noise barriers in the areas of high noise generation during pipeline erection and related construction activities at the CTMS site specifically in locations which are close to the inhabitants of the nearby villagers.
- Silent diesel generators sets will be usesd;
- Night time construction activities near settlements be restricted;
- PPEs will be provided to the construction workers.

Impact	**Noise Quality Impact due to Onshore Construction Activities**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

572. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on noise quality during construction phase is assessed as **Minor.**

Operational Phase

573. *Impact Sources*: Ambient noise during operation phase will be primarily generated from operation onboard FSRU from power generation unit, pumps and compressors. The location of the FSRU is proposed to be located more than 1.5 km away from any nearest settlement at Kutubdia Island, the likely impact of ambient noise on human receptors is likely to remain within the existing ambient noise conditions. The minor operations at CTMS site will result in ambient noise levels along the fence line within the applicable noise standards for day and night time.

574. Embedded Controls: Noise and vibration from the Project will be mitigated through engineering control and wherever possible high noise equipment will be enclosed in noise-proofed buildings that effectively contain the noise. It is planned that the Project will meet the noise emission criteria specified in the GOB ECR, 1997 as presented in ***Table 5.8.***

Table 5.8 Noise Emission Criteria

Location	Noise Level Limit (dB(A)	
	Daytime (0600 – 2100 hrs)	Night-time (2100 – 0600 hrs)
Industrial Area	75	70
Residential Area	55	45

575. Receptors: Since, all the receptors are residential and hence the receptor sensitivity is considered to be **Medium**.

576. *Impact Assessment:* The location of the FSRU is proposed to be located more than 1.5 km from any nearest settlement at Kutubdia Island, the likely impact of ambient noise on human receptors is likely to remain within the existing ambient noise conditions. The minor operations at CTMS site will result in ambient noise levels along the fence line within the applicable noise standards for day and night time. There will be no significant change in the resultant noise levels, however, localized disturbance will be caused at nearby receptors due to the Project related activities.

577. *Mitigation Measures:* The proposed mitigation measures are as follows:

- Comply with the noise emission criteria as per the Schedule 4 of ECR, 1997; Noise Pollution (Control) Rules, 2006 and noise guidelines prescribed in the General EHS guidelines of the IFC;
- Monitor ambient noise levels in and around the Project site as per the Environment Monitoring Program formulated for the Project which will comply with National Regulatory requirements.

- In case of any exceedance of noise levels at the fence line, identify noise sources, make provisions of noise reduction at source and provide noise attenuating barriers

Impact	**Impact on Ambient Noise Levels during Operation Phase**				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Maximum impact will be observed close to CTMS boundary.				
	Low	Medium		High	
Impact Magnitude	Negligible	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High		
	Settlements located within 500 m from the pipeline route & CTMS site.				
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large	
Impact Significance (With Mitigations)	Significance of impact is considered **Negligible.**				

578. *Residual Impact:* Considering the implementation of above mentioned mitigation measures, the significance of residual impact on noise quality during operation phase is assessed as **Negligible.**

5.3.7 Potential Impacts on Ground Water Quality

Construction Phase

579. *Impact Sources:* The spillage and seepage of chemical, oil and lubricants from storage area, waste handling area and generation of domestic waste/wastewater from construction labour camp may adversely affect ground water quality.

580. *Embedded Controls:* Provision of septic tank and soak pit at CTMS labour camp.

581. *Impact Assessment:* The existing groundwater quality analysis does not reveal any existing contamination or pollution of groundwater. The contamination of subsurface groundwater may happen due to accidental spillage of fuel, lubricants and chemicals from storage areas at the land based CTMS facility. Contamination of subsurface groundwater can also occur in case of frequent accidental discharges on open soil or unpaved areas. The same is also valid for the disposal of hazardous waste in site storage area/ disposal facility. The geographical extent of potential impact due to above activity is anticipated to be local and impact duration is expected to be short term. The sensitivity being **high**, as the water is unpolluted and provides services as drinking water, domestic uses (washing, bathing) for the region, the significance of impact on ground water quality without mitigation measures in place is assessed as **Moderate**.

582. Mitigation Measures

- Ensure proper spill control and management at site;
- Ensure storage of lube oil, chemicals, hazardous material and waste on impervious surface in covered shed provided with bunds and provisions of spill containment and periodically recover any spilled material and timely dispose of the waste in Hazardous Waste Landfill site;
- Monitor groundwater from time to time to detect any contamination.

Impact	Impact on Groundwater Quality due to Runoff and Spillage of Chemicals and Oil				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Low	Medium	High		
Impact Magnitude	Negligible	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High		
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate**				
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large	
Impact Significance (With Mitigations)	Significance of impact is considered **Negligible**				

583. *Residual Impact:* With mitigation measures in place, the significance of residual impact on groundwater resource during construction phase is assessed as **Negligible**.

Operational Phase

584. Ground water may be contaminated from the operational area due to spillage of oil & lubricant or hazardous waste. The mitigation measures and impact will be same as in construction phase.

5.3.8 Potential Impact on Surface Water Quality

Construction Phase

585. Source of Impact: Potential impact on surface water quality could arise due to:

- Offhsore: During construction phase, sewage (black and grey water) of ~10 m^3/day will be generated during offshore jetty construction;
- Onshore: Generation and disposal of domestic waste water from construction camp;
- Onshore: Use of biocides and oxygen scavenging chemicals in hydrotesting water and its discharge.

586. *Embedded Control Measures*: The embedded control measures are as follows:

- Offshore:All sewage generated will be treated and disinfected onboard and disposed offshore beyong 3 nautical miles (nm) complying with the MARPOL requirements.
- Onshore: Provision of septic tank and soak pit to treat wastewater from labour camp proposed to be located at the CTMS site.

587. *Assessment of Impact*: Considering the embedded control measures in place for both offshore and onshore activities during construction phase, the impact of domestic wastewater will be minimized. Surface run offs from construction material storage area, construction waste storage areas, hazardous waste (waste oil, used oil etc.) and chemical storage areas may lead to pollution of receiving natural drainage channels etc. The proposed ~16 km onshore pipeline related will involve its laying using HDD technique with limited involvlement of earth work due to excavation, however there will be some stacking of soil and drill cutting which if not control will escape through surface runoff into the nearby water receiving bodies. This situation is likely to be more pronounced considering high rainfall received in these areas. The surface run offs may contain the high sediment load, oil residues, organic wastes, etc. This may adverse impact on water quality, which ultimately leads to impacts on aquatic ecology.

588. During construction phase, RBLTL will provide basic amenities sand sanitation facilities for workers at the construction site. The domestic wastewater will be treated through septic tank and soak pit. Therefore, sewage will not be discharged into the nearby surface water body.

589. No excavation of seabed material will be required, as the subsea pipeline ~2 km from FSRU to *Kutubdia* Island and 2.7 km subsea pipeline in the *Kutubdia* Channel will be laid through HDD technique, the disturbance to seabed sediments will be minimal. Construction of jetty near FSRU will involve piling work. The pile driving work in the seabed for construction of the jetty off *Kutubdia* Island will generate fine sediments and will also result in resuspension of sediments in water in localized area. This is expected to increase the turbidity of water and will have an adverse impact on surface water quality in the area surrounding the jetty. The turbid waters impact on aquatic ecology will temporily affect primary productivity. The leakage and spillage of oil and lubricants from machineries and equipment may also cause adverse impact on surface/marine water quality. The impact on aquatic ecology and benthos has been discussed in the ecological impact assessment section.

590. After pipeline laying, hydro-testing will be required. Hydro-testing wastewater if directly discharged into the *Kutubdia* Channel or nearshore will affect the water quality. Hydro-testing water generally characterized by high pH, turbidity, metals, oxygen scavengers like ammonium or sodium bi-sulphite etc, biocide residue etc.); this will ultimately affect the aquatic ecology as well as benthic ecosystem.

591. The *Kutubdia* Channel and near shore of *Kutubdia* Island is an ecological sensitive area in terms of fish habitat, breeding and nursing ground for fishes

and also habitat Olive Ridley Sea Turtle. The water quality of the river is fit for fishing (ECR 97 Use Class D) and also no major contamination was recorded (*Refer Section 4.8*) from the baseline monitoring conducted. The surface runoff from construction site, generation of suspended solid during piling, discharge hydro-testing water, spillage & leakage of oil and lubricate, etc., may cause perceptible changes in the existing baseline condition (by affecting TDS, TSS, BOD level, etc). The impact will be temporary in nature. The significance of potential impact on surface water quality during construction phase is assessed as **Moderate**.

592. *Mitigation Measures:* The mitigation measures are as follows:

- Provide temporary bunds around the piles of the earth work and drill cuttings.
- Restrict exvation activities during monsoon season;
- Channelize all surface runoff from the construction site through storm water drainage system and provide adequate size double chambered sedimentation tank;
- Prevent & mitigate spill of paint/fuel within the construction site;
- RBLTL will ensure that the hydro-testing water is treated before discharge into sea/channel conforming to DoE standards. As per the requirement of IFC EHS Guidelines for LNG facilities (April 2017), the required quality of treated hydro-testing water is to conform to the standards pH 6.0 to 9.0; BOD 25 mg/L; COD 125 mg/L, TSS 35 mg/L; Phenols 1.0 mg/L and priority pollutant metals (total) 5 mg/L; and chlorides 600 mg/L (average) and 1200 mg/L (maximum).

Impact	**Impact on Surface Water Quality during Construction Phase**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

593. *Residual Impact*: Considering the implementation of the above mentioned mitigation measures, the significance of residual impact on surface water quality during construction phase is assessed as **Minor.**

Operational Phase

594. Source of Impact

- Generation and discharge of gray & black, ballast water and bilge water from FSRU;
- Generation and disposal of domestic waste water from the land based facility
- Cold water and Machine cooling water discharges from FSRU vaporization of LNG

595. *Embedded Controls*: The control measures are as follows:

- Gray water and black water from FSRU will be treated, disinfected and temporarily stored in holding tank onboard FSRU before discharged offshore beyond 3 nm through service boats as per MARPOL requirements;
- The bilge water will be treated onboard to ensure oil content of less than 15 ppm before discharge into sea beyond 3 nm through service boats.
- The ballast water discharge will be done into sea only after ensuring that it is clean and segregated.
- All waste oil generated from bilge, slop and ballast water treatment will be collected and disposed of at the nearby Chittagong Port facility thus conforming to the requirement of MARPOL.
- No direct discharge of domestic /industrial waste water will be done into the sea near FSRU.
- The free chlorine concentration of the machine cooling seawater and cold seawater discharges will be maintained at levels less than the international norm of 0.2 ppm.
- At the onshore CTMS, a sewage treatment plant (STP) of capacity 2 m^3/day will be installed for treatment and disinfection before disposal for use in plantations at CTMS as per the requirements of DoE, Bangladesh.

Discharge of Industrial & Domestic Wastewaters

596. *Impact Assessment*: Black water (sewage) (2 m^3/day) and gray water of (8 m^3/day) will be treated, disinfected onboard and temporarily stored in holding tank before it is will be disposed offshore beyond 3 nm through service boats. Bilge water of 1 to 5 m^3/day will be treated (to 15 ppm of oil content) and temporily stored in holding tank onboard FSRU before disposed offshore beyond 3 nm through service boats. Any discharge with oil content is prohibited unless all exceptions are met under Annex 1 of MARPOL. Only clean and segregated ballast water will be discharged into sea. Considering the above mentioned embedded control measures in place onboard FSRU, the impacts due to discharge of sewage (black water), gray water, bilge and ballast water discharge will not pose environmental adverse impacts. Surface run off from oil storage waste handling unit (waste oil, used oil, etc.) may lead to the pollution of receiving water bodies. The surface run off may contain oil and lubricant, in case there is spillage from above mentioned areas. However, taking into account the provision of onsite drainage system with sedimentation tank, oil filters, etc., the pollution load is not expected to be significant.

597. Domestic waste water generated at CTMS will be treated in sewage treatment plant complying with the requirements of DoE and use of treated wastewater in plantation at CTMS.

598. *Mitigation Measures:* The mitigation measures are as follows:

- Ensure that the FSRU engaged will have valid certificates for marine pollution, thus complying with the requirements of MARPOL standards for the offshore operations. Any specific requirements by Department of Environment, Government of Bangladesh will be complied with for pollution related control measures.
- At CTMS, channelize all surface runoff from through storm water drainage system and provide adequate size double chambered sedimentation tank

Impact	Surface water quality impact due to operational activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

599. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on surface water quality during operation phase is assessed as **Minor.**

Cold Water & Machine Cooling Water Discharge:

600. *Impact Sources:* During operation phase, the FSRU option would involve use of sea water for vaporisation in the re-gasification process and for engine cooling. The intake point will be located on the eastern side of the FSRU while the discharge point will be located on the western side of the FSRU in open sea. There will be cold water discharge (maximum of 15,000 m^3/ hour) at 7 ºC less than ambient temperature and machine cooling water (maximum 3000 m^3/hour) at 4 ºC more than ambient will be discharged from engine room.

601. Both cold water and machine cooling water will be discharged offshore to allow maximum mixing of the thermal plume to ensure that the temperature is within 3 ºC of ambient temperature at the edge of the mixing zone as required under the International norms.

602. *Impact Assessment:* Separate simulations to consider worst case scenarios for cold water and machine cooling water discharge were done using Steady State three dimensional CORMIX model that relies on measured/ modeled ambient conditions to generate plume geometry. CORMIX is a United States EPA supported mixing zone model used for point source discharges. The model allows for evaluation of compliance with regulatory mixing zone standards. Scenarios were modeled using CORMIX by varying ambient velocity, temperature and salinity as following:

A) LNG Vaporizer Cold Water Discharge
- Discharge rate of 15,000 m^3/hour, 4.17m^3/sec with drop of 7 °C temperature below the ambient from single outfall pipe with assumed diameter of 1.5 m
- Horizontal discharge at 90° to the hull from 4 m above water surface;
- Considered discharge salinity the same as that of ambient salinity
- Average wind speed of 5 m/sec; and
- Ambient currents perpendicular to the discharge direction

B) Machine Cooling Hot Water
- Discharge rate of 3,000 m^3/hour, (0.833 m^3/sec) with increase of 4°C temperature above ambient from single outfall pipe with assumed diameter of 1.5 m
- Horizontal discharge at 90 to the hull from 4 m above water surface;
- Considered discharge salinity the same as that of ambient salinity
- Average wind speed of 5 m/sec;
- Ambient currents perpendicular to the discharge direction; and
- Heat loss coefficient of 64.4 and 100 W/m^2/°C used for ambient water temperature of 18 °C and 30 °C, respectively

603. The criteria adopted is to comply with the IFC Water Quality Standard of temperature change of 3 °C at 100 m mixing zone length from the discharge point in the water. ***Table 5.9*** covers the input parameters to the CORMIX model.

Table 5.9 Scenarios for LNG Vaporizer Cold Water Discharge

SN	CORMIX Inputs	Scenarios for LNG Vaporizer Cold Water Discharge							
		1	2	3	4	5	6	7	8
1	Discharge Flow m^3/hour (m^3/sec)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)	15,000 (4.17)
2	Ambient Temperature °C	18	18	18	18	30	30	30	30
3	Temperature change, °C	-7	-7	-7	-7	-7	-7	-7	-7
4	Effluent Temperature, °C	11	11	11	11	23	23	23	23
5	Effluent Salinity, ppt`	17.1	17.1	32	32	17.1	17.1	32	32
6	Ambient currents, m/sec	2.5	0.2	2.5	0.2	2.5	0.2	2.5	0.2
7	Wind speed, m/sec	5	5	5	5	5	5	5	5
8	Outfall diameter, m	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
9	Outfall discharge height,	4	4	4	4	4	4	4	4
10	Water depth at the site, m	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
11	Mannings coefficient	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
12	Ambient density, kg/m3	1011.6	1011.6	1023	1023	1008.4	1008.4	1019.5	1019.5
13	Discharge density, kg/m3	1012.9	1012.9	1024.4	1024.4	1010.4	1010.4	1021.7	1021.7
14	Discharge density increase	1.26	1.26	1.42	1.42	2.05	2.05	2.18	2.18

604. The outcome of the cold water discharge run through CORMIX model is shown in ***Table 5.10***.

Table 5.10 CORMIX Results of Cold Water Discharge

Scenario	Mixing Length in m at 3°C	Temperature change in °C at 100 m	Discharge Flow m^3/hour (m^3/sec)	Ambient Temperature °C	Temperature Change °C	Discharge Temperature °C	Discharge Salinity, ppt	Ambient currents, m/sec	Ambient Density, kg/m^3	Discharge Density, kg/m^3	Discharge Density increase
1	1.13	0.25	15000 (4.17)	18	-7	11	17.1	2.5	1011.62	1012.88	1.26
2	0.26	0.86	15000 (4.17)	18	-7	11	17.1	0.2	1011.62	1012.88	1.26
3	1.13	0.24	15000 (4.17)	18	-7	11	32	2.5	1022.98	1024.40	1.42
4	0.25	0.85	15000 (4.17)	18	-7	11	32.0	0.2	1022.98	1024.40	1.42
5	1.13	0.24	15000 (4.17)	30	-7	23	17.1	2.5	1008.37	1010.42	2.05
6	0.26	0.83	15000 (4.17)	30	-7	23	17.1	0.2	1008.37	1010.42	2.05
7	1.13	0.24	15000 (4.17)	30	-7	23	32.0	2.5	1019.48	1021.66	2.18
8	0.25	0.82	15000 (4.17)	30	-7	23	32.0	0.2	1019.48	1021.66	2.18

605. The above table shows that there will be temperature change 0.25 ºC to 0.86 ºC within 100 m from maximum discharge of cold water. The temperature curves and 3 D Plumes of cold water discharge using 8 scenarios are presented in ***Figures 5.8 to 5.9***. The discharge of cold water will be well within the permissible IFC standard of change of 3 ºC within 100 m of mixing zone from discharge location.

Figure 5.7 Obsereved Temperature Curves of Scenarios Run for Cold Water Discharge

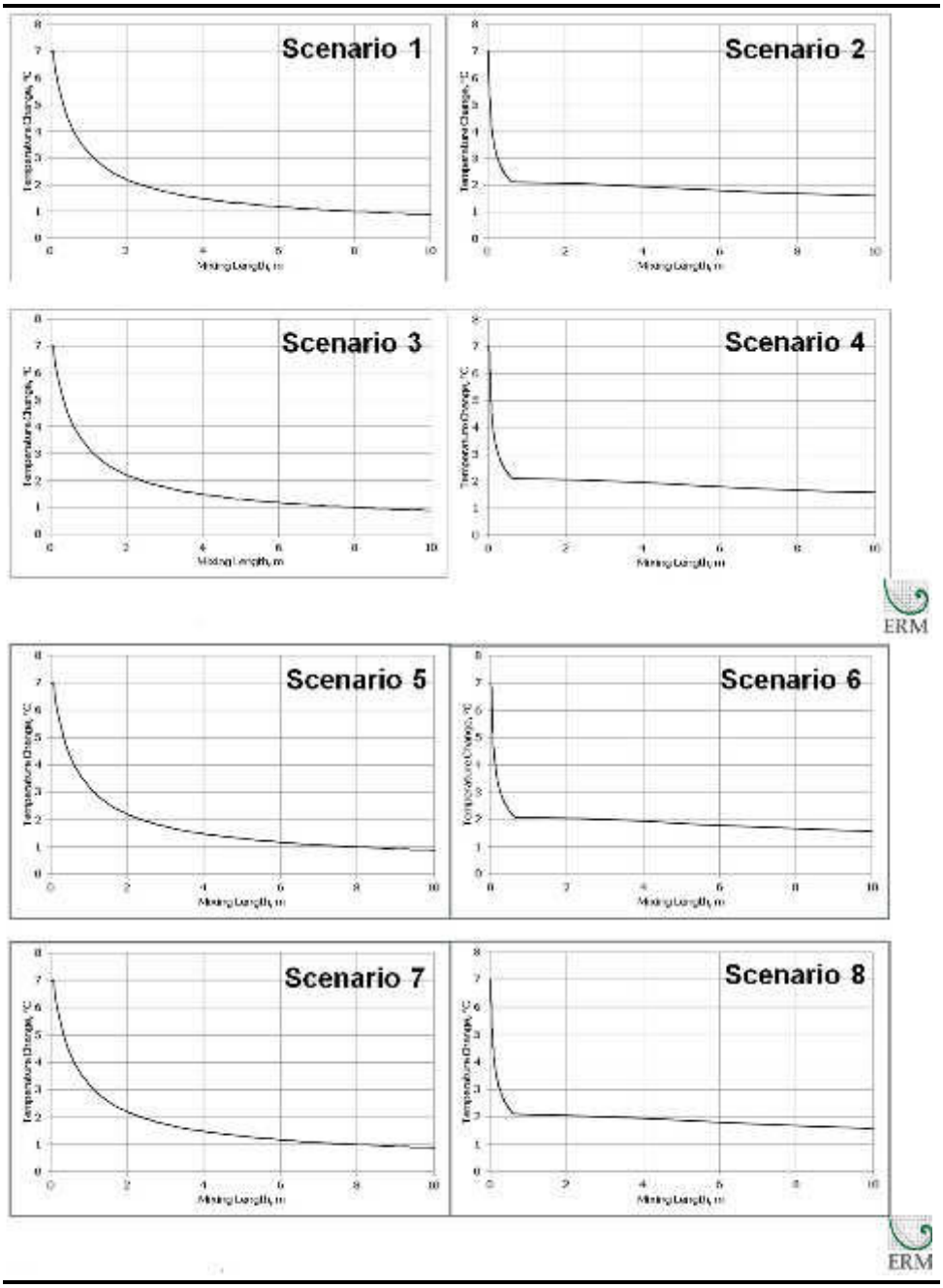
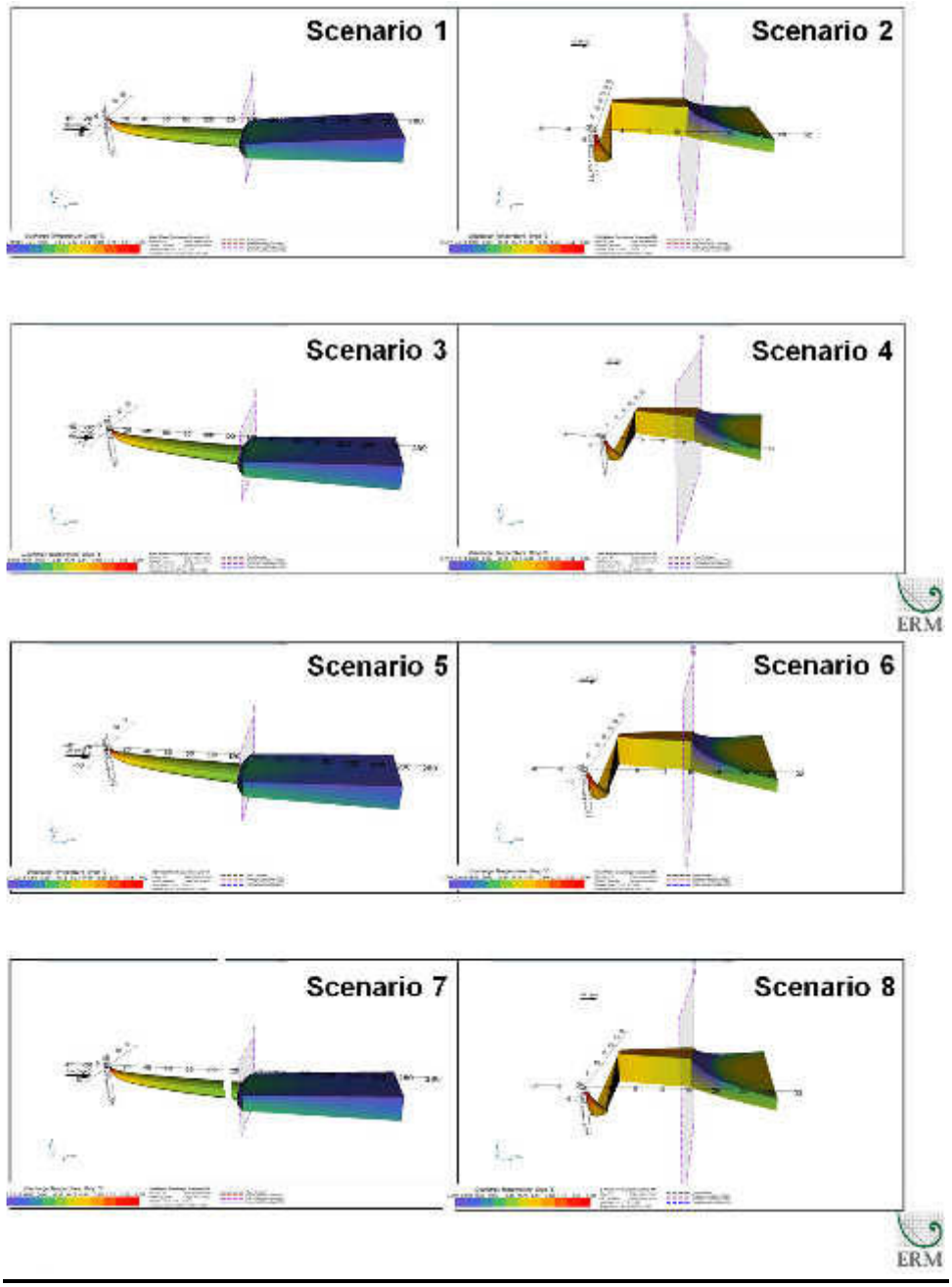


Figure 5.8 Observd 3D Plumes of Scenarios Run for Cold Water Discharge



606. The outcome of the machine cooling water discharge run through CORMIX model is shown in ***Table 5.11***.

Table 5.11 CORMIX Results of Machine Cooling Water Discharge

Scenario	Mixing Length in m at 3°C	Temperature change in °C at 100 m	Discharge Flow m^3/hour (m^3/sec)	Ambient Temperature °C	Temperature Change °C	Discharge Temperature °C	Discharge Salinity, ppt	Ambient currents, m/sec	Surface Heat Exchange W./m^2/°C	Ambient Density, kg/m^3	Discharge Density, kg/m^3	Discharge Density increase
1	0.12	0.10	3,000 (0.833)	18	+4	22	17.1	2.5	64.4	1011.62	1010.68	-0.94
2	0.01	0.20	3,000 (0.833)	18	+4	22	17.1	0.2	64.4	1011.62	1010.68	-0.94
3	0.12	0.10	3,000 (0.833)	18	+4	22	32.0	2.5	64.4	1022.98	1021.94	-1.04
4	0.02	0.20	3,000 (0.833)	18	+4	22	32.0	0.2	64.4	1022.98	1021.94	-1.04
5	0.12	0.10	3,000 (0.833)	30	+4	34	17.1	2.5	100.0	1008.37	1007.02	-1.35
6	0.02	0.19	3,000 (0.833)	30	+4	34	17.1	0.2	100.0	1008.37	1007.02	-1.35
7	0.12	0.10	3,000 (0.833)	30	+4	34	32.0	2.5	100.0	1019.48	1018.07	-1.41
8	0.02	0.19	3,000 (0.833)	30	+4	34	32.0	0.2	100.0	1019.48	1018.07	-1.41

607. The above table shows that there will be temperature change 0.10 ºC to 0.20 ºC within 100 m from maximum discharge of machine cooling water. The discharge of machine cooling water will be well within the permissible IFC standard of change of 3 ºC within 100 m of mixing zone from discharge location.

Figure 5.9 Observed Temperature Curves of Scenarios Run for Machine Cooling Water Discharge

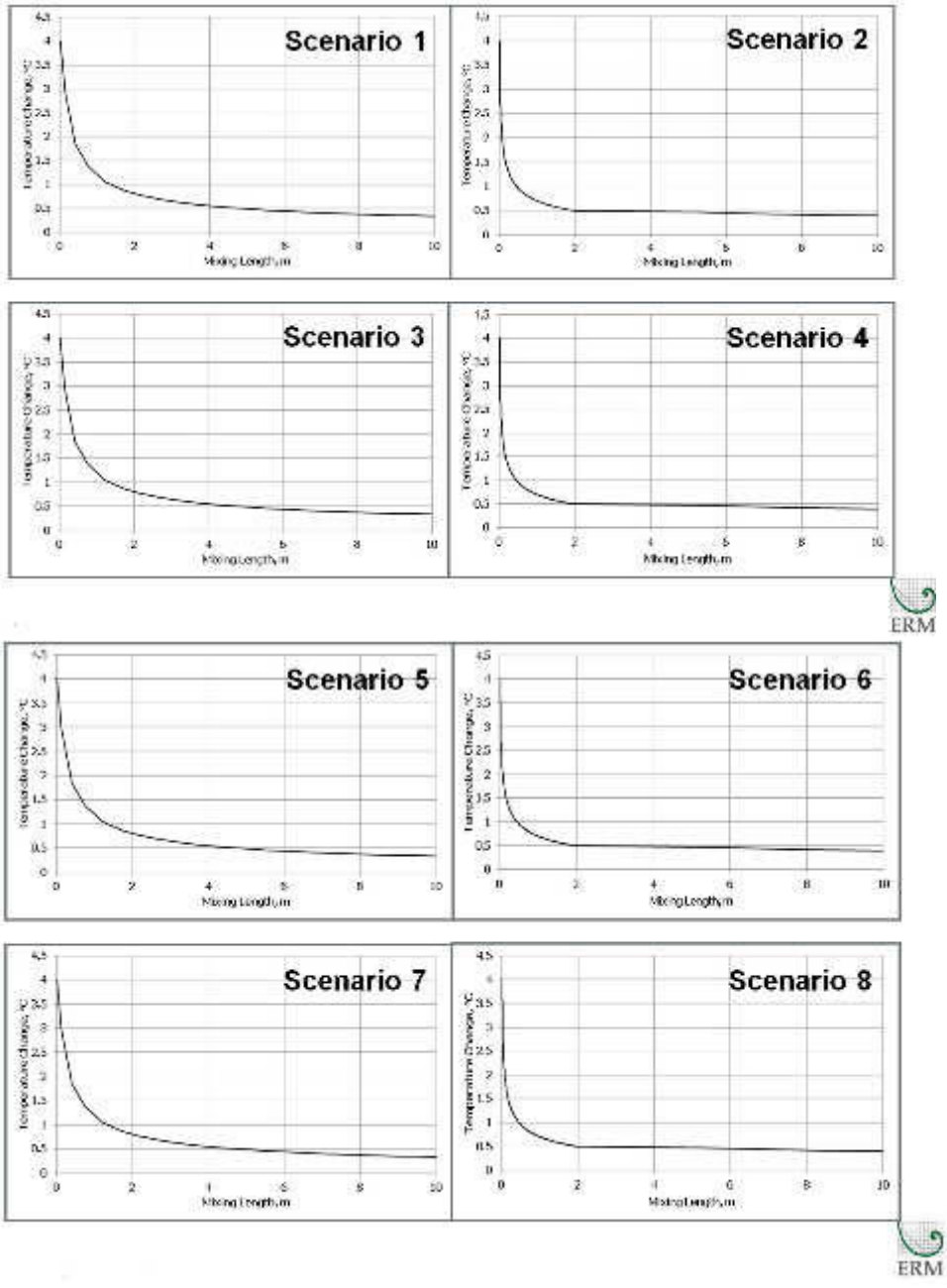
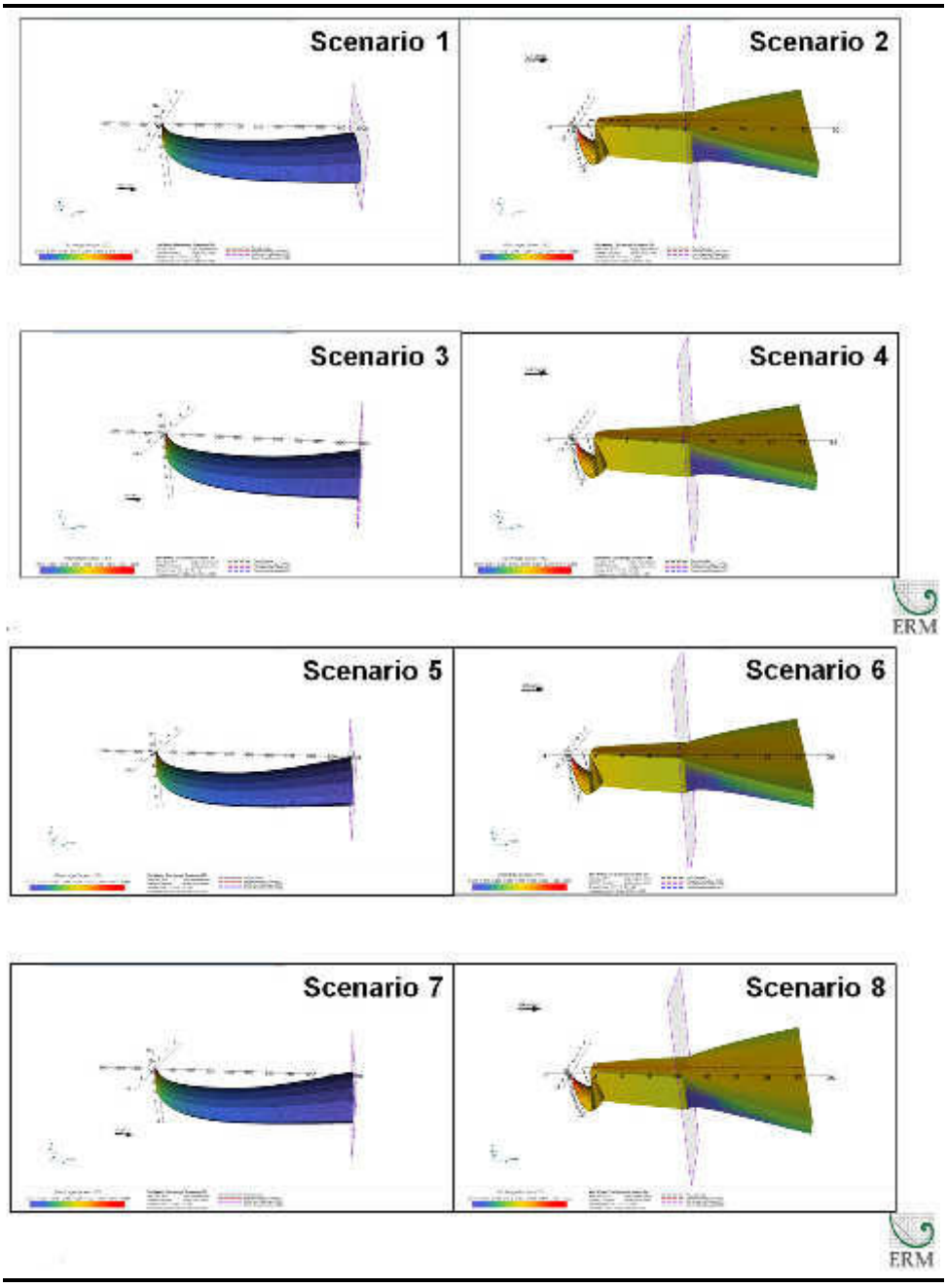


Figure 5.10 Observed 3D Plumes of Scenarios Run for Machine Cooling Water Discharge



608. *Mitigation Measures:* It is suggested to further minimize impact of cold and machine cooling water discharge, following mitigation measures to be followed:

- Prefer simultaneous discharge of cold and hot water streams thus allowing mixing before discharge, this will result in reducing the mixing zone length, hence minimize related impacts.
- Temperature checks to be performed regularly before discharge of cold water from LNG Vaporizer onboard FSRU.

609. From the above outcome, both discharge of cold water and machine cooling water will be well within the permissible IFC standard of change of 3 ºC within 100 m of mixing zone from discharge location. It is to be further noted that the above scenarios are run individually, however, when both streams are mixed (i.e. 18,000 m^3/hour) cold and machine cooling water discharged together, it will result in discharge at delta -5.4 ºC which will further reduce change of temperature in the mixing zone, thus restrict impact on marine biota due to minor change of temperature in the mixing zone. The receptors within the small mixing zone of 1.13 m will have impact of change in temperature of 3ºC or above. The receptors sensitivity within the small mixing zone has been considered as Medium. The significance of impact of cold water and machine cooling water will be **Minor**.

Impact	Impact of LNG Vaporizer Cold Water and Machine Cooling Water Discharge on Marine Biota.			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the significance of residual impact of LNG Vaporizer cold water and machine cooling water on marine biota during operation phase is assessed as **Minor.**

5.3.9 Potential Impact Terrestrial Habitat (Flora & Fauna)

Construction phase

610. Impact Sources:
- Vegetation clearance;
- Fugitive emission and deposition on vegetation; and
- Noise and vibration.

611. *Embedded Controls*: The control measures are as follows:
- Selection of pipeline route to minimize vegetation removal;
- Water sprinkling for dust suppression; and
- Provision of dust curtains to reduce the dust emission.

612. *Impact Assessment:* The vegetation clearance is expected to take place along the onshore pipeline route from *Kutubdia* Island to CTMS site at *Napura*. As per the baseline survey, no floral species were identified under threatened category. Mammalian species of concern in the area included, Large Indian Civet both listed Near Threatened as per IUCN Red List 2017.1. Among avifauna Red-breasted Parakeet listed Near Threatened as per IUCN Red List 2017.1. Among reptiles Spotted Pond Turtle (Vulnerable as per IUCN Red List 2017.1) and Indian Black Turtle (Near Threatened as per IUCN Red List 2017.1) were also reported from the area. The nature of the impact is negative and direct. The construction period is of ~12 months hence the impact duration can be assigned as short term. The impact will be mainly on the immediate pipeline route and CTMS site. The pipeline route has been selected to avoid its passage through mangrove plantation. The impact magnitude on terrestrial flora and fauna is small. Receptors sensitivity is medium because the species likely to be impacted are Near Threatened to Vulnerable as per the IUCN classification. The significance of impact of vegetation clearance for spur pipeline laying and CTMS site development would impact on terrestrial flora and fauna is assessed as **Minor.**

613. *Mitigation Measures:* The mitigation measures are as follows:

- Plantation of local species for stabilization of the filled in material and plantation at designated places along the pipeline corridor and at CTMS site; and
- Additional plantation to be carried out at areas identified in consultation with local forest department.

Impact	Impact on Terrestrial Habitat during Erection of Spur Pipeline and CTMS Site Development			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

614. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on terrestrial habitat, flora and fauna is assessed as **Minor**.

Operational Phase

615. *Impact Sources:* Limited adverse impacts on terrestrial habitats are expected from the Project during operation phase:
- Emission from operational plant
- Illumination, noise and vibration in both offshore FSRU location and onshore CTMS site.

616. *Embedded Controls:* During operation phase, RBLTL to develop plantations at designated places along the spur pipeline route and at CTMS.

617. *Assessment of Impacts:* Emission from the operational FSRU and CTMS, illumination, noise and vibration may cause disturbance to the local fauna. The impact can happen during the entire life cycle of the Project. Discussion of impacts on physical and biological receptors/resources has been discussed various sections above. The impact will be mainly on the immediate project area thus of extent would be local. Thus the impact magnitude on terrestrial flora and fauna is small. Receptors sensitivity is medium because the species likely to be impacted are Near Threatened to Vulnerable as per the IUCN classification. Based on the table below the impact of on terrestrial flora and fauna during operational phase of the project is assessed as **Minor.**

618. *Mitigation Measures:* The mitigation measures are as follows:
- To minimize potential impacts on ecology, RBLTL is to implement pollution control related mitigation measures and environmental enhancement measures.
- Maintain plantation done along the pipeline route, CTMS site and at other locations as identified in consultation with forest department.

Impact	Impact on Terrestrial Habitat during Operation Phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Negligible**			

619. *Residual Impact*: Considering the implementation of mitigation measures as suggested for pollution control and undertaking environmental enhancement measures by plantation within the Project components and surrounding areas, the significance of residual adverse impact on terrestrial habitat, flora and fauna is assessed as **Negligible.**

5.3.10 Potential Impact of Underwater Noise on Marine Fauna

Construction Phase

620. *Impact Sources:* The potential impacts on underwater noise generation on marine fauna will be due to piles driving for development of foundation of jetty. The sound pressure level (SPL) and sound exposure levels (SEL) expected during piles driving will be impulsive type that are likely to prevail for ~90 milliseconds with single strike per second in the shallow water of ~15 m depth. The underwater impulsive noise is expected to be SPL_{peak} of 225 decibel reference 1 micro pascal at 1 m (dB re 1µPa at 1m); SPL_{rms} of 210 dB ref 1µPa at 1m and SEL of 200 dB re 1µPa^2s.

621. *Impact Assessment:* During construction phase, there will be potential impact on marine fauna due to underwater noise generation mainly during pile driving activities for jetty construction at ~1.5 km from western shore of *Kutubdia* Island. The sound energy generated from source of pile driving due to hammering of piles into seabed propagates compression and transverse waves along the length of the piles into seabed through marine water column. Noise produced is typically broadband noise, with some low tonal peaks. The underwater noise levels expected to be generated from significant sources during the construction phase are described in ***Table 5.12.***

Table 5.12 Underwater Noise Levels Considered

SN	Underwater Noise Sources	Noise Source	Frequency (Range)Hz##	Assumptions
1	Pile Driving for jetty construction	SPL_{peak}: 225 dB re 1µPa at 1m SPL_{rms}: 210 dB ref 1µPa at 1m SEL: 200 dB re 1µPa^2s*	25 to 4,000 (62 to 10,000)	▪ Pulse signal - impulsive noise of ~90 milliseconds with 1 strikes per second ▪ Prevailing shallow water depth of ~15 m

Note# =Sound Pressure Level (SPL) Peak and Root Mean Square (RMS) are expressed on a decibel scale (dB) and referenced to 1 micro Pascal at 1 m from the source [dB re 1 µPa @ 1m]; The Sound Exposure Level (SEL) measured over a period of time SEL = SPLrms + 10 Log(T) where T is time in seconds.
= Sound frequency is expressed in Hertz. Only the approximate range of peak frequencies is presented, frequencies outside this range are likely to exist but be lower in sound level.
* = Pile driving data is sourced from Compendium of Pile Driving Sound Data prepared for The California Department of Transportation by Illinworth and Rodkin, September 2007. The data chosen is of Impact Hammer Pile Type of 0.6 meter (24-inch) AZ Steel Sheet Pile Type measured values of SPL peak of 205 dB re 1 µPa, SPL rms of 190 dB re 1 µPa and SEL of 180 dB re 1 µPa^2 s at 10 m from source in relative water depth of ~15 m.

622. *Criteria of Underwater Noise Levels:* Noise sources, if sufficiently loud, may be detrimental to certain marine species under some circumstances and may result in physical harm or behavioural changes as defined in ***Table 5.13***.

Table 5.13 Criteria Underwater Noise Levels applicable to Turtles & Cetaceans

SN	Marine Fauna	Criterion Underwater Noise Level	Possible Impacts	Reference
1	Turtles	SPL $_{peak}$: 224 dB re 1 µPa SEL: 198 dB re 1 µPa^2 s	Threshold causing injury from single or multiple blows.	Broner & Huber, 2010
		SEL: 183 dB re 1 µPa2 s	Instantaneous exposure and behaviour responses	
2	Marine mammals (Cetaceans)	SPL $_{peak}$: 224 dB re 1 µPa SEL: 183 dB re 1µPa^2. S	Instantaneous exposure Permanent Threshold Shift (PTS)	Southall et al (2007 pg. 443)

Note: It is to be noted that marine mammals are unlikely to intentionally approach operations producing continuous or semi-continuous sounds that are powerful enough to lead to auditory damage. At lower sound levels there may be behavioural changes such as changes in diving patterns and avoidance behaviour, particularly when the noise source is intermittent. Continued exposure often results in habituation to the sound, followed by a recommencement of normal behaviour. Marine mammals in the Project area are generally known to occur in water depths of 50 m and more, which is available beyond 50 km from FSRU location, however, sighting of cetaceans in shallow marine water cannot be ruled out.

623. *Impact Assessment - Underwater Noise Modelled Results:* The transverse waves and some of the ambient noise propagate through seabed into the sea water. Transmission loss of sound energy takes place spherically when it propagates uniformly in all directions in deeper regions whereas in shallow water, it propagates cylindrically. The sea water depth in the areas of pile driving for raising foundation of the proposed jetty is ~15 m. The intermediate noise propagation model has been considered to assess impact of underwater noise levels on prevailing marine fauna due to pile driving for jetty construction at the shallow water depth (~15m). It is also important to note that absorption of sound energy increases with the increase of frequency of the sound waves. Considering underwater noise source from pile driving as input to the noise model, the results obtained are presented in ***Table 5.14***.

Table 5.14 Underwater Noise Propagation: Pile Driving for Jetty off Kutubdia Island

Distance from Source, m	SPL dB re 1µPa		SEL dB re 1 µPa^2 s				Safe Range Observed
	Peak	RMS	Single Strike	10-min	1-hour	3-hour	
1 (source)	225	210	200	-	-	-	**Turtles and Cetaceans:** SPL$_{peak}$ 224 dB re 1µPa safe range is observed within 50 m. SEL 198 dB re 1 µPa^2.s is observed within 1 km from source. The SEL 183 dB re 1 µPa^2.s for behavioural changes is observed within 6.5 km from source.
50	199.5	184.5	174.5	201.5	209.5	214.5	
100	195.0	180.0	170.0	197.0	205.0	210.0	
200	190.5	175.5	165.5	192.5	200.5	205.5	
500	184.5	169.5	159.5	186.5	194.5	199.5	
1000	180.0	165.0	155.0	182.0	190.0	195.0	
2000	175.5	160.5	150.5	177.5	185.5	190.5	
5000	169.5	154.5	144.5	171.5	179.5	184.5	
6500	167.8	152.8	142.8	169.8	177.8	182.8	
10000	165.0	150.0	140.0	167.0	175.0	180.0	
25000	159.0	144.0	134.0	161.0	169.0	174.0	
50000	154.5	139.5	129.5	156.5	164.5	169.5	

624. From the table, the criterion injury threshold (applicable to turtles and cetaceans) of SPL $_{peak}$ of 224 dB re 1 µPa will remain within 50 m from source of pile driving activities. The criterion injury threshold of SEL of 198 dB re 1 µPa^{2}s will remain within 1 km from source. While the criterion threshold for

behavioural changes of SEL of 183 dB re 1 µPa²s will be observed within 6.5 km from source.

625. *Receptors Sensitiviy*: The near shore of *Kutubdia* Island is an ecological sensitive area in terms of fish habitat, breeding and nursing ground for fishes and also habitat Olive Ridley Sea Turtle. Cetaceans in general are observed in water column of 50 m and more, however, sighting of cetacean in the shallow marine water cannot be ruled out, the receptor sensitivity is considered to be **Medium**.

626. With the medium receptor sensitivity and small magnitude of impact, the impact significance without mitigation is assessed as **Minor**.

627. Mitigation Measures: The proposed mitigation measures are as follows:

- Generate low intensity impulsive noise prior to start of pile driving activities and ensure that any visible marine fauna moves away from the underwater noise source.
- Periodic monitoring of under water noise during pile driving activity
- Use of Big bubble curtain (BBC) – Based on the results of under water noise monitoring, if felt necessary, freely rising bubbles injected by perforated pipes encircling the pipe will be used, which reduces underwater noise propagation;
- Using High frequency - low energy piling technology

Note: The input of worst case noise levels were considered in the ESIA. Once the project design is finalized, RBLTL will develop necessary revision in the action plan prior to start of construction activities for its implementation during pile driving activities in concurrence with prior discussion with ADB.

Impact	**Underwater Noise Impact on Marine Fauna during Pile Driving**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

628. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual underwater noise impact on marine fauna during pile driving is assessed as **Minor.**

Operational Phase

629. *Impact Sources*: The underwater noise generation will be mainly from LNG cargo movement (particularly during arrival at and departure from the jetty). The expected underwater noise levels will be SPL_{peak} of 203 dB re 1µPa at 1m or SPL_{rms} of 185 dB ref 1µPa.

630. *Impact Assessment - Underwater Noise Modelled Results:* Considering the above mentioned underwater noise levels during operation phase of LNG Project at FSRU/jetty location as input to the model, the results obtained are presented in ***Table 5.15*** considering the criteria threshold levels as defined in ***Table 5.13***.

Table 5.15 Underwater Noise Propagation due to Cargo & Support Vessels Movement Operation Phase

Distance from Source, m	SPL dBre1µPa		SEL dB re 1 µPa² s				Safe Range Observed
	Peak	RMS	10-min	1-hour	3-hour	24-hours	
1	203.0	185.0	-	-	-	-	**Turtles and Cetaceans:** SPL peak of are not at all impacted at any distance from source. SEL 198 dB re 1 µPa2.s is observed within 100 m from source. SEL 183 dB re 1 µPa2s for behavioural changes is observed within 2 km from source.
50	177.5	159.5	183.5	186.5	191.5	199.0	
100	173.0	155.0	179.0	182.0	187.0	196.0	
200	168.5	150.5	174.5	177.5	182.5	193.0	
500	162.5	144.5	168.5	171.5	176.5	189.0	
1000	158.0	140.0	164.0	167.0	172.0	186.0	
2000	153.5	135.5	159.5	162.5	167.5	183.0	
5000	149.8	131.8	155.8	158.8	163.8	180.6	
6500	145.8	127.8	151.8	154.8	159.8	177.9	
10000	143.0	125.0	149.0	152.0	157.0	176.0	
25000	137.0	119.0	143.0	146.0	151.0	172.0	
50000	132.5	114.5	138.5	141.5	146.5	169.0	

631. From the above table, the criterion SEL of 198 dB re 1 µPa².s (threshold of permanent injury to turtles) is expected to remain within 100 m from source, while criterion SEL of 183 dB re 1 µPa² s (threshold for behaviour changes in turtles or permanent threshold shift in cetaceans) is expected to remain within 2.0 km from source. The underwater noise due to LNG cargo movement in the area with no sensitive habitats prevailing within the impact zone, and cetaceans generally prevail in 50 m and above water depth, however, their presence in shallow water cannot be ruled out, the impact of underwater noise generation from the LNG cargo and related vessels movement along the jetty location is assessed as **Minor**.

632. With the above defined **medium** receptor sensitivity and small magnitude of impact, the significance of impact of underwater noise on marine fauna is assessed as **Minor**.

633. Mitigation Measures: The proposed mitigation measures are as follows:

- Main cargo vessel and supporting vessels should use low speed to reduce underwater noise generation.

Impact	Underwater Noise Impact on Marine Fauna during Operation Phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

634. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, significance of impact on marine fauna due to the residual underwater noise during operation phase is assessed as **Minor.**

5.3.11 Impact on Aquatic/Marine Habitats

Construction Phase

635. Source of Impact: Following activities would result in impact on aquatic/ marine habitats

- Withdrawal of seawater for hydrotesting
- Surface runoff during erection of spur pipeline along identified route, discharge of hydro-testing water, spillage & leakage of oil and lubricate, from construction site;
- Noise and vibration due to pile driving activities (as discussed above);
- Movement of barges, tugs, support vessels for marine facilities construction; and
- Illumination causing disturbance to marine fauna.

636. *Impact Assessment:* The impacts are assessed based on sensitive receptor species as identified in ***Table 5.16***.

Table 5.16 Threatened Aquatic Fauna Reported in the Study Area

S N.	Scientific Name	Common Name	IUCN BD	IUCN Global
1	**Fish:** *Anoxypristis cuspidate*	Knife tooth Sawfish	-	EN
2	**Reptile:** *Lepidochelys olivacea*	Olive Ridley Turtle	EN	VU
3	**Mammal:** *Orcaella brevirostris*	Irrawaddy Dolphin	NT	VU
4	**Mammal:***Neophocaena phocaenoides*	Indo-Pacific Finless Porpoise	NT	VU

637. The withdrawal of seawater for hydro-testing of spur pipeline poses impact on small fish fauna by getting impinged through the intake water. Also any

discharge of untreated hydro-testing seawater in sea will pose adverse impact on marine fauna.

638. During construction phase illumination of activities like construction of offshore jetty, laying of subsea pipeline and movement of the vessels would result in illumination for performing construction at these sites.

639. Lighting can impact olive ridley sea turtle hatchlings (Karnad et al., 2009[1]) and adults (Witherington, 1992[2]). Sea turtle hatchlings naturally orient towards the sea using primarily visual cues. When artificial night-lighting is added to the landscape, this confuses the turtle hatchlings which are sometimes disoriented (follow a circuitous path) and often mis-oriented (move towards the artificial light instead of the sea), resulting in exhaustion, dehydration, greater risk of predation, and in all cases, death (Tuxbury and Salmon, 2005[3]). The turtles are more sensitive to lights which are in blue spectra (wavelength) of visible range.

640. Olive Ridley turtles (Lepidochelys olivacea) IUCN listed Vulnerable 2017.1 have been reported nesting in the western coast of *Kutubdia* Islands. The pipeline is passing through northern end of the west coast of *Kutubdia* Island also reportedly has turtle nesting sites with a potential of 180 individuals of turtles nesting annually. There is further requirement to establish the nesting frequency and sites of Olive Ridley Turtle on the west coast of *Kutubdia* Island. The Olive ridley nesting reportedly takes place from December to February in the region.

641. Other potential impact may be there due to collision of marine fauna - fish (Knife tooth saw fish), reptiles and mammals) with the moving vessels. Spillage of lube oil or motor gas oil during bunkering may also pose risk to marine life as well as to coastal avifauna. There is likelihood of dolphin/porpoise mortality/injury during due to Project construction related vessels movement off *Kutubdia* Island and in *Kutubdia* Channel.

642. Two species of cetaceans - Irrawaddy Dolphin (*Orcaella brevirostris*-IUCN Vulnerable 2016.v3) and Indo-Pacific Finless Porpoise (*Neophocaena phocaenoides)* listed IUCN Vulnerable ver (2017.1) have been reported off *Kutubdia* Island. These species are likely to get impacted due to various construction activities of the project such as construction of subsea pipeline from FSRU to northern part of *Kutubdia* Island. The marine dolphins reported are migratory species as per Appendix I of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), 8 Feb 2015. The population of individual dolphin species in the

[1] Karnad, D., Isvaran, K., Kar, C. S., & Shanker, K. (2009). Lighting the way: Towards reducing misorientation of olive ridley hatchlings due to artificial lighting at Rushikulya, India. Biological Conservation, 142(10), 2083-2088.

[2] Witherington, B. (1992). Behavioral Responses of Nesting Sea Turtles to Artificial Lighting. Herpetologica, 48(1), 31-39. Retrieved from http://www.jstor.org/stable/3892916

[3] Tuxbury, S. M., & Salmon, M. (2005). Competitive interactions between artificial lighting and natural cues during seafinding by hatchling marine turtles. Biological Conservation, 121(2), 311-316

study area is not expected to be greater than 1% of the global population of individual species. Hence it is not expected to trigger any critical habitats.

643. Surface runoff from construction site, generation of suspended solid during piling, discharge of hydro-testing water, spillage & leakage of oil and lubricate, etc., may cause perceptible changes in water quality and also can affect the aquatic habitat, turtles and dolphins cetaceans.

644. The impact extent is regional as the project induced activities covers a larger part of the study area than the project footprint. The impact duration is short term as the construction will be carried out for ~12 months. Impact scale will be medium as the impact will be reversible and likely to have minor change over baseline in due course of time. Impact magnitude thus assessed is medium and the receptor sensitivities are medium as species affected are of IUCN VU 2017-1, hence bear conservational significance. Based on the table below the impact on aquatic habitat is assed as **Moderate**.

Impact	Impact on marine fish due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			

Mitigation Measures

645. Following mitigation measures to be adopted to minimize impact of Project related offshore facilities construction:

- Withdrawal of seawater for hydrotesting is to be ensure with proper screen at the suction and maintaining low intake seawater velocity i.e preferably less than 0.15 m/sec (0.5 ft/sec), thus to avoid impingement of marine fauna.
- Also ensure the hydro-test water is treated before discharge as defined in the paragraph 591 (***Section 5.3.8***)
- Survey of dolphin sightings in the area; identification of months with higher activity; establishment of dolphin habitat if any in proximity to the Project area;
- Study on the frequency and area of occurrence of endangered Knife tooth Sawfish in the area with local fishery expert to be conducted prior to start of construction activities;

- Establishment of Turtle Nesting locations through Forest Department and Local NGO's. Support Local Forest Department and Local NGOs for in situ turtle nesting activities;
- Ensure provision of availability of spill control measures onboard the vessels viz. spill kits to be made available on site;
- To minimize impact of illumination, light sources used should be of low vapour sodium lamps or light of near red spectra region i.e. > 600 nm of wavelengths (Karnad et al, 2009).
- Provision of shading and shielding for lights thus to avoid spillage of light to beaches and nearby surrounding marine water during laying of subsea pipeline thus to avoid disruption of the hatchling movement;
- Switch off unnecessary lights especially during turtle nesting and hatching season.
- Minimize the vessel movement during the egg nesting months of December to March;
- Prohibition under contractual condition for poaching of turtle eggs by the construction workers. Adequate safeguard will be built in the contract of the EPC Contractor to prevent any poaching of turtle eggs by the construction workforce as well as to prevent any disturbance to aquatic habitats from construction activities;
- Implementation of air and noise (above water and under water) control measures as suggested under air and noise impact sections
- Proper spill control measures viz. spill kits to be made available on site.

646. <u>*Residual Impact*</u>: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on aquatic habitat is assessed as **Minor**.

Operational Phase

647. Impact Sources
- Spillage and leakage of fuel and lube oil;
- Movement of LNG cargo and support vessels; and
- Illumination at jetty and FSRU.

648. Embedded Controls
- Positioning of illumination lights in the Project facilities areas, thus avoid spillage of light beyond Project footprint;
- Intake of seawater for LNG vaporization and machine cooling water with proper screens to prevent impingement / entrainment / entrapment of aquatic life during sea water withdrawal.

649. <u>*Impact Assessment:*</u> As mentioned in the impact on marine animals during construction phase the cetaceans that are likely to get impacted even during operation phase are Knifetooth Sawfish (IUCN listed EN 2017-1), Olive Ridley's Turtle (IUCN listed Vulnerable 2017.1), Irrawaddy Dolphin (IUCN Vulnerable VU 2017.1), and Indo-Pacific Finless Porpoise (listed IUCN VU 2017.1).

650. Spillage/ leakage of fuel and lube oil from the FSRU, bunkering of marine gas oil by support vessels, discharge of cold water from FSRU operation etc may cause impact on marine fish - Knife tooth sawfish, Olive Ridley Turtle, marine mammals Irrawaddy Dolphin and Indo-Pacific Finless Porpoise. There is likelihood of mortality/injury of these species during operation phase due to vessel movement surrounding the jetty area.

651. The impact extent is local as the impact may happen in proximity to the jetty and surrounding areas. The impact duration in medium term as the above mentioned fish, turtle and cetaceans visits the area rarely. Impact scale will be medium as the impact will be reversible and likely to have minor change over baseline in due course of time. Impact magnitude thus assessed is small and the receptor sensitivities are high as species affected is globally endangered. The significance impact on the identified Knife tooth sawfish, Olive Ridley Turtle, marine mammals Irrawaddy Dolphin and Indo-Pacific Finless Porpoise aquatic habitat is assessed as **moderate**.

652. *Mitigation Measures:* The mitigation measures are as follows:

- Support Local Forest Department and Local NGOs for in situ turtle nesting activities and support government initiatives in terms of research and monitoring for Dolphin studies in the region.
- Ensure provision of availability of spill control measures onboard the vessels viz. spill kits to be made available on site;
- To minimize impact of illumination, use light sources say low vapour sodium lamps or LED lamps, light of near red spectra region i.e. > 600 nm of wavelengths (Karnad et al, 2009).
- Switch off unnecessary lights especially during turtle nesting and hatching season.
- There should be no flood lighting, up-lighting, or other forms of directional lighting aimed above the horizon at the FSRU.

Impact	**Impact on Sensitive Marine Fauna Receptors during Operation Phase**			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

653. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on aquatic habitats is assessed as **Minor**.

5.3.12 Potential Impact due to Land Acquisition

654. *Impact Sources:* The land required for construction (i.e. laying) of ~16 km long (30 inches diameter) high pressure gas spur pipeline (from *Kutubdia* Island to CTMS Valve Station no. 2 at *Napura, Banshkhali)* and CTMS will be ~50 acres. For operation and maintenance purposes out of ~50 acres, Petrobangla, Government of Bangladesh will acquire ~30 acres of land on permanent basis both for pipeline (~26 acres) and CTMS (~4.0 acres). The ownership of all the land required and acquired will lie with Petrobangla. Once land is acquired, it will be handed over to RBLTL on lease for 15 years for pipeline erection and subsequent operations and maintenance for supply of RLNG into the national gas grid.

655. The width of the land to be required for laying of pipeline will be ~ 15m along the pipeline route while for operation and maintenance it will be 8 m width along the pipeline route. The requisition and acquisition of land for the Project will be taken up as per the Resettlement Framework developed to comply with the requirements of national law [i.e. "The Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982" or acquisition of land and other assets through negotiated settlement based on consultations with affected persons (both title-holders and non-title holders] and of ADB's, Safeguard Policy Statement, 2009. The Resettlement Framework covers requirements to be followed to bridge the gaps between national law and ADB's safeguard policy statement.

656. Land Loss: The indicative route of the land required and acquired for pipeline route is shown in baseline section. The land requisition and acquisition will be as per ***Table 3.5*** (in ***Section 3***). The detailed chain-age wise description of land involved Daag/Khatia nos. wise is presented in **Annex 6** of this document.

657. Land for the gas spur pipeline construction and operation and for setting up of CTMS will be acquired by Petrobangla, Government of Bangladesh. The gas spur pipeline will be connected into the national grid of *Moheshkhali – Anwara* Section. The spur pipeline is expected to pass through *Uttar Dhurung, Chhanua* and *Puichhari* Union *Parishads* of *Kutubdia* and *Banshkhali Upazila* respectively.

658. With the setting up of the Project, the land use from agricultural and salt pan of the government land/ private land will be permanently converted into industrial land. Although the pipeline will be subsurface, no structural development would be permitted which may lead to loss of value for land. It is anticipated that during the construction phase the land owners will lose land due to land acquisition. Based on initial estimation (using 1991 census records), the land owners for permanent land acquisition (~26 acres for pipeline and 3.95 acres for CTMS) are expected to be 1,095 with likely 238 land parcels while for temporary land requisition (49.343 acres) the expected land owners will be 1782 with likely 387 land parcels. The land parcels taken as part of temporary land

requisition will be returned back to the land owners upon completion construction period (of ~12 months) of pipeline laying. Compensation will be paid to the land losers as per the Resettlement Plan to be prepared as per requirement included in Resettlement Framework covering the requirements of national law and ADB's SPS, 2009. It should be noted that the onshore pipeline corridor will pass subsurface (laid through HDD technique) sand beach (3 m below surface) portion of Dakshin Dhurrung and Uttar Dhurung Union Parishad. The sand beach portions of these two Unions are reclaimed land, which has no productive utility for the land owners. The compensation for the portion of reclaimed land will benefit the land owners. The ownership of permanently acquired land will remain with Petrobangla. Impact due to land loss is assessed to be **Moderate**.

659. *Mitigation Measure*: As a mitigation measure the land owners will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework.

- The process of land requisition and acquisition will be done as per the Resettlement Plan to be prepared as per Resettlement Framework complying with the requirements of national law and ADB's safeguard policy statement, 2009.

- A Resettlement Framework has been prepared. The requisition and acquisition of land for the onshore spur gas pipeline and CTMS will be executed and owned by Petrobangla. RBLTL will be given the land for 15 years for erection of pipeline and subsequent operations. The Resettlement Framework covers requirements to be followed by Petrobangla on compliance with national laws and ADB's Safeguard Policy Statement of 2009. Compensation arrangements for land acquisition, loss of crops and trees and income of all affected persons (APs) - are included in the Resettlement Framework.

- Consult the PAFS through the process and ensure that are able to participate in a free, prior and informed way.

- Provide access to an efficient /effective grievance redressal process

- The land owners those who will be losing land will receive cash compensation under the law (CCL); and

- Cash grant to cover the difference between cash compensation under law (CCL) and the replacement cost.

Impact	Loss of Land Ownership for the Pipeline Route and CTMS land			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	
Impact Extent	Local	Regional	International	
Impact Scale	Low	Medium	High	
Frequency	During construction phase of the project			
Impact Magnitude	Negligible		Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Moderate.**			

660. *Residual Impact:* As the loss of land will be permanent, the related significance of impact is considered as **Moderate**.

Fragmentation of Land

661. Parcels of land along the proposed gas spur pipeline may get temporarily fragmented due to the linear acquisition associated with the route of the gas pipeline. There may be creation of orphan lands [1]which may be rendered too small or unviable for cultivation both for agriculture or salt. Valuation of the land prices may decrease.

662. *Mitigation Measures:* As a mitigation measure it should be carefully assessed during socio-economic survey and Petrobangla should try to avoid creation of such orphan land parcels. If creation of orphan land parcels could not be avoided, the land owners will be appropriately compensated (to be compensated if remaining land is no longer viable) as detailed out in Entitlement Matrix in the Resettlement Framework with special focus on vulnerable households.

[1] Orphan land parcel is that land located outside of the normal compensation area but is made uneconomic by occupation or acquisition part of the plot. It is eligible for compensation. Compensation may be determined based on reviewing of the land parcel by Revenue Department or any Valuation Committee on cases to case basis if any land owner lodges a request.

Impact	Fragmentation of Land for Onshore pipeline			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Low	Medium	High	
Frequency	During the construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			

5.3.13 Potential Livelihood Impacts

663. **Construction Phase:** The land parcels that will potentially go for land acquisition are agricultural lands and salt cultivation fields as assessed form satellite imagery and from the Reconnaissance Survey Report for the RLNG pipeline route. The impacts on different stakeholder groups are assessed as following:

664. **Livelihood of Land Owners:** Owners and families deriving income from the land parcels involved in agricultural and salt pan activities for the pipeline and CTMS will be impacted due land loss, resulting in loss of their livelihood from the portion of the land to be acquired for the Project. Restriction on use of land for CTMS area will be permanent and lead to impacting their livelihood and income. The impacts due to land acquisition for CTMS could also be long term and in some instances lead to change in occupational pattern (like cultivator to agricultural wage labour, contract worker etc.) if any sharecropping family or land depended workers is unable to find alternate land/ salt pan. The requisition land will be returned to the land owners after construction and restoration. Disruption of income for the land owners will be temporary during laying of the pipeline. The land owners, whose land will be permanently acquired, can continue to use the land and generate income after construction of the pipeline is over - for agricultural and salt cultivation purpose with certain restrictions as agreed by Petrobangla. Compensation will be paid as per the Resettlement Framework for the permanent loss of privately owned land involved in the livelihood earning.

665. *Mitigation Measures*: The land owners for the onshore gas pipeline will face short term disruption due to laying of the pipeline. The Project affected people (land owners) for the terminal station valve 2 may face permanent livelihood loss but they can also invest the compensation money for buying land in other place.

Impact	Impact on Livelihood of Land Owners of land falling in Onshore Spur Pipeline Corridor and CTMS site at *Napura*			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	
Impact Extent	Local	Regional	International	
Impact Scale	Low	Medium	High	
Frequency	Construction Phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor.**			

666. <u>*Residual Impact*</u>: Considering the implementation of above mentioned mitigation measures, the significance of residual impact is assessed as **Minor.**

5.3.14 Sharecroppers, Lessee Farmers & Land Depended Groups Salt Pan Workers:

667. <u>*Impact Sources*</u>: Sharecroppers (if any) and salt harvesting workers cultivating along the onshore gas pipeline route and CTMS at *Napura* would have to discontinue their practice in the portion of land involved the pipeline route aand for CTMS once the construction activities start.

668. <u>*Impact Assessment*</u>:The land owners will receive cash compensation, transition allowance and they will also be allowed to take away the crops, also the affected employees and wage earners will receive cash grants as defined in the Entitlement Matrix in the Resettlement Framework. The impacts on crop productivity or livelihood losses for the land owner are expected during the construction period that is likely to last for a maximum of 12 months. Based on site visits on existing gas pipelines in the vicinity implemented by Petrobangla and discussions with the land owners along the pipelines recently constructed, it is confirmed that the private lands were available for continued use once the construction of the pipeline is completed and no permanent land losses are expected to the land owners due to the laying of the proposed gas pipelines. To ensure safety of the pipelines and for maintenance purposes, RBLTL will carry out consultations with the land owners informing them on restrictions to erect structures or plant large trees apart from allowing access to enable maintenance activities whenever required. Impact is assessed to be **Moderate**.

669. *Mitigation Measures*: Following mitigation measures will be in place:

- As a mitigation measure the share croppers, lessee farmers and the salt pan workers will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework. The land owners will be compensated for their standing crops and trees as per the entitlements detailed out in the Resettlement Framework;
- For lease holders and sharecroppers using the land parcel at least 60 days advance notice will be served so that they can harvest standing seasonal crops and collect the salts. If harvest is not possible they will be equivalently compensated;
- Unskilled labour during the project construction phase should be sourced from the local community;
- Training should be provided to the local people for their skill enhancement and their provisions as it will be provided in the Resettlement Framework.

Impact	Livelihood Impact on Share Croppers, Lessee Farmers and Salt pan Workers			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Nearby project area			
Frequency	During entire life of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

670. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact is assessed to be **Minor.**

5.3.15 Impact on Fishing Activity

671. Fishing is one of the primary livelihood options for the population of Kutubdia Island Upazila. The Kutubdia Island Upazila has 7,116 (as on 30th June 2016) registered fishermen and there may be additional 20% more unregistered fishermen according to the District Fisheries Officer; it makes the estimated amount of 8,500 fishermen in the island. The fishermen practice deep sea fishing (fishing during 15 to 20 days per trip), daily fishing (i.e. fishing during 24 -30 hours per trip) and foot fishing /shoreline fishing. Potential impacts on fishing activities are discussed in this section.

Construction Phase

672. *Impact Sources*: During construction phase ~2 km of subsea pipeline will be laid connecting FSRU/jetty to *Kutubdia* Island and further up to *Napura* through ~16 km onshore buried spur pipeline laid through horizontal directional drilling.

673. *Impact Assessment*: Fishing is one of the primary livelihood options of the inhabitants of *Kutubdia* Island. As per the Fisheries Department records there are 168 registered fishermen in *Ali Fakir Deil* Village and 23 fishermen in *Bindapara* Village in *Dakshin Dhurung* and *Kaiyarbil* Unions respectively that are adjacent to the project area. The fishermen practice deep-sea fishing, daily fishing, foot fishing/ shoreline fishing throughout the year as their livelihood means. The sand beach portion is used for anchoring of boats, fishing net drying and repairing, boat repairing, etc. There will be no impact on shoreline fishing for the fishermen of two nearby villages i.e. *Ali Fakir Deil* and *Bindapara* in terms of restriction on use of push nets and small setback nets (*choto behundi jal*). It was observed during several field visits to the site locations and had been reported during the consultations with fishermen of the adjacent villages and the key fisherman informant that shoreline finshing does not have any particular fishing ground. The fishermen often shift north and south of the location for better catch. Hence, the fishermen can continue to do fishing both during construction and operation phase. As no onshore structure at *Kutubdia* Island or close to *Kutubdia* Channel are proposed, hence no potential impact on shoreline fishing activities are anticipated during construction and operation phases of LNG terminal.

674. **Twin Berthing for FSRU and LNG Carrier:** The Floating Storage and Regasification Unit (FSRU) will be located in the Bay of Bengal, approximately 1.5 km from the north western shoreline off *Kutubdia* Island; it will have an exclusion zone of 500 m surrounding the FSRU/jetty for security and safety reasons. This may not directly impact fishing activities but they may have to sail further west or south-west for daily fishing. There could therefore be some minor disruption in existing fishing boat movements. As per the fishing routes mapped by the fishermen during stakeholder consultations shows that they take a south-west route or north-west route, while sailing for deep-sea fishing or daily fishing. The modelling of the cold water and machine cooling water discharge confirms that there is no appreciable decrease or increase in temperature in the worst-case scenarios within 100m of the mixing zone from the discharge location and therefore livelihood impacts on fishing communities are unlikely. Construction related impacts on livelihoods of fishing communities carrying out on-shore fishing and deep sea fishing activities along the ~2 km subsea pipeline is not expected as the pipeline will be laid through horizontal directional drilling underneath the seabed, without the need for (i) exclusion of fishing activities for the period of construction and operation; (ii) restriction of movement of fishing vessels, and (iii) access restrictions to the fishing grounds or traditional fishing routes. However, detailed livelihood impacts will be assessed including any restrictions on fishing and required measures to be developed in the Resettlement Plan. No impact on fishing activities in deep sea are anticipated both during construction and operation phases.

5.3.16 Conflict with Local People

675. Consultations in the neighbouring villages indicate that the people in the area look forward to new employment to be generated by the project. Even though RBLTL/its contractors would endeavor to provide maximum employment to the local people, there would be constraints due to the lack of required technical skills and expertise in the local population. So, certain percentage of semi-skilled and highly skilled migrant labour would be used by contractors for manning these activities. It is anticipated that occasional conflicts would arise with the local community over the recruitment of migrant workers. Conflicts with the local population are also likely due to the cultural difference between migrant workers and nuisance caused by workers due to improper sanitation facilities etc. However these may be managed with good labour practices. Since the conflicts can cause temporary disruption in work, the impact is considered to be of **Minor** significance.

676. Mitigation Measures
    - Communication in the affected villages during the construction phase and the installation of an effective grievance redressal mechanism;
    - Migrant labours would be provided training on local culture and traditions.

5.3.17 Community Health and Safety

677. The community health and safety impacts may arise due changes in environmental quality, influx of non-resident workers to the area and additional river traffic movement.

Construction Phase

Dust and Noise Discomfort

678. Proposed land for pipeline route and CTMS site will cause disturbance to inhabitants residing close to site and access roads will get affected due to noise and dust generated from vehicular movements, site preparation operation of machineries, construction activities. Water sprinkling on the access roads and at the construction sites would reduce dust emissions considerably. To reduce noise related impacts, project vehicles should not blow horns near settlements and the night time movement of vehicles and construction activities will also be restricted.

679. Construction materials and heavy equipment used during the construction phase will be brought into the site through barges using the water ways. Though it will not cause any traffic congestions on roads and possible disruption to the community usage of roads – however, it will increase inconvenience to community in terms of air and noise pollution caused by due to pipeline laying during construction phase.

680. Impacts, risks associated with access to waterways are comparatively lesser and the only identified impact is with respect to spillage and seepage in the sea due to lubeoil movement and handling and unloading/bunkering of fuel (diesel/marine gas oil). As there will be subsea pipeline thus eliminating earlier proposal of trestle for pipeline and onshore regasification the potential risk to the fishing boats and the fishermen involved in shoreline fishing are eliminated.An exclusion zone of 500 m will be maintained surrounding FSRU/jetty, which will furthere eliminate potential safety risk to fishing boats.Potential societal risks will get attenuated due the proposal of subsea and subsurface (2 m below ground level) gas pipeline for its entire route. Adequate mitigation measures as outlined in the ESMP will be implemented to prevent and minimize impacts on community health and safety.

681. Mitigation Measures
- Water sprinkler system should be installed for dust suppression;
- High noise generating construction should be suspended during night hours.

Impact	Impact on community health & safety due to dust and noise generation			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Negligible**			

682. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on community health and safety is assessed as **Negligible.**

Transmission of Infectious Diseases

683. Approximate 500 workers will be employed during the construction phase of the project and it is anticipated that about 25% of the workers would be non-locals. The influx of workers to the community may cause impacts to public health, especially an increase in prevalence of diseases. Influx of migrant labours during construction can cause mixing of the migrant workforce with the local people. This mixing of the groups may cause some adverse impacts to public health in the neighbouring villages with the potential for spread of infectious diseases like as AIDS.

684. Improper sanitation facilities and disposal of municipal solid waste in the construction labour camps can also trigger vector borne diseases. Measures such as proper collection, storage and disposal of wastes, construction of septic tanks to prevent contamination of water resources from sanitary effluents generated from labour camps will be implemented. Taking these measures into account, the impact to public health and safety is evaluated to be of **Minor** significance.

685. Mitigation Measures

- Labour Camp is planned to be located at CTMS site away from nearby village
- Restricted access of local villagers in the labour Camp
- Movement of migrant labourer with in the villages should be restricted
- Waste generated from labour camp should not dump with in the villages
- Waste water generated from labour camp should not discharged within the village

Impact	Impact on Community health & safety due to transmission of infectious diseases			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Minor**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Negligible**			

686. *Residual Impact*: Considering the implementation of above mentioned mitigation measures, the significance of residual impact on community health and safety is assessed as **Negligible.**

5.3.18 Employment Generation

687. The construction phase of the project is likely to generate both direct and indirect opportunities for employment. The estimated direct employment would be approximately 200 un-skilled workers during the peak construction phase which will primarily source form Island. In-direct employment would be primarily in the supply chain as vendors which are anticipated to be set up to support the construction. The local people are expected to be having options for such in-direct employment, even if they are not directly involved as construction labour. Overall construction activity would have positive impact on the socio-

economic conditions in general and employment scenario in particular in the study area.

Impact	Employment Generation during construction				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.19 Demand for Lodging, Housing and Civic Services

688. Employment opportunities created by the project is expected to attract large number of people from outside the district. The in-migration of long term or permanent staff will create demand for permanent housing and other support services. There would be requirement of housing and other amenities even though the project will provide on-site lodging facility. This is expected to drive up the demand for housing and supply of other support services in turn resulting in the development of adjoining areas and having a positive impact on the quality of life in the area.

Impact	Demand for lodging, housing and civic services				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.20 Benefits of Community Development Activities / CSR Activity

689. Once the proposed LNG Terminal has established its social license to operate in the community, the continued sustenance of community relations will require the project proponents to engage in community development initiatives among the project affected villages as per needs and priorities identified by opinion leaders of the community. The Upazila and Union Parishad administration can also identify priority areas for social investment that the company would be requested to contribute to. The initiatives of the project proponents are likely to be focused on livelihood restoration, income generation, education and provision of health facilities which can further improve the quality of life of the community in the vicinity.

Impact	Benefits of Community Development Activities				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.21 Potential Impact on Occupational Health and Safety

Construction Phase

690. *Source of Impact*: The sources of impact to the health and safety of the Project's construction workforce are listed below.
- Accidents and injuries associated with the operation of heavy machinery and other construction activities; and
- Health impacts associated with environmental conditions and changes in environmental quality, arising from emissions to air, water, land and noise emissions from construction activities as well as from storage and handling of waste, particularly hazardous waste.

691. The construction workforce of 50 managerial, 150 skilled and 300 unskilled workers will be exposed to occupational health and safety impacts arising from construction activities.

692. Embedded Control: The project embedded control measures are as follows:
- The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for working methods, plant utilisation, construction sequence and safety arrangements;
- A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site;
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips.

Assessment of Impacts

Accidents and Injuries from General Construction Activities

693. Over-exertion, ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries on construction sites. Loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent causes of lost time accidents at construction sites. Falls from elevation associated with working with ladders, scaffolding, and partially built structures are also among the most common causes of fatal or permanent disabling injury at construction sites.

694. Construction activities may pose significant hazards related to the potential for dropping materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

695. Vehicle traffic, use of lifting equipment and the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have

limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

696. Construction sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms. Access to construction areas, including the pipeline corridor and the access road, will be restricted to reduce risks to public health and safety. These risks could create long-terms impacts to the health and safety of the construction workforce and therefore the impact severity is assessed to be medium. Measures will be implemented to ensure that these risks are considered prior to the commencement of construction, and that all risks are communicated to the workforce. Appropriate PPE will be provided and equipment maintained and inspected regularly. Taking this into account, the impact to the health and safety of workers is assessed to be **Moderate.**

697. *Mitigation Measures:* The measures will be in place to minimize the health and safety impacts to personnel from general construction activities include:
- Measures will be implemented to reduce the likelihood and consequence of the following hazards:
  - falling from height;
  - falling into water;
  - entanglement with machinery;
  - tripping over permanent obstacles or temporary obstructions;
  - slipping on greasy walkways;
  - falling objects;
  - asphyxiation;
  - explosion;
  - contact with dangerous substances;
  - electric shock;
  - mistakes in operation;
  - variable weather conditions;
  - lifting excessive weights; and
  - traffic operations.
- Competent and adequately resources sub-contractors will be used where construction activities are to be sub-contracted;
- All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor;
- All workers will be properly informed, consulted and trained on health and safety issues;
- Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the makers;
- All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded;
- All scaffolds will be erected and inspected and the appropriate records maintained by the Contractor;

- Safety hoops or cages will be provided for ladders with a height in excess of two metres;
- When there is a risk of drowning the lifebelts shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are present when work is proceeding;
- All breathing apparatus, safety harnesses, life-lines, reviving apparatus and any other equipment provided for use in, or in connection with, entry into Confined Spaces, and for use in emergencies, will be properly maintained and thoroughly examined at least once a month, and after every occasion on which it has been used;
- Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate an Leq of more than 85 dB(A). When hearing protection is used, arrangements will be made to ensure the wearers can be warned of other hazards; and
- The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress.

Impact	Accident and Injuries from General Construction Activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	100 managerial, 300 skilled and 600 unskilled workers			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

698. *Residual Impact*: Considering the above mentioned mitigation measures, the significance of residual impact is assessed as **Minor.**

5.3.22 Health Impact Associated with Environmental Conditions

Construction Phase

699. Changes in the environmental quality of air, surface water, groundwater and soil quality may occur as a result of construction activities. High noise levels are also expected from the operation of heavy machinery.

700. An increase in dust and noise during the construction period has the potential to lead to health impacts associated with eye irritation and general disturbance

to daily activities. Waste will be generated during the construction including excavated material, construction waste, hazardous waste, sewage sludge and general refuse. The discharge of domestic waste effluent from construction workers may have the potential to cause contamination of surface water and groundwater in this area.

701. There is a potential for long term impacts to worker's health from changes in environmental quality, as workers will be exposed to higher levels of emissions than off-site receptors. The health and safety impact associated with changes in environmental quality is considered to have ***moderate*** significance**.**

702. *Mitigation Measure:* Mitigation measures as outlined in the immediately preceding section on accidents and injuries from general construction activities to be followed.

Impact	Health impacts associated with environmental conditions			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	50 managerial, 150 skilled and 300 unskilled workers			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

703. *Residual Impacts:* Considering the implementation of above mentioned mitigation measures, the significance of residual impact on occupational health and safety during construction phase is assessed as **Minor.**

Operational Phase

704. *Source of Impact*: Occupational health and safety impacts associated with LNG Facilities operations include Fire and explosion, Roll-over, Contact with cold surfaces, Chemical hazards, working in confined spaces[1] etc. The operation workforce and unskilled workers will be exposed to occupational health and safety impacts arising from operational activities.

[1] http://www.ifc.org/wps/wcm/connect/2757f69d-8936-457e-8d48-7aac7486525f/LNG+Facilities+EHS+Guideline_2016+Vs+2007.pdf?MOD=AJPERES

705. *Embedded Control:* The project embedded control measures are as follows:

- A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site;
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips;

706. *Impact Assessment*: Fire and explosion hazards at LNG facilities may result from the presence of combustible gases and liquids, oxygen, and ignition sources during loading and unloading activities, and /or leaks and spills of flammable products.

707. Storage of large quantities of LNG in tanks may lead to a phenomenon known as roll-over. Roll-over may occur if LNG stratifies into layers of different densities within the storage tank, resulting in pressures that, in the absence of properly operating safety- vent valves, could cause structural damage.Storage and handling of LNG may expose workers to contact with very low-temperature product.

708. When LNG comes in contact with air, it begins to vaporize, returning to its natural gaseous state. As LNG is a cryogen, there is a risk of cold burns if it is in contact with skin. LNG vapor cloud can be hazardous if allowed to collect in a confined space. Because LNG can replace oxygen in a confined space, there is a potential of causing dizziness, fatigue, nausea, headache, and irregular breathing. Confined space entry (storage tanks, secondary containment areas, storm water/wastewater management infrastructure etc.) by workers and the potential for accidents may vary among LNG terminal facilities depending on design, onsite equipment, and infrastructure.

709. These risks could create long-terms impacts to the health and safety of the operation workforce and therefore the impact severity is assessed to be medium. Measures will be implemented to ensure that these risks are considered prior to the commencement of operation, and that all risks are communicated to the workforce. Appropriate PPE will be provided and equipment maintained and inspected regularly. Taking this into account, the impact to the health and safety of workers is assessed to be **Moderate.**

710. Mitigation Measures

- The Project will adopt a total safety control system, which aims to prevent the probable accidents such as fire accidents or chemical spills;
- Fire fighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area) and automated fire extinguishers will be provided at strategic locations with clear labelling of the extinguisher type;
- Plant equipment at low temperatures that can pose risk to workers should be identified and protected to prevent accidental contact. Training on handling and dispensing of LNG, hazard due to contact with cold surfaces (cold burns) should be provided; PPEs (gloves, insulated clothing should be used);

- Constant monitoring of pressure, density and temperature of LNG storage tanks; installation of pressure safety valves to prevent roll overs;
- Installation of multiple loading points at different tank levels to allow distribution of LNG to prevent stratification;
- Material Safety Data Sheets (MSDS) for each chemical used should be available and readily accessible at the facility;
- Wear cold insulating gloves, a cold insulating apron, eye protection, and face shield while working in extreme cold environment;
- A safety manual for storage and handling of Hazardous chemicals will be prepared and implemented;
- The staff will be trained for first-aid and fire fighting procedures. The rescue team will support the first-aid and fire fighting team;
- A first-aid centre with the trained personnel;
- Training and rehearsal of the emergency response procedures by the emergency team members and personnel on site will be completed periodically;
- A safe assembly area will be identified both at FSRU and land based and evacuation of the premises will be practised regularly through mock drills;
- Safe work practices will be developed to provide for the control of hazards during operation and maintenance;
- In the material storage area, hazardous materials will be stored based on their compatibility characteristics;
- A near miss and accident reporting system will be followed and corrective measures shall be taken to avoid / minimize near miss incidents;
- Safety measures in the form of DO and Don't Do will be displayed at strategic locations;
- Safety audits will be conducted periodically as per the regulatory requirements;
- Fire fighting system will be tested periodically ; and
- All hydrants, monitors and valves will be visually inspected every month.

Impact	Impact on Health and Safety of Operational Workforce			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	65 staff (35 offshore +30 onshore)			
Frequency	During operation phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Moderate**			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered **Minor**			

711. Residual *Impact:* Considering the implementation of above mentioned mitigation measures, the impact magnitude will be reduced; however still there would be significant occupational health and safety impacts resulting from the operational activities and the significance of residual impact is considered to be **Minor.**

5.4 CUMULATIVE IMPACTS

712. The impact assessment process has also covered potential for cumulative impacts if the any physical, biological, social, cultural environmental component is affected due to presence of existing and planned future developments in the region.

713. The approach for assessing the cumulative impacts was adopted in reference to the guidance that has been issued by the International Finance Corporation (IFC) in form of the ***Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013)[1].***

714. Accordingly it was important to determine the present conditions of components of environment of the study area. Section 4 of this report on Baseline Conditions has spelt out in great details the present conditions of the various environment and social components as established through this ESIA. The findings did not indicate any existing stress on the environment component including airshed, water shed, etc were relatively unpolluted. At the same time natural resources and ecosystem services were also not under any additional pressure (usually associated with unplanned urban growth and industrial development). Future trends of environmental baseline as estimated through the present impact assessment process and with due consideration of all mitigation / management plans that have been proposed in this ESIA, no significant deterioration in the existing condition of the changes in the physical and biological related environment baseline conditions is anticipated as result of this proposed LNG Terminal.

715. The reasonably foreseeable future actions (RFFAs) at this stage comprise of the following developments:

Table 5.17 Reasonably Foreseeable Future Actions

Reasonably Foreseeable Future Action (RFFA)	Proponent	Distance from the Project Under Consideration (PUC)
2X600 MW Coal-Fired Power Station at Matarbari	CPGCBL	15 km
Coal Fired Power Station at Pekua 2X600 MW - Phase I 2X600 MW – Phase II	EGCB	12 km

[1] The Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013) of IFC presents a useful approach for developers in emerging markets the conduct of a rapid cumulative impact assessment (RCIA).

Reasonably Foreseeable Future Action (RFFA)	Proponent	Distance from the Project Under Consideration (PUC)
LNG Terminal at Moheshkhali	Power Cell	35 km
LNG Terminal at Moheshkhali	Petrobangla – Excelerate Energy	35 km

716. Amongst the RFFAs mentioned above, the Environmental Impact Assessment for the proposed coal fired power station at Matarbari[1] has been conducted and was reviewed to have an understanding of the impacts anticipated on the VECs. Based on this review it was understood that maximum spread of emissions and discharges from this power station and subsequent impact on air and water environment is limited to a maximum impact zone of 3.5 km. So it can be generally surmised that the proposed power stations are not likely to contributed to any cumulative impacts in the present area under consideration (i.e. the study area for this ESIA).

717. From the above table, it is also evident that the LNG Terminals being proposed at *Moheshkhali* are quite distant to contribute towards any cumulative impacts in the *Kutubdia* region. No common air shed or water shed is envisaged amongst the present project under consideration (the *Kutubdia* LNG Project) and the RFFAs. So in in light of the above discussion, cumulative impacts are not anticipated.

[1] Environmental Impact Assessment of Construction of Matarbari 2X600 MW Coal Fired Power Plant and Associated Facilities for Coal Power Generation Company of Bangladesh Limited (Prepared by JICA Study Team), June 2013

6 ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

718. Assessments of alternatives at the time of project design help in finalizing the best option that is techno-commercially viable having minimum impact on the local environmental and social conditions.

719. Analyses of alternatives were considered for the following aspects of the Kutubdia LNG Terminal Project;

- Site Location
- Technology
- Pipeline Route Alternatives

720. Analyses of alternatives were conducted based on the following criteria viz.

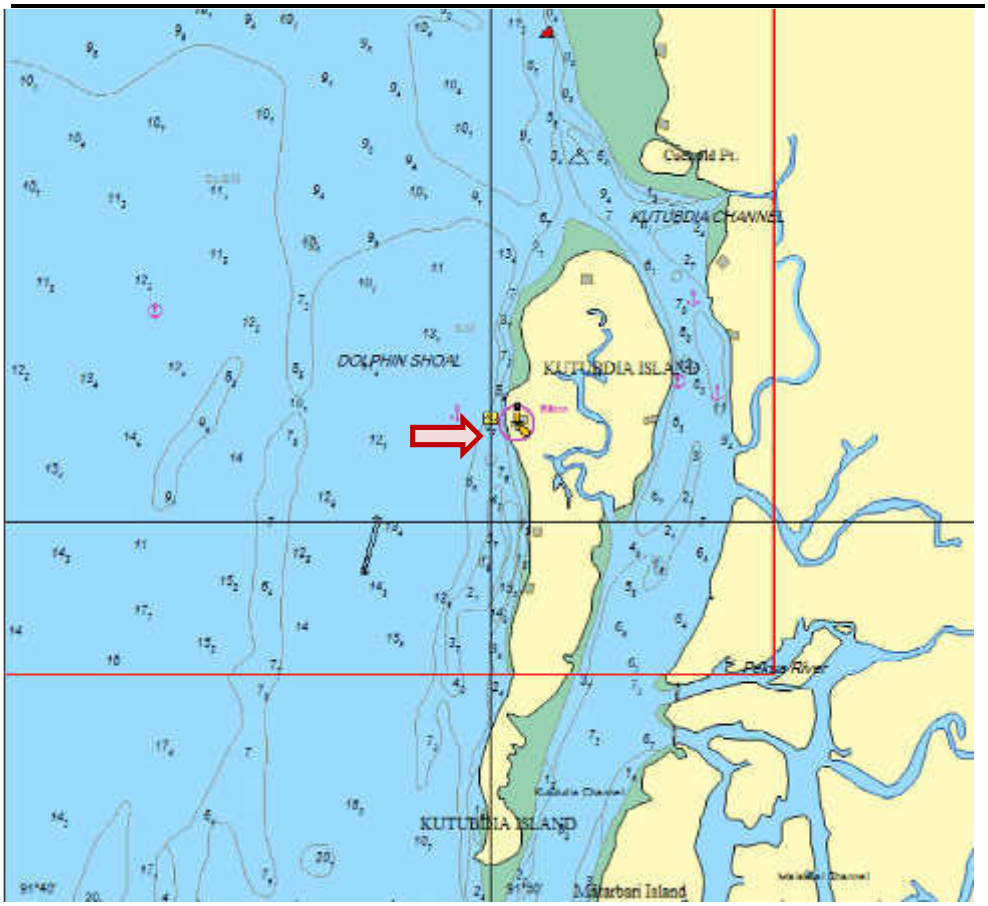
A. Techno-economic Feasibility
B. Operability in different climatic/oceanographic conditions
C. Flexibility to expand in future
D. Environmental Consideration
E. Ecological Aspects
F. Social Aspects

721. Details of alternatives assessed for individual options are presented in following sections.

6.2 SITE LOCATION ALTERNATIVES

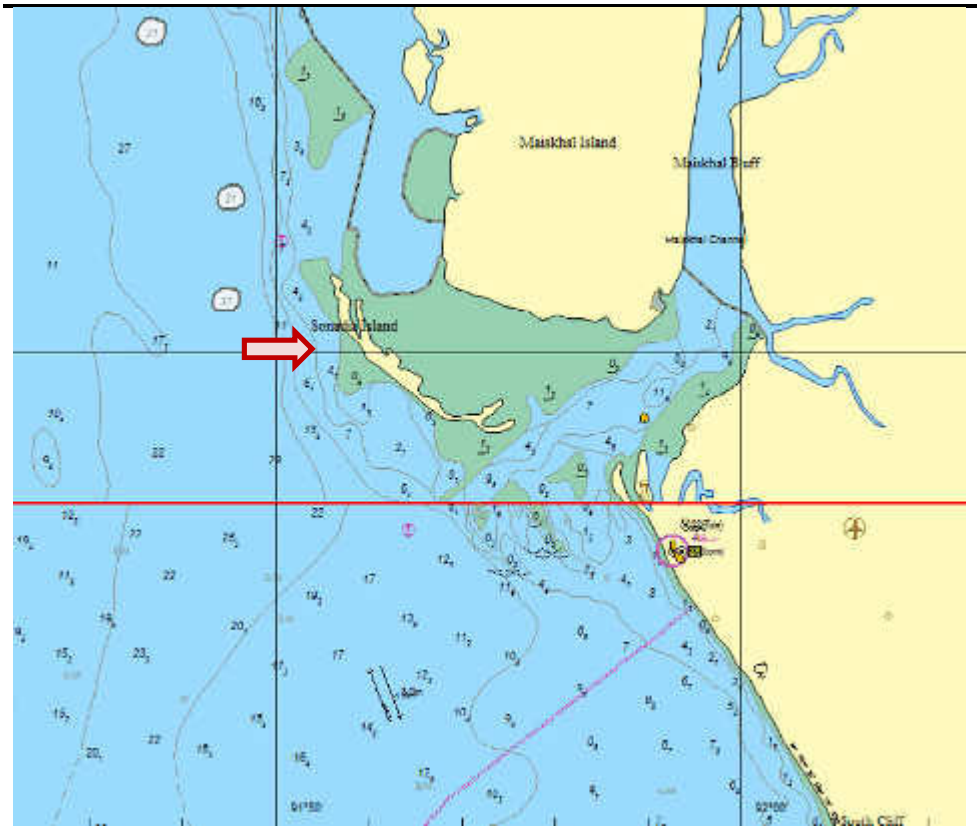
722. Five locations on the west coast of Bangladesh have been studied as potential locations for the LNG terminal *viz. Parki, Kutubdia, Matarbari, Moheshkhali / Sonadia* and Elephant Point. Among the sites the Parki site was characterised by very shallow water depths. Thus this site was not found to be suitable for LNG facility construction. Alternative assessment for site location only considered *Kutubdia, Matarbari, Moheshkhali/ Sonadia* and Elephant point sites. The four locations are shown in ***Figure 6.1***.

Figure 6.1 LNG Terminal - Location Alternatives



Alternative 1 - Kutubdia Site

Alternative 2 - Matarbari Site



Alternative 3 - Moheshkhali/Sonadia Site

Alternative 4 - Elephant Point Site

Source- DHI, 2016. Consultancy Services for Desktop Study for Site Screening in Chittagong and Moheshkhali Region, Bangladesh

723. The alternative analysis for the four sites is presented in ***Table 6.1***.

Table 6.1 Analyses of Site Alternatives

S N.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Site Details	This option considers an FSRU moored off Kutubdia Island in approximately 13m water depth, west of Kutubdia lighthouse and at 3 km from the shore line.	This option considers an FSRU moored off Matarbari Island in approximately 10m water depth, ~1km from the edge of Kutubdia channel.	This option considers an FSRU moored ~2km west of northern tip of Sonadia Island in 15 to 30m water depth.	This option considers an FSRU ~3km off Elephant Point in 11m water depth behind a protective breakwater.
A.	**Techno-economic Feasibility**	Around the Island, the bathymetry map indicates a steeply sloping sea floor with the 10m bathymetry line located within 1km from shore. An area with more than 13m water depth can be found less than 3km from shore. Access to this area by LNGCs would be possible with minimum dredging.	The bathymetry map indicates steeply sloping depth contours close to Matarbari Island	The bathymetry map indicates steeply sloping depth contours in the vicinity of Sonadia Island, with the 20m bathymetry line within 1km of the shore line at the northern end of Sonadia Island.	The bathymetry map indicates depth contours parallel to the shore with the 10 m bathymetry line within 2 km from the shore line
B	**Operability in different climatic/oceanographic conditions**				
	Shoreline Evolution	Kutubdia Island has been experiencing erosion and deposition at the same time. Strong longshore currents in the monsoon season cause rapid erosion in the southern and western shorelines of Kutubdia Island. However, the coast line near the lighthouse was found to be relatively stable	Matarbari Island was subject to considerable shoreline erosion. However, overall, the island is in a gaining phase in terms of area. Large areas of high suspended sediment concentration are located around Matarbari Island and at the entrance of Kutubdia channel.	The area has unstable bank line on the northern tip of Sonadia Island. For an onshore terminal to be feasible at this location land would need to be reclaimed and this is expected to be a costly solution.	The area have a stable coastline with little soil erosion or deposition has been found to occur
	Tides and Current	Strong tidal currents occur around Kutubdia Island. The maximum current speed is approximately 2m/s.	Strong tidal currents occur around Matarbari Island. The maximum current speed is approximately 2.4m/s.	Strong currents occur around the site of interest off Sonadia Island. The maximum current speed is approximately 2.4m/s.	Currents are relatively lower at Elephant point compared to other locations.

S N.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Cyclone (All the areas are prone to cyclones. Cyclones occur mainly from April to May and August to December.)	Storm surge as large as 6m have been recorded during past cyclone events. Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs up to 4-5m offshore Kutubdia Island. Storm surge for that event was estimated at 1.2m off Kutubdia Island.	Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs upto 4-5m offshore Matarbari and up to 3m in the Kutubdia channel. Storm surge for that event was estimated at 1.6m off Matarbari Island.	Cyclonic waves were relatively high off Sonadia Island compared to other sites. Cyclonic waves calculated based on the cyclone event in April 1991 indicated reach 8m Hs off Sonadia. Storm surge for that event was estimated at 2m off Sonadia Island.	Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs reaching 5m nearshore elephant point. Storm surge for that event was estimated at 2m off Elephant point.
	Wave	Wave environmental conditions at site are relatively benign, and thus the site is expected to be suitable for the terminal to operate without the necessity of breakwater.	Wave environmental conditions at the site are higher than for Kutubdia but still relatively benign, and thus the site is also expected to be suitable for the terminal to operate without the necessity of breakwater.	The area around Moheshkhali Island is characterised by a slightly higher wave conditions.	The area around Elephant Point is characterised by a relatively benign wave conditions.
C.	**Flexibility to expand in future**	Possible	Possible	Possible	Possible
E.	**Future Shift to Onshore solution**	Possible, distance to shore allows for operations of cryogenic line.	Possible, distance to shore allows for operations of cryogenic line.	Not possible, distance to shore is greater than typical allowable length for operations of cryogenic pipeline.	Possible, distance to shore allows for operations of cryogenic line.
D	**Environmental Consideration**				
	Overlapping exclusion zone to 3rd parties	Not Applicable	To the Kutubdia Channel	Not Applicable	Not Applicable
	Overlapping safety zone to 3rd parties	Not Applicable	To Kutubdia Channel and onshore infrastructures.	Not Applicable	Not Applicable
	Dredging requirement	Not Applicable	Yes	Not Applicable	Yes
	Breakwater requirement	Not Applicable	Not Applicable	Not Applicable	Yes
E	**Ecological Aspects**				
	Effect of offshore pipeline to mangrove forest and sandbar	Not Applicable	Lower impact to the mangrove forest at the southwest coast of Kutubdia Island and Matarbari Island	Higher impact to the mangrove vegetation and sand bars at Moheshkhali/Sonadia Island	Not Applicable

S N.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Impacts on turtle nesting sites and migratory birds	Few scattered nesting site reported by villagers near the project site. Migratory birds also visit the shores and mudflats of Kutubdia Island	Southern tip of Kutubdia is a known site for nesting of Olive Ridley turtles. Greater number of migratory birds visits the shores and mudflats of Matarbari Island as compared to Kutubdia.	Sonadia Island is designated as Ecologically Critical Area in Bangladesh. The island provides breeding areas for four globally threatened marine turtle species, and serves as a significant bird refuge for over 80 migratory species	The site is not known for nesting site for marine turtles. Few migratory birds visit the shores and mudflats of the area
F	**Social Aspects**				
	Effect of onshore pipeline routing on general population	Impact to the population of Kutubdia	Impact to the population of Matarbari	Not Applicable	Impact on population of Cox's Bazar

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Option Selected

724. The *Kutubdia* site has a stable shoreline (as also the *Matarbari* and Elephant Point Site) compared to the Sonadia site which have an unstable bank line at the northern tip of *Sonadia* Island. Construction of onshore terminal at Sonadia would require land reclamation and this is expected to be a costly solution for construction of LNG terminal. Moreover, the Sonadia site is an Ecologically Critical Area in Bangladesh as nesting of 4 marine turtles and over 80 migratory birds are reported from the island. Kutubdia site is located closer to the shoreline (approximately 3 km) and will not require (also the Matarbari Site, Elephant Point site) construction of long offshore or breakwater for operation of the LNG terminal as compared to the Elephant point site. Lastly, the harsher ocean environment with respect to wave conditions (~73% of the waves with Tp>8s) and very strong currents (>2m/s during NE monsoon) at the Matarbari location are expected to limit the LNG offloading availability at that site compared to the Kutubdia site which has comparatively stable ocean environment. Matarbari site is ecologically more sensitive than the *Kutubdia* site as reported turtle nesting areas are close to the site. The *Matarbari* site is in proximity to mangrove vegetation at the south of *Kutubdia* and *Matarbari* islands which have a greater potential to get impacted compared to *Kutubdia* site which is located far from any mangrove vegetation patch. Moreover, construction of LNG terminal at the *Kutubdia* Channel will also delimit the movement of local vessels. In view of the above the *Kutubdia* site is selected for construction of the LNG terminal.

6.3 TECHNOLOGY ALTERNATIVES

725. The following technological alternatives have been considered

- FSU/FSRU
- Offshore Pipeline- Submerged/ Pipeline on Trestle
- Dual/Single Berthing Options

6.3.1 FSRU / FSU

726. Options considered at the design phase include LNG storage and regasification at the offshore facility or the Floating Storage and Regasification Unit (FRSU) and only LNG storage at the offshore facility or the Floating Storage Unit (FSU) and regasification at the onshore facility. The alternative assessment for the options is presented in ***Table 6.2***.

Table 6.2 Alternative Assessment-FRSU or FSU

S N.	Parameters	FRSU	FSU
A	Techno-economic Feasibility		
	Ground Area Requirement	1 to 2ha	1 to 2ha
	Offshore equipment	Suitable mooring arrangement or Single or Dual Berth jetty	Single or Dual Berth jetty
	Offloading	SPM: Ship to ship transfer Single Jetty: FSRU moored to Jetty, Ship to ship transfer Dual Jetty: Both FSRU and LNGC moored to Jetty	Single Jetty: FSU moored to Jetty, Ship to ship transfer Dual Jetty: Both FSU and LNGC moored to Jetty
	Containment System	Moss or Membrane Tanks	Moss or Membrane Tanks
	Offloading System	Marine Loading Arms/ hoses	Marine Loading Arms/ hoses
	CAPEX	Low	Low
	OPEX	High (High lease rate of FRSU)	Low
B	Operability in different climatic / oceanographic conditions	As the regasification would occur offshore; the process is more vulnerable to extreme weather /oceanographic conditions	As regasification would occur on-shore the system is less vulnerable e to extreme weather/oceanographic conditions
C.	Flexibility to expand in future	Could be done with higher capacity FRSUs	Land would be available for possible expansion of the LNG facility
D	Environmental Consideration	Noise and illumination impact to the local communities from the onshore receiving facility	Noise and illumination impact to the local communities from the onshore storage and regasification facility
E	Ecological Aspects	The process will involve ecological impacts due to noise and illumination on the marine and onshore biodiversity	The process will involve ecological impacts due to noise and illumination on the marine and onshore biodiversity
F	Social Aspects	The land requirement is only about 4 acres. Local community may experience noise impacts In case of an accident the risk to the local community is reduced as the onshore facility will comprise only of a metering facility whereas regasification and storage is all offshore	The land requirement is only about 40 acres for the onshore regasification facility. Local community may experience noise impacts In case of an accident the risk to the local community may arise from the onshore gas regasification and storage facility

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Option Selected

727. Both offshore (FRSU) and onshore (FSU) regasification facilities may generate some ecological and social impacts and the impacts are envisaged to be of similar significance. The onshore regasification unit will protect the LNG facility from extreme weather conditions as the offshore facility would be more vulnerable to waves, currents and natural calamities (cyclones etc.). The capital

cost of both the options would be low, however, the operation cost of the offshore gasification would be higher due to high lease rate of FRSU. Moreover, with the FSRU solution, gas send out will be interrupted when the FSRU is required to disconnect. Onshore buffer storage and onshore regasification facilities, offer improvement in gas send-out availability as it would be able to continue regasification and gas send-out when the FSU is required to disconnect.

728. However in case of FSRU, the onshore facilities will only comprise of metering facilities. This will require only about 3.72 acres of land at Kutubdia Island which would result in a significant reduction of environmental and social footprint of onshore land. This potentially reduces land requirement for onshore facilities from ~40 acres (FSU + ORF) to ~3.72 acres (FSRU). This translates into low socio-economic impacts, reduced land use changes and reduced societal risks. The FSRU option also effectively obviates the land based re-gas option and reduces environmental impacts - air emissions will be reduced from captive power plant of 20 MW (FSRU+ORF Option) to 2 MW power generation. In view of this the FSRU option is preferred over the FSU option.

6.3.2 FSRU Berthing Options- Dual or Single Berthing

729. The LNGC may attach with the FSRU by dual or single berthing options. Dual berthing includes mooring/fendering structures to moor the FSRU and LNGC, loading arms for LNG transfers from the LNGC to the FSRU. Single berthing includes mooring/fendering structures to moor the FSRU. The FSRU contains loading arms or cryogenic hoses for LNG transfers from the LNGC to the FSRU. Dual and single berthing options are shown in ***Figure 6.2***.

Figure 6.2 Dual and Single Berthing Options

Schematic diagram of FSRU (on Left) and LNGC at Dual Berth Jetty

Schematic diagram of FSRU (on Right) and LNGC at Single Berth Jetty

Source: Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

730. ***Table 6.3*** presents alternative assessment of dual and single berthing.

Table 6.3 Alternative Assessment- Dual Berthing or Single Berthing

S N	Parameters	Dual Berthing	Single Berthing
A	Techno-economic Feasibility	Double berth jetty are sometime preferred by the LNG provider as offloading on these jetty is similar to offloading for onshore terminals	A single berth jetty requires side by side offloading. This is sometimes less preferred than offloading over the jetty by LNGC suppliers
	Cost	This configuration is generally 30-40% more expensive than a single berth jetty	Less cost intensive compared to double berthing
B	Operability in different climatic / oceanographic conditions	In case of emergency both the FSRU and LNGC can detach separately leading to a reduced evacuation time	The FSRU will not be able to detach and move unless space is provided by the LNGC.
C.	Flexibility to expand in future	Not Applicable	Not Applicable
D	Environmental Consideration	Not Applicable	Not Applicable
E	Ecological Aspects	Not Applicable	Not Applicable
F	Social Aspects	Not Applicable	Not Applicable

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Option Selected

731. Considering better operability in different climatic/oceanographic conditions, dual berthing option is preferred over the single berthing option.

6.3.3 Offshore Pipeline- Submerged/ Pipeline on Trestle

732. Approximately 1.5 km pipeline needed to be constructed to transport LNG from FSRU to the onshore metering facility. Two options considered for the following pipeline alignment

- Subsea pipeline and
- Pipeline on a trestle with road access

733. ***Table 6.4*** presesnts alternative assessment of offshore pipeline vs pipeline on trestle.

Table 6.4 Alternative Assessment Offshore Pipeline- Subsea Pipeline or Pipeline on a Trestle

S N.	Parameters	Subsea offshore pipeline	Offshore pipeline on a trestle
A	Techno-economic Feasibility		
	Use of Field Proven technology	Cryogenic subsea pipeline is not a field proven technology	Cryogenic pipeline mounted on trestle is a field proven technology
	Operation and Maintenance	Operation and maintenance would be difficult and cost intensive	Operation and maintenance comparatively easier and less cost intensive
B	Operability in different climatic/oceanographic conditions	The subsea pipeline would be less vulnerable to oceanographic and climatic conditions	Trestle mounted cryogenic pipeline would be more vulnerable to oceanographic and climatic conditions
C.	Flexibility to expand in future	Not Applicable	Not Applicable
D.	Ecological Aspects	Construction of subsea pipeline would impart less impact to the benthic communities	Piling at the time of trestle construction would impart significant impact to the benthic communities
		Subsea pipeline do not have the potential to improve the local ecology	Barnacles and other sessile organisms may form colonies on the pillars and platforms of the trestle and improve the productivity of the habitat locally and attract more fish in the area
E.	Social Aspects	No barrier to local fishing routes	3 km long trestle mounted pipeline could create barrier to the movement of local fishing vessels.

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Option Selected

734. Trestle mounted pipeline would be more vulnerable to oceanographic and climatic conditions compared to the subsea pipeline. However, the construction and maintenance of the subsea pipeline would be more cost intensive. On the other hand the subsea pipeline is not expected to create significance disturbance to the benthic communities and do not create barrier to the movement of vessels as compare to the trestle mounted pipeline. So a subsea pipeline is considered to be more feasible option.

6.4 PIPELINE ROUTE ALTERNATIVES

735. R-LNG at the CTMS would be transferred to Napura valve station for connecting to the Anwara-Moheshkhali gas pipeline. Four pipeline alignment

options from Kutubdia CTMS to Napura valve Station were studied by Imagis Engineering Solutions Pvt. Ltd. to identify the alignment with least environmental and social sensitivity. The alternative routes are presented in ***Figure 6.3*** and an assessment of the options is indicated in ***Table 6.5***. Land use and land cover maps of the four alignments are presented in **Annex 9.**

Figure 6.3 Pipeline Route Alternatives

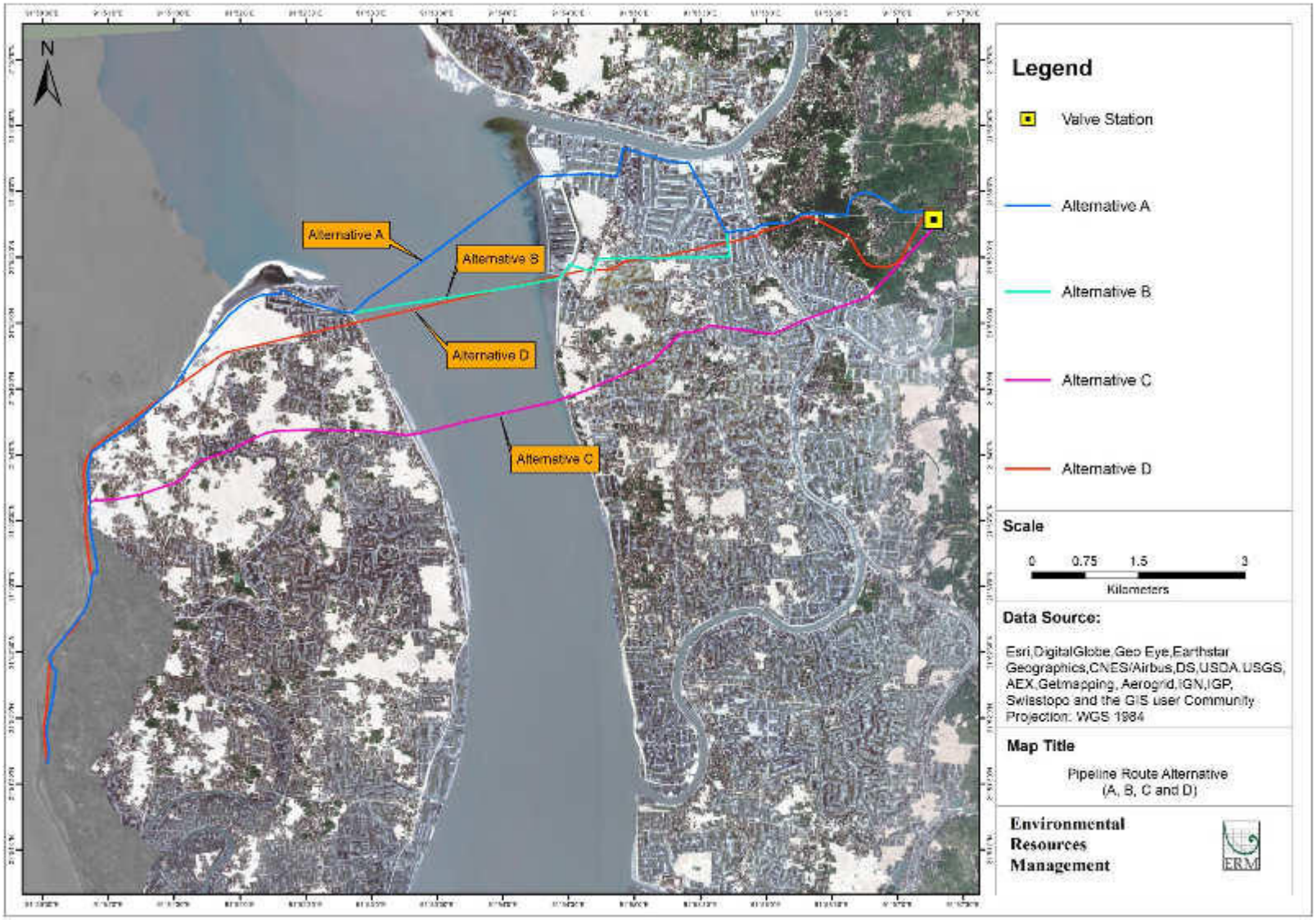


Table 6.5 Analysis of Alternative-Onshore Pipeline Route

S. N.	Description	Alignment A		Alignment B		Alignment C		Alignment D	
	Route Particulars								
i.	Route length in meter	18863		17757		16391		17000	
ii.	Land use (in %) for Acquisition Strip of 8 m	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
a.	Agriculture	20.89	18.85	27.03	25.16	24.66	23.82	36.66	36.63
b.	Block Vegetation	5.36	6.10	5.66	6.44	5.94	6.86	1.22	0.75
c.	Channel	16.68	16.56	15.62	15.46	14.35	14.56	16.04	16.01
d.	Coastal Sandy Area	8.52	8.55	9.00	9.04	10.56	10.61	19.15	19.90
e.	Creek	0.29	0.29	0.31	0.30	0.00	0.00	0.32	0.33
f.	Embankment cum Road	2.88	2.09	1.22	1.28	0.00	0.00	0.00	0.00
g.	Mudflat and Mangrove	1.04	1.02	1.10	0.94	0.00	0.00	0.00	0.00
h.	Road	2.86	2.45	2.88	2.45	1.54	0.58	0.49	0.48
i.	Saltpan	33.62	33.74	28.12	27.40	41.03	41.61	25.35	25.76
j	Sea	0.29	0.04	0.30	0.04	0.33	0.04	6.68	0.00
k.	Settlement	6.92	9.05	8.06	10.16	1.59	1.86	0.10	0.14
l.	Waterbodies	0.65	1.26	0.69	1.33	0.01	0.06	0.00	0.00
A	**Techno-economic Feasibility**								
	Construction problem Due to Channel and Road Crossing	Number of channel crossing five; numbers of road crossing one. Channel and road crossing length is more (3.40 km). Pipe laying is very difficult below the water channel, where in special technology is to be used not only for investigation but also for laying and operations. The laying cost per unit length becomes high at such places.		Number of channel crossing five; numbers of road crossing two. Channel and road crossing length is more (3.01km). Pipe laying is very difficult below the water channel, where in special technology is to be used not only for investigation but also for laying and operations. The laying cost per unit length becomes high at such places.		Number of channel crossing six; numbers of road crossing seven. Channel and road crossing length is less (2.32 km).		Number of channel crossing four; numbers of road crossing seven. Channel and road crossing length is less (2.27km).	
	O & M Problem	Channel crossing length is more so operation and maintenance would be difficult		Channel crossing length is more so operation and maintenance would be difficult		Channel crossing length is less so operation and maintenance would be easier		Channel crossing length is less so operation and maintenance would be easier	

S. N.	Description	Alignment A	Alignment B	Alignment C	Alignment D
B.	**Operability in different climatic/oceanographic conditions**	Major part of the pipeline is passing through sea shore. In that case, it is expected that the pipeline laying is strong enough to sustain the natural forces like tsunami, cyclones, tidal effects, tornado etc, this attracts more cost in terms of pipe anchorage.	Major part of the pipeline is passing through sea shore. In that case, it is expected that the pipe laying is strong enough to sustain the natural forces like tsunami, cyclones, tidal effects, tornado etc, this attracts more cost in terms of pipe anchorage.	Small part of the pipeline passing through sea shore.	Small part of the pipeline passing through sea shore
C.	**Environmental Details**				
i.	Name of District/District details (Through which line pass)	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District
ii.	Town in Alignment nearby	Not Present	Not Present	Not Present	Not Present
iii.	Settlement area within ROW in ha	1.19	1.2	0.22	0.016
iv.	Forest in Km/Ha.	Not Present	Not Present	Not Present	Not Present
v.	Block Vegetation in ha	0.85	0.85	0.82	0.130
vi.	Mangrove Vegetation in ha	0.15	0.14	0.00	0.00
x.	Historical/Cultural monument	None	None	None	None
D.	**Ecological Aspects**				
	Crossing through Block/mangrove Vegetation	Pipeline passing through *Casuarina* and mangrove vegetation patches	Pipeline passing through *Casuarina* and mangrove vegetation patches	Pipeline passing through *Casuarina* vegetation but not through mangrove patches	Pipeline passing through *Casuarina* vegetation but not through mangrove patches
	Crossing through reported turtle nesting sites	Few scattered Olive Ridley turtle nesting sites were reported by the villagers of Uttar Dhurung and Dakshin Dhurug. Stretch of pipeline may pass in proximity of such reported nesting areas.	Same as Alignment A	Same as Alignment A	Same as Alignment A

S. N.	Description	Alignment A	Alignment B	Alignment C	Alignment D
E.	**Social Aspects**				
	Physical Resettlement	Physical resettlement is more. This situation may result is some resistance from local community to offer the land holdings or may give rise to acquisition cost.	Physical resettlement is more. This situation may result is some resistance from local community to offer the land holdings or may give rise to acquisition cost.	Physical resettlement is less but more than Alignment D.	Minimum physical resettlement.
	Compensation Cost	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the pipeline is under mono-cropped agricultural land. Land Price of agricultural land is less than the price of salt pan and crop compensation will be for one seasoned standing crop.

Source: ERM Analyses and Imagis 2016. Reconnaissance Survey for LNG Terminal and associated Pipeline at Kutubdia Island, Bangladesh

Option Selected

736. Channel and road crossing is more for Alignment A and Alignment B compared to the other alignments. Among the 4 alignments considered Alignment A and B will pass through mangrove vegetation and the other two alignments would not. Minimum physical resettlement would take place for Alignment D. Major part of the Alignment D is under mono-cropped agricultural land compared to the other alignments where salt pans exist more on the pipeline corridors. Land price of agricultural land is less than the price of salt pan. In view of this Alignment D is preferred over the other options.

7 CONSULTATION AND PARTICIPATION

7.1 INTRODUCTION

737. A stakeholder is defined as "an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project". "Stakeholder Analysis" is the process of sorting identified stakeholder groups according to their impact on the project and the impact the project will have on them. This information is then used to assess the manner in which the interests of the stakeholders or projects impact on them should be addressed in the project development plan or its operation.

738. The importance of stakeholder analysis lies in the assessment and understanding of the socio-political environment surrounding the project. It allows for:
- Identification of the interests, concerns and societal risks surrounding the stakeholders, as well as conflicts of interests (if any);
- Identification of relations between stakeholders that may enable "coalitions" of project sponsorship, ownership and co-operation as well as the mechanisms which may influence other stakeholders;
- Key groups/ individuals to be identified who need to be informed about the project during the execution phase;
- Identifying stakeholders (those who might have an adverse impact on the project) and taking appropriate measures to mitigate their influence; and;
- Development of a framework for participatory planning and implementation of various project activities including interventions for community development.

739. The identification of stakeholders and their inclusion in the decision-making process is thus essential in the process of prioritizing, analyzing and addressing issues; and in creating management systems and strategies to address the concerns/ expectations of various stakeholders.

740. The following sub-sections provide a profile of the various stakeholders in the project as well as their concerns and relative influence with regards to the project.

7.2 IDENTIFICATION OF STAKEHOLDERS

741. The stakeholders who would directly impact or are directly impacted by the project are known as Primary Stakeholders, those who have an indirect impact or are indirectly impacted are known as Secondary Stakeholders. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the ***Table 7.1***.

Table 7.1 List of key stakeholders

Stakeholder Category/ Group	Key Stakeholders
Primary Stakeholders	
Local Community	▪ Land Owners (whose land will acquire for the Kutubdia Project) ▪ Local Community Other than land owner ▪ Community involved in Fishing activity ▪ Community involved in Salt Cultivation ▪ Cultivator involved in Agricultural activity
Local Administration	▪ Dakshin Dhurung Union ▪ Uttar Dhurung Union ▪ Chhanua Union ▪ Puichhari Union ▪ Kutubdia Upazila ▪ Banshkhali Upazila
Other Primary Stakeholders	▪ Reliance Bangladesh LNG Terminal Ltd.
Secondary Stakeholder	
Institutional Stakeholders	▪ District Administration ▪ District Land Acquisition Department ▪ District Land Acquisition Department ▪ District Fisheries Department ▪ Upazila Agriculture Department ▪ Upazila Fisheries Department ▪ Upazila Forest Department ▪ District and Upazila Water Development Board ▪ Department of Environment (DOE), Cox's Bazar ▪ Bangladesh Small and Cottage Industries Corporation (BSCIC)
Other Secondary Stakeholder	▪ EPC Contractors ▪ Local NGOs

Consultations with District Administration

742. The ERM team held meetings with District Administration at District Collectorate Office in Cox's Bazar, details of which are as follows:

- Consultation was held with Md. Ali Hossain, Deputy Magistrate (DM), Cox's Bazar District on 23.08.2016. DM was briefed on the background of the project and the objective and scope of the ESIA Study and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia.
- Consultation was held with Md. Anwarul Naser, ADM (Revenue), Cox's Bazar District on 14.11.2016. ADM was briefed on the background of the project and the objective and scope of the ESIA Study. The discussions helped to understand the land acquisition process in Bangladesh and the overall status of the lands identified for the project site.

Consultations with District Fishery Department

743. ERM team also held meetings with Mr. Amitosh Sen, District Fisheries on 23.08.2016 and 19.11.2016. These consultations included discussion and information requests regarding various aspects of fishing practices, fishery resources, fishermen communities, etc.

Consultations with BSCIC

744. A meeting was also conducted with Md. Shameem Alom, Coordination Officer, Bangladesh Small & Cottage Industries Corporation (BSCIC) on 23.08.2016. BISIC (Salt Office), Cox's Bazar is managing salt cultivation process in the district. These consultations included discussion and information requests regarding various aspect of salt cultivation activity in the Kutubdia Island.

Consultations with District Forest Officer

745. ERM team also held meetings with Md. Ali Kabir, Divisional Forest Officer (DFO), Cox's Bazar South Forest Division and G M Mohammad Kabir, ACF, Cox's Bazar, Chittagong Coastal Forest Division on 23.08.2016. These consultations included discussion and information requests regarding presence of forest land within the island, process of acquisition of forest land, future plans (if any) of the Forest Department in respect of Kutubdia, social forestry related activities within island , etc.

Consultations with Department of Environment (DOE), Cox's Bazar

746. A meeting was also conducted with Sarder Shariful Islam, Assistant Director, Department of Environment (DoE), Cox's on 25.08.2016. These consultations included discussion and information requests regarding Environmental Clearance process, IEE application, facilities for disposal of solid and/or hazardous wastes in Cox's bazar District, etc.

Consultations with M Zahirul Islam, Principal Investigator, Marinelife Alliance, Cox's Bazar

747. ERM team also held a meeting with a local NGO (Marinelife Alliance) who are working in the area of marine life conservation in the entire coastline along the Cox's Bazar region. These consultations included discussion and information sharing regarding marine ecology of the Kutubdia region and presence of habitats and nesting grounds for faunal species including sea turtle.

Consultations with Salahin Tanvir Gazi, Upazila Nirbahi Officer (UNO), Kutubdia

748. The ERM team held meetings with Upazila Administration at Upazila Office in Kutubdia, details of which are as follows:

- Consultation was held with Mr. Salahin Tanvir Gazi, Upazila Nirbahi Officer (UNO), Kutubdia on 24.08.2016. The UNO was briefed on the background of the project and the objective and scope of the ESIA Study and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia.
- Another round of consultation was held with the UNO along with Chairmen from all five unions at Upazila Office on 14.11.2016. UNO and other chairmen were briefed on the background of the project and the objective and scope of the ESIA Study. Consultations were conducted to understand

the land acquisition process, general status of the land identified for the project, livelihood status of the residents of the Upazila, etc.

Figure 7.1 Consultations with Upazila Administration

Consultations with Upazila Nirbahi Officer (UNO), Kutubdia and the Union Chairmen

Consultations with Nasim Al Mahmood Upazila Fisheries Officer, Kutubdia

749. Consultations with the Upazila Fishery Officer were conducted on 24.08.2016 to get an insight into fishing practices within the island, process of registration of the fishermen, socio economic status of fisherman, fish catch, marketing etc.

Consultations with Md. Monir, Sub. Asst. Agriculture Officer, Kutubdia

750. Consultations were held with the Sub. Asst. Agriculture Officer, Kutubdia on 24.08.2016 to get an insight on agricultural activities and farming practices, agricultural produce, category of farmers, socio economic condition of the farmers, reason behind conversion of agricultural land into salt pan within the island, etc.

Consultations with Omar Farukh, Asst. Upazila Education Officer, Kutubdia

751. Consultations were held with the Asst. Upazila Education Officer, Kutubdia on 24.08.2016 to get an insight into educational status of community, the educational infrastructure present within the island, etc.

Consultations with Dr. Abdulah Hassa, Medical Officer, Upazila Health Complex, Kutubdia

752. Consultations were held with the Medical Officer, Upazila Health Complex, Kutubdia on 24.08.2016 to get an insight on disease profiles and morbidity pattern of the island, the health infrastructure present within the island, etc.

Consultations with Humayun Kabir, Observer, Bangladesh Meteorological Dept., Station Kutubdia

753. Consultations were held with the Observer, Bangladesh Meteorological Dept., Station Kutubdia on 24.08.2016 to understand the meteorological information

that is being collected through this station and also to understand the micro-climatic setting of the island.

Consultations with Elton Section Officer & Mongsa Thaymarma, Surveyor, Water Development Board, Kutubdia

754. Consultations were held with the officers of the Upazila Office of the BWDB on 24.08.2016 to get an insight on coastal protection structures (earthen embankment) in Kutubdia Island, their status along with future development plans, if any.

Consultations with Asit Kumar Ray, Range Officer, Coastal Forest Department, Kutubdia

755. Consultations were held with the Range Officer, Coastal Forest Department, *Kutubdia* on 24.08.2016 to get an insight on ecological sensitivities of the island in terms of forest areas, mangrove vegetation, coastal shelter belts, social forestry programs, etc. Discussions were also held on presence of habitats and nesting grounds for faunal species including sea turtles on the island. A subsequent round of discussions on these issues was further held on 16.11.2016.

Figure 7.2 Consultations with Forest Department

Consultations with Range Officer, Coastal Forest Department, Kutubdia

Consultations with Dakhsin Dhurung Union

756. Consultations were held with the members of the Dakshin Dhurung Union, Kutubdia on 16.11.2016 to get an insight about population, livelihood, infrastructure, future development plan and potential areas of development through CSR activity in respect of the Dakshin Dhurung Union.

Figure 7.3 Consultations with Dakhsin Dhurung Union

Consultations with Dakshin Dhurung Union, Kutubdia

Consultations with Local Communities

757. Community consultation is central to every impact assessment study because it helps to gather the opinion of the public on the proposed project and assess its potential effect on the public especially vulnerable groups. Consultations were carried out with community people residing in the region across all the Union Parishads to assess the extent of impact on the common people.

Figure 7.4 Consultations with Local Communities

Bati Ghar Para, Ali Fakir Deil, Dakshin Dhurung Union

Binda para, Kaiyarbil Union

Consultations with Fisherman Community

758. Fisherman community is the frontline community who can be adversely impacted due any FSRU project as their livelihood is entirely dependent on fishing activity in the sea. For that reason fisherman community of the island is considered as one of the primary stakeholder of the project. Consultations in form of Focus Group Discussions (FGDs) were carried out with fisherman community residing in the island across all the Union Parishads to assess the extent of impact on them

759. The locations were FGDs were conducted with the fishermen community and the fishing settlements that it represented, is presented in ***Figure 7.5.***

Figure 7.5 Location of Focus Group Discussion with Fisher man Community

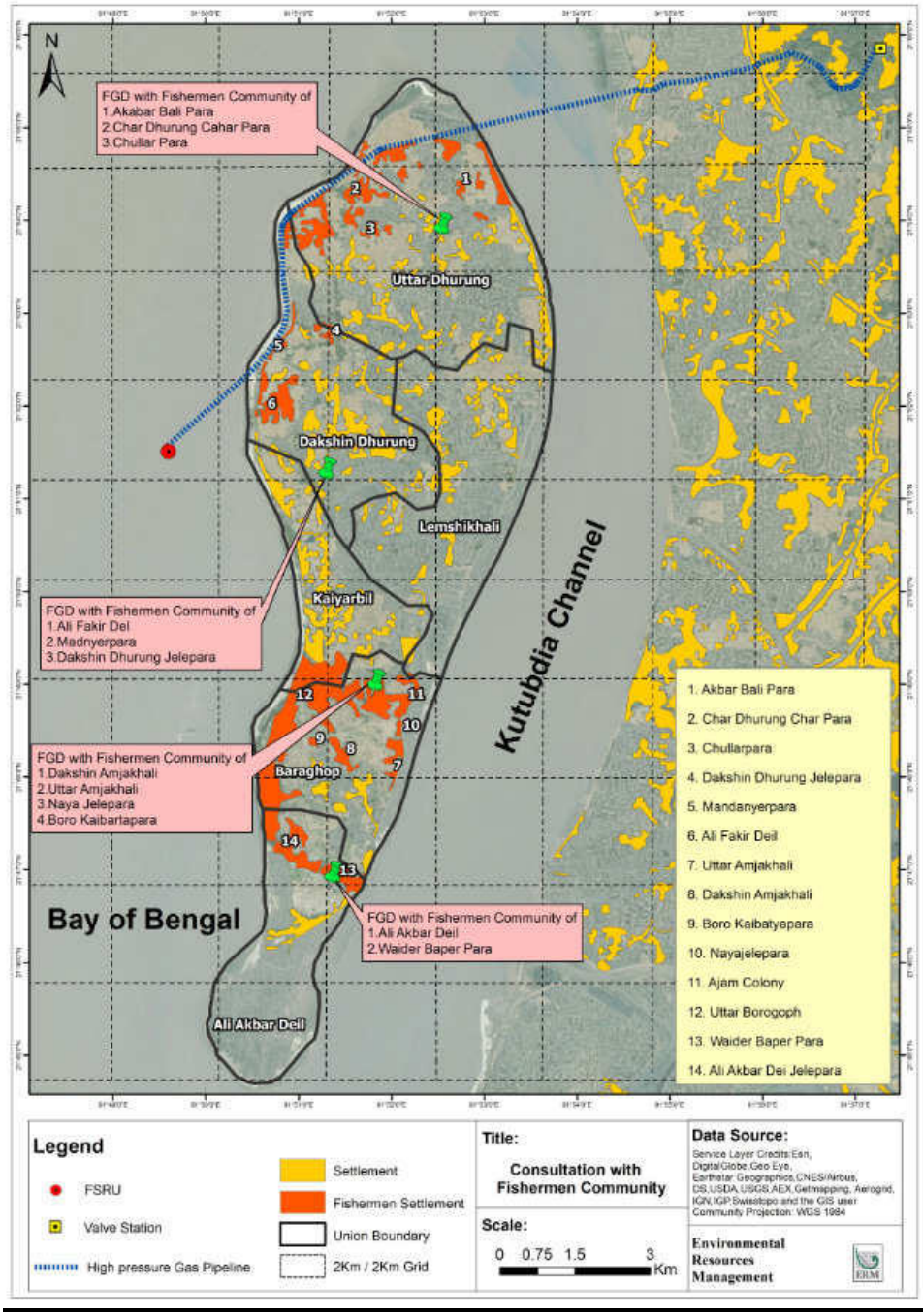


Figure 7.6 Consultations with Fisherman Communities


Fisherman Community of Dakshin Dhurung Union


Fisherman Community of Boroghop Union


Fisherman Community of Ali Akbar Deil Union


Fisherman Community of Uttar Dhurung Union

Key Informant Interview-Secretary of Kutubdia Fisherman Union

Key Informant Interview - Mr. Abaul Kalam, Knowledgeable Fisherman (referred as a resource person by District Fishery Officer)

760. The brief outcome of the consultations with the key stakeholder groups are listed below. The minutes of all consultations are recorded under **Annex 11** of this document.

7.3 SUMMARY OF STAKEHOLDER CONSULTATIONS

761. ERM undertook consultations/ meetings with identified stakeholders during the course of the site visit. The intensive deliberations provided a platform for two-way communication between the team of consultants and the stakeholder groups. This in turn helped in developing an understanding of the perceptions of stakeholders with regards to the project and also allowed for a means of recording their feedback. The key points discussed with each of these stakeholders are provided in the table below:

Table 7.2 Stakeholders and Key Points Discussed

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
Local Community			
1.1	Land Owner of Dakshin Dhurung Union	▪ Issues/grievances with respect to the land purchase process; ▪ Community perception towards the project ▪ Socio-economic condition of the people inhabiting the study area.	▪ Proposed Project area is primarily single cropped agricultural land as irrigation facility is not available. ▪ Only individual level pond irrigation is present in a few land parcels ▪ As per local community, original embankment was about 100-200 m towards west of the present bund. The present embankment area was under cultivation and under private ownership. This land parcel was eroded around 10 year back. ▪ Presently villagers use the land available along the shore for activities like boat maintenance, drying of fishing nets, repairing of fishing nets, cultivation of water melon and vegetable etc.
1.2	Local Community other than land owner	▪ Land holding pattern in the study area; ▪ Impact of land purchase on livelihood; ▪ Perception of agricultural labourers towards the project;	▪ There is an anchorage point about 100 m north of the existing lighthouse. This point is in use by the fishermen of the village. About 20-30 boats are anchored here. ▪ Most of the boats are motorized and go out for fishing for 3-4 days at a stretch in sea. ▪ There is a ship navigation channel upto the

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
		▪ Current engagement scenario – alternate livelihood options; ▪ Basic amenities in the village – electricity, water supply etc.; ▪ Profile of households by source of water; ▪ Proposed schemes for water supply in the village; ▪ Health scenario in the village and distances of Hospitals/ Clinics;	Chittagong port which is about 6-7 km from the shore. ▪ During low tide the fishing boats goes west of the navigation channel and during high tide it goes east of the navigation channel. ▪ During cyclonic weather the fishermen keep the boats in the *Kutubdia* Channel. ▪ The original embankment was about 100-200 m towards west of the present bund. Location of the present bund was used as an airstrip during the British period. The present embankment area was under cultivation and was also under private ownership ▪ There are around 8-10 huts just along the bund towards the southern side of the potential site. They are part of the *Kaiyarbil* Union. ▪ Cultural sites: – There was a *mazhar* that has been washed off. – On the beach side just north of the present lighthouse there was a graveyard which has been washed off and is presently demarcated by four wooden posts. It is not in use. – Cultural properties within Island include (i) Ek Hatia Fakir Mosque, established in 1904, (ii) Tomb of *Kutub Aulia* (iii), *Kalarma* Mosque ▪ The *Ek Hatia Fakir* Mosque is located close to the Project site ▪ Consultations revealed that only a few households were engaged in agricultural activities and majority are engaged in fishing activity ▪ Lands are mostly used for growing crops for self-consumption. ▪ Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation. ▪ People are very positive about the industrial development as it will create some livelihood opportunity for local people however they also apprehensive about the pollution which might emanate from industrial activity. ▪ Water supply is not present in the village. Villagers totally are dependent on tube well for fulfil their water requirement for drinking and other household activity. ▪ Electricity is not present in the Dakshin Dhurung and Kaiyarbil unions. People expect some help for the industrial developer on this aspect. ▪ Union level health facility is present in Dakshin Dhurung and Kaiyarbil union but it is not enough to cater the health related need of the local people. People are totally dependent on Upazila Health Complex for their health issue.
1.3	Community involved in fishing activity	▪ Total number of fishermen ▪ Type of fishing ▪ Number of fisherman in Kutubdia Upazila (daily/deep sea) ▪ Number of fisherman in Dakshin Dhurung and	▪ Maximum fisherman (around 4000) are residing in 3 fisherman colonies within Dakshin Dhurung Union; most of them reside in Dakshin Dhurung Jelepara, Ali Fakhir deil, Madaniyar Para settlements (around 2200 to 2300 fisherman) ▪ There are around 500 fisherman residing in Kayiar Bil and Bindapara village in Kaiyarbil Union

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
		Kaiyarbil Union (daily and deep sea) ▪ Number of fisherman in Ali Fakir Deil village and Bindapara village (daily/ deep sea) ▪ Type of fishing - Daily fishing/ Deep sea fishing ▪ Type and number of boat use for daily fishing and deep sea fishing ▪ Number of fisher man engaged per boat ▪ Type of fish catch both in daily fishing and deep sea fishing ▪ Number of fisherman involved in daily fishing and deep sea fishing ▪ Season for deep sea fishing and daily fishing ▪ Number of days of deep sea fishing in year ▪ Number of days of daily fishing ▪ Annual income from fishing - both deep sea and daily fishing ▪ Distance and direction for daily fishing in different season ▪ Distance and direction for deep sea fishing in different season ▪ Fish landing point in this two villages ▪ Point of offshore fish trading	▪ Fishing activity is conducted around the year. It is restricted only between October to November for a period of 20-25 days for hilsa breeding migration ▪ There are three type of boats used for fishing activity i.e. industrial trawler, mechanised boat and small mechanised fishing boat ▪ Industrial trawlers and mechanical boats are used for deep sea fishing activity ▪ 20 to 35 fisher man per boat is usually engaged in deep sea fishing activity while 8 to 10 fisherman per boat is involved in day fishing. ▪ Almost 6 month a year all boat are involved in Hilsa fishing. It is the prime fish catch for all fishermen. ▪ Gondapara in Kutubdia Channel north of the Kutubdia Island in the main breeding center for hilsa fish in Bangladesh ▪ A deep sea fishing boat has a fish catch worth of around 4 to 6 lakh BDT in one trip while for a day fishing boat, the fish catch is worth around 0.5 to 1.5 Lakh BDT. ▪ One deep sea fishing trip is continued for 15 days and they move upto 300 km south west inside the sea ▪ Three category of personnel are generally involved in a fishing boat i.e. Sailor, Engine Driver and Fisherman ▪ All of them are the contractual worker of the boat owner ▪ Annual contract value of sailor, engine driver and fisher man is 4 to 8 lakh, 1 to1.5 lakh, 0.9 – 1.2 lakh respectively ▪ Day fishing boat sells their fish catch to the trader in Kutubdia channel near Sekhkhali and Banskhali ▪ Deep sea boat sells their fish catch in Chittagong and Cox Bazar ▪ The most common fish net is Behundi (marine setbag net)
1.4	Cultivator involved in Agricultural activity	▪ Number of people involved in Agriculture in Dakshin Dhurung and Kaiyarbil Union ▪ Type of Agricultural land-Irrigated or Unirrigated ▪ Involvement of Agricultural Labour ▪ Number of Crop in a year- Single and Bi-Cropped ▪ Type of Agricultural Produce ▪ Number of people involved in Agriculture	▪ Agricultural activity is very limited with in the island due to repeated storm surge and salt water ingression in agricultural field and due to that fertility of agricultural field deteriorated ▪ Most of agricultural land is mono cropped or bicropped. ▪ Paddy is the main agricultural produce of the area. Other than that vegetable are also produced ▪ Community are not interested in agriculture due to less profit. So that most of agricultural land is converted in to salt pan for earning more profit.
Local Administration			
2.1	Union and Upazila Administration	▪ Administrative composition of the Union ▪ Temporal changes in the landuse; ▪ Positive and negative impacts of industrialization;	▪ The objective and scope of the present visit was explained to the Upazila Nirbahi Officer (UNO) and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia ▪ The UNO introduced the ERM team to Upazila officials, Union Chairmen and facilitated their interactions with individual departments in

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			Kutubdia. ▪ Land which is present in the sea shore is not belongs to Government. ▪ Reliance Power has to select the land first and submit a formal proposal to the land office ▪ After getting the formal proposal from Reliance Land office will react on the issue ▪ First they will check the land rights ▪ If it is Khas (Govt.) Land then it will be a permanent settlement between Land Ministry, Govt. of Bangladesh and Reliance Power ▪ If it is eroded land before 30 years and no claim has been established then it is considered as govt. land as per "State Acquisition and Tenancy Act 1950"and then it will be a permanent settlement between Reliance Power and Land Ministry. Govt. of Bangladesh ▪ If it is eroded land but not before 30 years and before acquisition if any claim on this land parcel surfaces, then it will considered as private land and land acquisition will be initiated as per "Acquisition and Requisition of Immovable Property Ordinance, 1982". ▪ There are no legal rights of the community on reclaimed land if it is a eroded before 30 years and then subsequently reclaimed for community use. ▪ Sub-Registry Office of land office at Upazila level records the data regarding land erosion. ▪ Land Ministry, Govt. of Bangladesh will decide the rent for Khas (Govt.) land under permanent settlement between Govt. of Bangladesh and Reliance Power ▪ If it is Private land acquisition then last 12 month average land price will consider ▪ Private land price will be last 12 month land price multiplied by 1.5
2.2	Upazila Fisheries Officer, Kutubdia	▪ Total Number of fisher man in Kutubdia Island ▪ Total Number of registered fisher man ▪ Registration process of the fisherman ▪ Type of Fishing activity ▪ Type of fishing boats ▪ Number of fishing boats ▪ Type of Fishing gear ▪ Fishing landing site ▪ Commercial Fish drying activity ▪ Aquaculture with in the island	▪ Two rounds of registration of fisher men have been undertaken in Kutubdia - 5716 fishermen have been registered under Phase I while 1228 fishermen have been registered under Phase II. ▪ Both mechanised as well as non-mechanised boats are in use in the Kutubdia Upazila. It is understood that at present approx. 150-200 boats mechanised boats (Danish boat/tempo boat and medium/large size wooden boats) are presently operating from this island; the number of non-motorised boats wooden boats in use is much higher (approx. 800 boats) ▪ Two separate form of fishing are practiced including daily fishing (which continues for maximum of 1 to 1.5 days) and deep sea fishing (continues at a stretch for 10-12 days); Around 80% of the fisher men are involved in day fishing ▪ Type of fishing gear commonly used include *Hundara Jal, Behundi Jal* ▪ Fishermen use push net, beach side seine net, shrimp net, etc. ▪ In *Dakshin Dhurung* and *Kaiyerbil* Unions, 876 and 260 fishermen have received FIDs ▪ Fishermen use the entire stretch of the coast for anchoring the boats, venturing in the seas and also for drying of their nets. ▪ There is no fish landing site on the island as the fish catch is sold off in the high sea.

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			▪ Commercially the fish drying activities are carried out towards the south-eastern part of the island; it is done privately and without any association with the Fisheries Department.
2.3	Sub. Asst. Agriculture Officer, Kutubdia	▪ Total Agricultural Land in Kutubdia Island ▪ Total irrigated and unirrigated agricultural land within the island ▪ Total number of farmer within the island ▪ Cropping pattern of the area ▪ Types of Agricultural produce ▪ Type of farmer as per the land holding size ▪	▪ Total area of the *Kutubdia Upazila* is 15,102 Ha of which area under cultivation is 5465 Ha. ▪ Some of the regions in this *Upazila* are tripled cropped with *Rabi, Kharif I (Aaush) and Kharif II (Amon)* ▪ Single cropped area is 250 Ha, double cropped area is 1670 Ha while the triple cropped area is 2500 Ha ▪ Farmers are being given identity cards – *Krishi Upakaran Sahayata* Card ▪ At present there are 13,740 farmers who are involved in cultivation of paddy and vegetables ▪ Farmers are classified as landless, marginalised, small, medium and big - based on the agricultural land holding size ▪ Net cropped area in *Dakshin Dhurung* Union *Parishad* is 680 Ha while that in *Kaiyarbil* Union *Parishad* is 360 Ha ▪ Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation.
2.4	Asst. Upazila Education Officer, Kutubdia	▪ Literacy rate of Kutubdia Island ▪ Educational infrastructure within the island	▪ The literacy rate of *Kutubdia Upazila* is 71%. ▪ The department has focused on 100% enrolment of children and has achieved enrolling almost 95% of the children into schools. ▪ Three types of educational systems in practice – general school, madrasa and vocational institutions ▪ For graduate / post graduate education, students have to visit *Chittagong* ▪ Details on educational Infrastructure available in *Kutubdia Upazila* was shared with ERM ▪ Dropout rate among boys are more especially during winter. They get involved into fish drying activity during this period as it is an easy source of earning money.
2.5	Medical Officer, Upazila Health Complex, Kutubdia	▪ Health infrastructure of the island ▪ No of health practitioner in Upazila health complex ▪ Health infrastructure at union level ▪ Dieses profile of the island	▪ The *Upazila* Health Complex has three departments – Out Patient Department (OPD), 31 bedded indoor facility and an emergency ward. ▪ There are 3 Medical Officers (MOs) at the *Upazila* Health Complex along with one Family Welfare Councillor and one UHNFO. ▪ At Union *Parishad* level there are Family Welfare Centers. ▪ It was reported by the MO that diarrhoea and respiratory tract infections are some of the common diseases among the population of the island ▪ Usually after natural disasters people suffer from water borne diseases. ▪ There are no ambulance service available on the island ▪ Inorder to reach out to all the community people 12 Community Clinics are held by the health department, 2 each for 6 Union Parishads. ▪ Immunization camps are held regularly
2.6	Observer, Bangladesh Meteorological Dept., Station	▪ Information regarding meteorological parameters	▪ Meteorological parameters such as temperature, humidity, wind speed, wind direction, barometric pressure, cloud cover and rainfall are manually recorded at this weather station at *Kutubdia*.

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
	Kutubdia		▪ This station however does not record specific data on special weather events (such as cyclones, storm surges, tidal flows, etc.) ▪ Recent information collected on select meteorological parameters was discussed
2.7	Elton, Section Officer & Mongsa Thaymarma,Surveyor, Water Development Board, Kutubdia	▪ Information regarding the earthen embankment surrounding the island ▪	▪ The *Upazila*, which is an island is surrounded by 40 km bund (embankment) ▪ The height of the embankment ranges from 6.5 -7 m from the ground level. ▪ The width at the base of the embankment ranges from 45 to 150 m at different locations whereas the width of the top of the embankment is 2.5 m. ▪ The Water Development Board has a plan to upgrade and reconstruct some portions of the embankment that has been damaged due to Ruanu Cyclone (May 2016)
2.8	Range Officer, Coastal Forest Department, Kutubdia	▪ Total forest land within the island ▪ Forest land in Dakshin Dhurung and Kaiyarbil Union ▪ Land acquisition process for the forest land ▪ Presences of wildlife in Kutubdia island ▪ Future social forestry program of forest department	▪ Total protected forest area (Gazetted forest land) in *Kutubdia Upazila* is 867.19 acres ▪ *Dakshin Dhurung* and *Kaiyarbil* unions, where the project is located, have no protected / reserve forest lands. ▪ However in both the unions, a total of 30 Ha. were under social forestry, of which 14 Ha. were lost during the recent Ruanu cyclone. ▪ For acquiring any land that is either under Protected or Reserve Forest under *Kutubdia Upazila*, application has to be filed with the DFO (Coastal), *Chittagong* Division for permission. ▪ For areas that are under social forestry, applications are to be filed with the DC who will then place it with the Forest Department for valuation of the trees that may be required to be felled for the project. ▪ It was informed by the Range Officer that in the south western part of the island turtles comes for nesting; migratory birds also visit this portion of the island during the winter season. Crocodiles and *Kamots* (sharks) have also occasionally been sited on the coastal beaches of the island (especially in the northern portion of the *Kutubdia* Channel).
	Institutional Stakeholders	▪	▪
3.1	District Administration	• Land acquisition process ▪	▪ Stressed on the need to protect sea and land ▪ Advised to collect information on special weather events (cyclone, storm surge, etc.) as well as meteorological and hydrogeological information – the project planning should appropriately consider such factors ▪ DC Office cannot enter into any type of contract with foreign/private agency ▪ The project proponent needs to enter into an agreement with the concerned ministry – the Ministry of Power, Energy and Mineral Resources (MoPEMR) in this case. ▪ MoPEMR will pass on the information to the DC Office accordingly ▪ The process of land uptake for the project will involve the following: – Once an agreement is entered on with the Project Proponent, the Ministry can forward the proposal to DC Office for reviewing – DC Office will then examine schedule of land (mouza/khatian /Dag No.)

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			and establish ownership – In case of government land DC will ask for a settlement proposal (leasing of land). – In case of private land the DC will initiate land acquisition. ▪ For GTCL gas grid project (Moheshkhali Anwara stretch) acquisition of private land for the pipeline RoW has been carried out through the DC ▪ All Government land (khas) within a district belongs to the DC. This includes canal, road, river, grazing land and reclaimed land. ▪ For all cases DC sends the proposals to the Land Department for verification.
3.2	District Fisheries Department	▪ Total Number of fisher man in Kutubdia Island ▪ Total Number of registered fisher man ▪ Registration process of the fisherman ▪ Type of Fishing activity ▪ Type of fishing boats ▪ Number of fishing boats ▪ Type of Fishing gear ▪ Fishing landing site ▪ Commercial Fish drying activity ▪ Aquaculture with in the island	▪ Ongoing program of Govt. of Bangladesh for registration of fishermen and issuing them fishermen identity cards (FID cards) ▪ Till date 7116 fishermen have been registered in Kutubdia, out of which 2464 fishermen have been issued FIDs ▪ FIDs are issued only to Bangladeshi citizens having National Identity Cards (NIDs) and only to adult fishermen (age > 18 years) ▪ So actual number of fishermen are expected to be around 20% higher ▪ Minimum 8 months of involvement in fishing in a year is required for being considered as a fisherman, ▪ In future in absence of FIDs, coast guards may prevent from fishing in the seas ▪ There is an ongoing systems for registration of boats; registration of boats is by Marine Mercantile Dept. (MMD) located in Chittagong ▪ The fees required for registration of boats is based on engine capacity of the boats ▪ Two types of fishing is prevalent in this region – day fishing and deep sea fishing ▪ Day fishing is with boats with engine capacity less than 30 HP ▪ Deep sea fishing involves a trip of 7-15 days and with boats of engine capacity around 50-70 HP ▪ The most common fish net is Behundi (marine setbag net)
3.3	Bangladesh Small and Cottage Industries Corporation (BSCIC)	• Total are of salt cultivation • Number people involved in salt cultivation • Seasonality of the salt cultivation • Location of salt cultivation ▪ Marketing process of salt	▪ Frequent cyclonic storms and sea water surge into the Kutubdia Island over the years has caused infertility of the island soil - this has prompted island residents to opt for salt cultivation. This region earlier used to have mostly agricultural land. ▪ Salt cultivation is done for almost 6 months in a year between November and May. ▪ Salt cultivation is mainly carried out on both sides of 'Pilat Kata Khal' (inland channel) within Kutubdia Island. Water from Bay of Bengal is channelized to the Kata Khal through several sluice gates from the Kutubdia Channel. ▪ In Kutubdia Island 7000 acres of land is under salt cultivation with around 4600 salt cultivators ▪ The salt cultivators take land on lease / 'barga' for 6 months for salt cultivation. Salt is sold through middlemen. ▪ There are no local markets in Kutubdia for selling salt and it proves costlier for the cultivators to take the salt and sell it in Chittagong markets. In

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			most cases the salt cultivators take loan from the middlemen for leasing out land and hence there is an arrangement between them that the salt will be sold only to them. ▪ Apart from salt cultivation, people on the island also earn their livelihood through fishing, paddy cultivation and working as daily labourers. ▪ The number of salt cultivators is not same every year. If the yield is better in one year then the number of salt cultivators increases the next year, almost by 10%. ▪ Unlike other areas such as Moheshkhali, in Kutubdia all the salt cultivators are from the island itself.
3.4	District Forest Department	• Total forest land within the island • Land acquisition process for the forest land • Presences of wildlife in Kutubdia island ▪ Future social forestry program of forest department	▪ *Kutubdia* Island has coastal afforestation zones and social forestry areas. ▪ Casuarina trees have been planted by the department as part of the Social Forestry measure on the sea facing side of the island. Community people are involved in maintenance and protection of the plants. ▪ The coastal afforestation programmes are undertaken on *Khas* land (Government land) – in such cases the land is not owned by the Forest Department ▪ Forest Department had planted casuarina trees under the coastal afforestation program in *Kutubdia* Island – however during the recent cyclonic event (Roanu) in May 2016, a large of these trees was uprooted. ▪ The Forest Department has planted mangrove species along the south eastern part of the Island especially around *Boroghop Ghat*. The species of mangrove planted include Keora (*Sonneratia apetala*) and Byne (*Avicennia sp.*) ▪ The Forest Department has not carried out any wildlife survey / study in the *Kutubdia* Island. ▪ The Forest Department suggested interacting with Marinelife Alliance (an NGO), who have been working on a 'Sea Turtle Project' along this entire coastline together with the Forest Department and the World Bank.
3.5	Department of Environment (DoE), Cox's Bazar	▪ Environmental Clearance process ▪ Application for Environmental Clearance ▪ Process of Site clearance ▪ Landfill and disposal site for hazards waste ▪ Ecological Sensitive area in and around the Kutubdia Island ▪ Future industrial development planning in Kutubdia island ▪	▪ Monitoring of the projects is being done by different offices of the DoE: • Green & Orange 'A' Category Projects: District Office • Orange 'B' Category Projects: Divisional Office • Red Category Projects: Head Office ▪ Application for site clearance (IEE) needs to be submitted to the District Office of DoE in three copies along with application fee as per the Environmental Conservation Rules, 1997. ▪ Processing of site clearance application in District and Divisional Offices will take minimum 2 weeks and as the project will be falling in Red Category and hence, the final clearance will be issued by the DoE Head Office only. ▪ Due to limited infrastructure and resources, the District Office is not involved in regular monitoring of environmental conditions in the Cox's Bazar District. However, Divisional Office at Chittagong provides support as the need arises. The District Office does carryout some water testing.

S. N.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			▪ No secured landfill for disposal of solid and/or hazardous wastes is currently available in Cox's Bazar District. The Cox's Bazar Municipal Corporate is having a dumping ground for municipal waste; however, this is not designed scientifically. ▪ The DoE is currently developing four landfills and treatment sites in Bangladesh, which are at (a) *Gazipur;* (b) *Narayanganj*; (c) *Rangpur;* and (d) *Cox's Bazar*. Out of these *Narayanganj* facility is completed and operational, whereas other three sites will be commissioned by mid- 2017. ▪ At present, Cox's Bazar district is not having any sewerage treatment plant and hazardous waste disposal site. However, the Cox's Bazar Development Authority has taken into consideration the development of a sewerage treatment plant, which is currently in initial planning and approval phase. ▪ Nearest hazardous waste incineration facility is available at Chittagong Port Authority. ▪ Cox's Bazar is not having any waste oil/ used oil and lubricant processing facility. At present, such waste oil/ lubricant is being collected by local businessmen and sold to reprocessing facilities in Chittagong region. ▪ No coastal zone management authority exists. However, coastal area security is being looked by Coast Guards. ▪ The proposed site is away from any ecological sensitive locations, however, the project could have impact on aquatic flora and fauna due to hot/ cold water discharges. ▪ Any destruction to the mangroves should be avoided during project construction and/or operations. ▪ No major development is currently planned in Kutubdia Island. However, Bangladesh Navy has taken site clearance for a submarine station to be located between Magnama Ghat and Ujantia in Pekua Upazila. This facility will use the Kutubdia channel as well.

7.4 STAKEHOLDER MAPPING

762. "Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of a stakeholder mapping is to;
- Study the profile of the stakeholders identified and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the project that each group retains;
- Gauge their influence on the project.

763. On the basis of such an understanding, the stakeholders are categorized into High Influence/ Priority, Medium Influence/ Priority and Low Influence/ Priority. The stakeholders who are categorized as high influence are those who have a high influence over the project or are likely to be heavily impacted by the

project activities, and are thus high up on the project proponent's priority list for engagement and consultation.

764. Similarly, the stakeholders categorized as medium influence are those who have a moderate influence over the project or even though they are to be impacted by the project, it is unlikely to be substantial and these stakeholders are thus neither high nor low in the project proponent's list for engagement. On the other hand, the stakeholders with low influences are those who have a minimal influence on the decision making process or are to be minimally impacted by the project and are thus low in the project proponent's engagement list.

7.5 *APPROACH & METHODOLOGY FOR STAKEHOLDER MAPPING AND ANALYSIS*

765. The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale, frequency) or degree of influence (power, proximity) of a stakeholder group and urgency/likelihood of the impact/influence associated with the particular stakeholder group in the project context. The magnitude of stakeholder impact/influence is assessed taking the power/responsibility[1] and proximity[2] of the stakeholder group and is categorized as negligible, small, medium and large. The Urgency or likelihood of the impact on/influence by the stakeholder is assessed in a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided below:

Table 7.3 Stakeholder Significance and Engagement Requirement

		Urgency/Likelihood of Influence on/by Stakeholder		
		Low	**Medium**	**High**
Magnitude of Influence/ Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

766. The following table provides brief profiles of the various stakeholders in the project as discussed in the previous sub section along with their key concerns about the project and their degree of influence.

1. Power/Responsibility: Those stakeholders to whom the organisation has, or in the future may have, legal, financial, and operational responsibilities in the form of regulations, contracts, policies or codes of practice.

2. Proximity: indicates stakeholders that the organisation interacts with most, including internal stakeholders, those with long-standing relationships and those the organisation depends on its day-to-day operations.

Table 7.4 Stakeholder Profiles and Influence Mapping

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)		Urgency/ Likelihood of Influence (Low, Medium, High)		Rating of Stakeholder Influence
Primary	**Community:** Land Owner	▪ This stakeholder group comprises of families whose land will be acquired for the proposed project. ▪ Small, medium farmers who own single or multi crop ancestral agricultural land or salt pans; ▪ Although land is an important asset, but economic value of agricultural land is limited due to low productivity and dependence on rainfall; and most of the cultivation on land is for subsistence and not for sale in market. ▪ Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation	▪ Land acquisition can be considered as an opportunity to liquidate their assets as the profit margin in agriculture become less due high production cost. ▪ Decline in land holding size of the farmers until money received out of land sale is reinvested by farmers for further land purchase.	Medium	▪ Land (Approx 40 acres land for land based facility and 34 acre land for pipeline) need to be acquired from private land owner (for laying the onshore pipeline), which is less than 0.1 present of total land mass of the Kutubdia island. ▪ It is anticipated that for setting up the land based facilities homestead land with possibly few structures may be acquired. In such a caseThe Project will try and route the onshore pipeline in a manner not to impact any residential structures. However in case of any unavoidable impact,	Medium	Moderate
	Community: Local Community	This stakeholder group comprises of the community residing in the study area.	▪ The local population has high expectation on getting employment opportunity from the project; and ▪ Is apprehensive of increase in pollution – dust, noise and water;	Small	▪ Concerned about safety due to plying of heavy vehicles in their area; ▪ Concerned about loss of standing crops due to movement of labour and equipment close by their fields; ▪ Want preference in employment opportunities generated by the project.	Medium	Minor
	Community involved in fishing activity	▪ Approximately 15000 fisherman residing in the Kutubdia Island ▪ Among them around 7200 are Govt. registered fisherman	▪ Fisherman has high expectation on getting employment opportunity for the	Medium	▪ Concern about pipeline from FSRU which can block their navigational channel for fishing ▪ They have to travel a greater	Medium	Moderate

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)		Urgency/ Likelihood of Influence (Low, Medium, High)		Rating of Stakeholder Influence
		• Approximately 5000 seasonal fisherman are also present in Kutubdia Island	younger generation as they are mostly not interested in pursuing fishing activities		distance for fishing		
	Community involved in agricultural activity	▪ Few people are involved in agricultural activity ▪ Lands are mostly used for growing crops for self-consumption. ▪ Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation.	▪ Agricultural activity is not very profitable with in the island due to frequent salt water ingression ▪ Community is not solely dependent on agriculture. ▪ Cultivator has high expectation on getting employment opportunities from the project	Medium	▪ Amount of agricultural land being acquired for the project is low (however exact estimate cannot be arrived at this stage) ▪ Agricultural land acquired for pipeline laying can be used for agricultural activity when the activity is over ▪	Low	Low
	Community involved in Salt Cultivation	▪ Most of agricultural land was converted into salt pan for the profitability of the activity a ▪ People are involved in this activity only for the six month ▪ Number of people involved in salt cultivation activity is increasing with time	▪ People are not solely dependent on this activity. This activity continues only for six to seven month of the year ▪ Salt pan is the most costly land parcel on the island	Medium	▪ Amount of salt pan being acquired for the project is low (however exact estimate cannot be arrived at this stage) ▪ Salt pan acquired for pipeline laying can be used for salt cultivation when the activity will over	Low	Minor
	Vulnerable Community	▪ This stakeholder group is comprised of the economically weaker families (Below the Poverty Line Families), the ST population, and women headed households. These subdivisions have been drawn on the basis of the understanding of the possibility of differentiated impacts on the community on the basis of the economic and social status in the society.	▪ The employment opportunities available to them will be for short term only.	Small	▪ The study area population is likely to get only short term benefit of employment in construction phase. ▪ The operational phase would have very limited job opportunity like few security personnel.	Medium	Minor

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)		Urgency/ Likelihood of Influence (Low, Medium, High)		Rating of Stakeholder Influence
	Local Administration both Union and Upazila	▪ They are the main administrative group who are responsible for the development activity of the area	▪ Most concern is around land acquisition and compensation ▪ Concerned about the Pollution due to industrial activity ▪ Concerned about the restricted movement in sea shore and sea ▪ High expectation on getting employment opportunity for the local people and development activity in the area ▪ Local administrative body has authority to restrict the land-use and resource utilization within the area of their jurisdiction.	Medium	▪ Local Administration need to work out a mechanism for cooperation to avoid loss to the property of villagers during construction works; ▪ They needs to play an effective role on in grievance redress mechanism established by RBLTL.	Low	Minor
		▪ Local area is having adequate workforce in unskilled category as mostly working population of the local area are salt pan worker, agricultural labor, fisherman; ▪ In absence of any industry nearby, mostly people have to stick to agricultural activity, fishing activity and salt cultivation activity industry; ▪ Employment opportunities generated during construction phase will attract local workers.	▪ Mostly employment opportunities for local people would be limited during till construction phase; ▪ The employment opportunities could be in form of requirement for construction labor, vending opportunities like vehicle hiring, tractors hiring, food item supply to labor colony etc.;	Small	▪ The local wage earners have high expectation of employment from the project; and ▪ The local availability of wage earners is linked to the agricultural and salt cultivation season.	Medium	Minor
Secondary	District Administration	▪ The revenue department is responsible for registration of land sale, mutation, updating and records and transfer of land;	▪ The construction phase requires a number of permissions and support from the local	Medium	▪ The influence of the stakeholders pertains to the role played in the land allotment process and the smooth functioning of the project	Low	Minor

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)		Urgency/ Likelihood of Influence (Low, Medium, High)		Rating of Stakeholder Influence
		▪ Local land survey department; land surveyor plays a significant role as land survey and record keeping; and ▪ The Dy. Commissioner is overall responsible for protection and maintenance of peace in the area.	administration; ▪ The procedural complication can cause significant project delay; and ▪ The land-matters can give rise to unnecessary litigations;				
	Department of Environment;	▪ The primary regulator for this FSRU project in Bangladesh is Department of Environment, Govt. of Bangladesh	▪ The project is required to obtain Environment Clearance from Department of Environment	Medium	▪ This process will start before project execution phase	Medium	Moderate
	Contractors/ Sub-contractors	▪ Contractor for the project is yet to be finalized	▪ Civil construction work during construction phase will absorb daily wagers mostly from local areas; and ▪ Migrant workforce would be hired for skilled jobs.	Medium	▪ It was reported by the developer that an estimated 400 laborers in the unskilled, semi-skilled and skilled categories will be employed during the construction phase under different contractors and sub-contractors.	Low	Minor

7.6 STAKEHOLDER ENGAGEMENT PLAN

767. RBLTL will establish a stakeholder engagement program for Kutubdia LNG Project which includes a comprehensive suite of stakeholder's consultation, disclosure activities and engagement exercises and media interactions. The objective of the communication plan includes:

- Setting up a process for identifying information and communication needs of RBLTL.
  - Undertake activities to supply the identified information and communication needs of RBLTL.
  - Provide support to the human resource department to ensure effective intra and inter departmental communication.
  - Identify RBLTL external stakeholders, their issues and information needs.
  - Develop communication support material for RBLTL key messages.
  - Develop appropriate corporate social responsibility policy initiatives.
  - Establish and maintain cordial relation with all stake holders including government, media, traditional authorities, local communities, and the general public as well as employees.
  - Assess effectiveness of the communication manual relevant to RBLTL

7.6.1 Resource and Responsibility:

768. As project Owner RBLTL has overall responsibility for stakeholder's consultation and engagement program. RBLTL's CSR department is responsible for implementing of this plan. The RBLTL's corporate head for external affairs is responsible for communicating with international stakeholders. RBLTL's responsibilities in this regard include:

- Responding to the concerns and issues expressed during public consultations.
  - Allocating sufficient funds to implement a viable Stakeholder Engagement Plan.
  - Ensuring that all public consultation and information disclosed is documented.

7.6.2 Communication Process

769. Project related community education activities, and documented stakeholder's engagement will be carried out by RBLTL. This are-

- Project Related Community Education Activities
- Interaction with community
  - Local Labour training
  - Interaction with media
  - Interaction with regulatory agencies
- Interaction with local NGO
- Documented Stake holders Engagement
- Quarterly photo shots of changing scope and size of the project development
  - Video & photo documentation –Livelihood ,community education, local labour
  - Rehabilitation & Resettlement
  - CSR activities
  - Stake holder engagement Register
  - Stack holder contact reports
  - Issues log

- Daily
- Newspaper clippings
- Monthly media summary

7.7 INFORMATION DISCLOSURE

770. RBLTL used a variety of communication technique to announce major project milestones and decision points. This are -

7.7.1 Reporting

771. Stakeholder Engagement Plan is the part of the Environment & Social Management Plan, which will be used for public consultations. Ongoing public consultation, meeting minutes and records will be kept in record. A summary report of all public consultation issues, grievances and redressal will be prepared at project level.

7.7.2 Informal Stakeholder Consultation

772. RBLTL will pursue a vigorous community outreach strategy throughout the project life cycle to buildup trust and facilitating open information exchange among stakeholders. RBLTL CSR department will interacts with community daily and consult on a broad range of issues with local leadership-traditional and political-and the general population. These interactions will be happen during CSR representatives are on their daily round, meeting with local people, providing informal updates on the progress of the project, and answering questions.

7.7.3 Formal Stakeholder Consultation

773. Meeting and briefing on the project will be provided to the following:
- Lender
- District Administration
- Union representative
- Government of Bangladesh
- Department of Environment
- Other regulatory Agencies
- International ,national & local media

Table 7.5 Stakeholder Engagement Plan

Stakeholder	Objective	Engagement Plan	Frequency
– District Administration – Upazila and Union Administration – Department of Environment – Forest Department – Other Concerned Government Department	– License and Clearances – Land Acquisition – Environmental Clearance	– Regular meetings for taking / giving progress updates – Timely submission of responses to queries raised – Proper filing of applications as per requirements – Undertaking environment – and social impact – assessments	On regular interval
– Local Community – Local Elected Representatives – NGOs – Effected Community	– Reputation – Building – Right – Information – Dissemination – Effective – Grievance – Management	– Community Interaction Programs – Group Meetings – Public Announcements & Press Release – Information sheets distribution	One meeting every month
– Lender – Regulator	– Compliance – Adherence – Reputation – Building	– Interim Assessments – Report Submission for – Financial and Physical – Progress – Quarterly Progress Report	On Regular Interval
– Local National and International Media	– Building – Positive – Opinion	– Community development – stories and significant – Project Updates will be publicized through Press Releases, Press Briefings, Press conferences, By-lined articles in the media, A print and radio advertising	Two media releases (any type) every year

774. Budgetary requirements for implementing the stakeholder engagement plan have been duly incorporated in the ESMP budget presented in Section 9 of the ESIA.

7.7.4 Project Disclosure Meeting

775. A further disclosure meeting was conducted as part of the environmental clearance process, as well as a part for ADB's disclosure requirements on 30th August, 2017 at Kutubdia that was attended by a wide cross section of stakeholders (Govt. Officials, elected representatives, NGOs, fishermen, community members, media, students, etc.). Details are presented in ***Annex 10***.

776. The implementation of a project is a complex time and labour intensive process involving multitude of lifecycle phases and processes. Over the duration of the project, it encounters numerous instances of conflicts, allegation and dissatisfaction within the working and associated human capital and their interactions. Some of these issues could be related to

- compensation payment,
- improper estimation of affected assets,
- failure to fulfil commitments,
- poor management of construction activities,
- accidents due to inappropriate planning of vehicle movement, and
- Cultural conflicts between migrant workers and local communities etc.

777. Most of the conflicts and allegations may not appear to be of serious nature but if not managed appropriately from the beginning may snowball into a bigger issue.

778. In order to manage these risks, an internal mechanism is required to be in place where the aggrieved party/s can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution available to them i.e. access to legal system through courts. In order to provide a formal forum to the aggrieved parties to deal with issues arising out of project, it is proposed that a joint grievance redress mechanism be instituted for both environmental and social related issues.

779. It is understood that Reliance Power already has a Grievance Redressal Mechanism (GRM) in place. There will be a specific GRM that will be put in place by Reliance Bangladesh LNG Terminal Limited (RBLTL – subsidiary of Reliance Power) for this project. This project specific GRM will be formulated in keeping with the process and procedure of the existing GRM and will be integrated into the same. The following sub sections provide an understanding of the GRM proposed for the project.

8.1 OBJECTIVES OF THE GRIEVANCE REDRESSAL MECHANISM

780. The basic objective of the GRM shall be to provide an accessible mechanism to the affected people, community or any stakeholder(s) having a stake in the project to raise their issues and grievances in regards to project functioning.

781. The fundamental objective of GRM is to resolve any social (including labour, contractor, community amongst others) and environmental related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of project related work activities. The other important objective is to democratize the development process at the local level and to establish accountability towards the stakeholders.

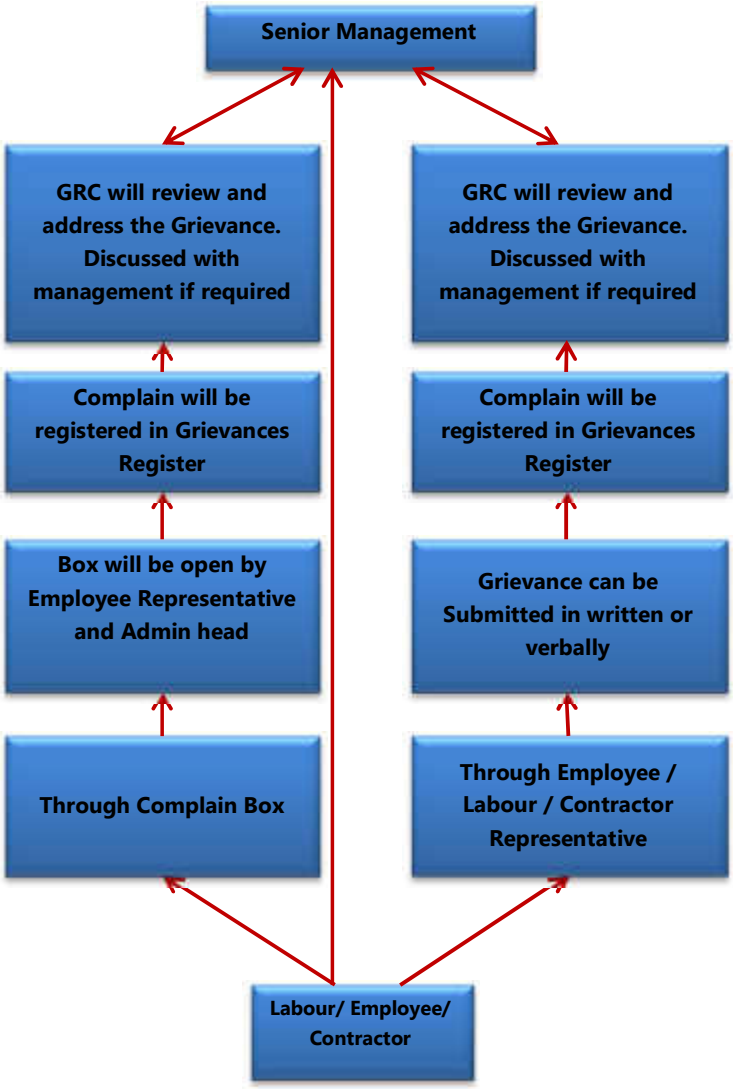
8.2 PROCESS OF GRIEVANCE REDRESS MECHANISM OF RBLTL

782. The key elements of the GRM to be adopted by RBLTL for the present project is summarised in the following sections.

8.2.1 Grievance Redressal Mechanism for Employees and Contractual Workers

783. A schematic representation of the grievance redress procedure for employee and contractor will be followed by Reliance Power is being shown below in *Figure 8.1*.

Figure 8.1 Existing Grievance Redress Process for the Employee and Contractor



784. As stated in the above figure, the employees and contractual workers can register their grievances in verbal or written form by communicating their grievances to the compliance personnel or group audit personnel or by dropping the grievance in the complaint box, which will be located at every strategic location of the facility. The GRC will maintain a log of all complaints

received in the form of a Grievance Register, as has been discussed in ***Section***. Grievance log will help to track cases, respond to grievances in a timely manner, check the status of complaints and track progress, measure effectiveness, and report on results.

785. The GRC will then review and investigate the grievance, along with the representatives from the concerned departments, and identify measures to resolve the grievance as appropriate. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused, and introduction of mitigation measures to prevent recurrence of the problem in the future. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

786. On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 4 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress. On the basis of the response, the grievance form will be updated and the grievance will be closed.

8.2.2 Grievance Redressal Mechanism for External Stakeholders

787. The grievance redressal mechanism for the external stakeholders for RBLTL is presented in the ***Figure 8.2.***

Figure 8.2 Grievance Redressal Mechanism for External Stakeholders

788. As can be seen from the above figure,

- The external stakeholders, including the local community, can register their grievances in verbal or written form by communicating their grievances to

the Liaison Officer or by dropping the grievance in the complaint box/register, which will be located at the entry gate of the land based facility.

- The GRC will maintain a log of all complaints received in the form of a Grievance Register, as has been discussed in ***Section***.The process for review and investigation of the grievances will be similar to the process for the employees and contractual workers.
- As part of the review process, the GRC will also undertake site inspections, if required. A site inspection will be undertaken by the factory manager or a member of the GRC. The purpose of the site inspection will be to check the validity and severity of the grievance. The inspection will be undertaken within ten days of receiving the grievance.
- The assigned individual will then work with other relevant members of the GRC and concerned departments to investigate the problem and identify measures to resolve the grievance as appropriate. On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 3 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress.
- On the basis of the response, the grievance form will be updated and the grievance will be closed.

8.2.3 Grievance Redressal Mechanism for Resettlement

789. As per ADB procedures, RBLTL has to establish a project specific Grievance Redress Mechanism (GRM) having suitable grievance redress procedure to receive and facilitate resolution of affected people's concerns, complaints, and grievances. A grievance mechanism will be established within one month from the approval and disclosure of draft Resettlement Plan to allow Project Affected Persons (APs) appealing any disagreeable decision, practice or activity arising from land or other assets compensation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. Care will always be taken to prevent grievances rather than going through a redress process. This can be done through careful land acquisition and resettlement design and implementation, by ensuring full participation and consultation with the APs, and by establishing extensive communication and coordination between the affected communities and local government in general. RBLTL will ensure that the public, particularly those directly affected by the project components will have the chance to express their legitimate grievance or to file a complaint about the project by setting up a mechanism to address the issues raised. This mechanism is not intended to bypass the government's own legal process, but is intended to provide a time-bound and transparent mechanism that is readily accessible to all segments of the affected people. The grievance mechanism should not impede access to the country's judicial or administrative remedies. APs can approach the court of law at any time and independent of grievance redress process.

790. All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the Project.

791. The GRM structure especially this purpose is as follows :

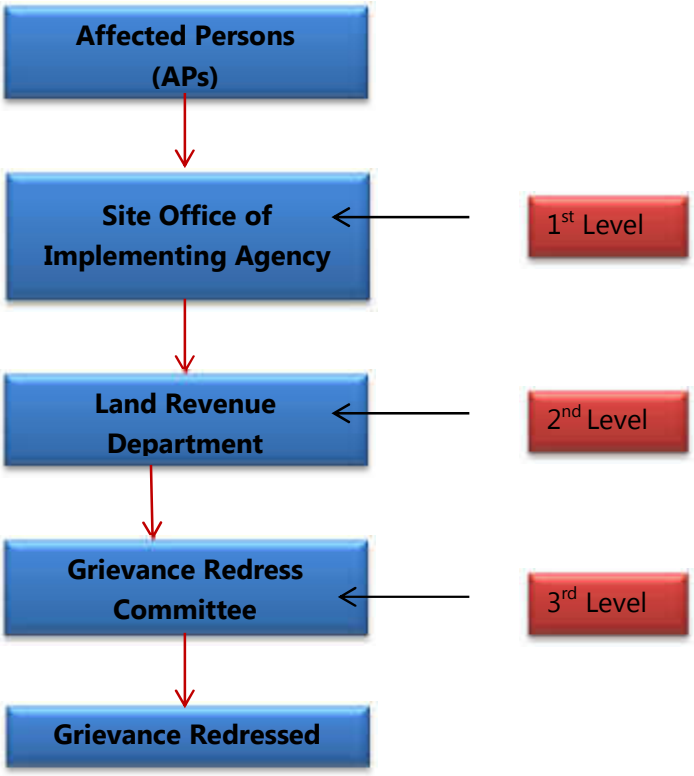
- *GRM Committee Structure for Resettlement*
  - Representative of RBLTL
  - Representative of RP implementing Agency
  - Representative of the Local Administrative Body
  - Local member from Union
  - Representative of the APs
  - Representative of the District Commissioner

- *Grievance Redress Process*
  - **1st Level-** APs will be informed in writing by the RBLTL through Land Revenue Department, Govt. of Bangladesh of their losses and entitlements. If APs agree with the conditions of entitlements, they can claim for the payments from the RP implementing agency.

  - **2nd level** – If the APs disagree, contact person from Land Revenue Department can be approached for clarifications. The Land Revenue Department will respond to queries within two weeks. Grievances raised will be documented providing details on the person, concerns raised, and the action taken by the Land Revenue Department. If the AP is satisfied, the compensation can be claimed from the Land Revenue Department.
  - **3rd level** – If the APs is not satisfied, Land Department will refer the issue to the GRC who will resolve it within four weeks. A hearing can be called, if needed, to give chance to the APs to present the concern in person.

792. The grievance redressal mechanism for Resettlement for RBLTL's Kutubdia LNG project is presented in the ***Figure 8.3***.

Figure 8.3 Grievance Redressal Mechanism for External Stakeholders



8.3 COMPOSITION OF GRC IN RBLTL

793. The GRM of RBLTL will be one single level of grievance redress mechanism or agency. This agency is called as the Grievance Redress Cell (GRC). GRC has the following representation to ensure fair and timely solution to the grievances:

- RBLTL Site personnel serving as the Community relations officer will also be serving as the Grievance Officer.
- General Manager on behalf of RBLTL management and site manager of site. However in cases the site manager is not available, this role may be deputed to his immediate deputy or any individual with that level of authority;
- Senior contractor personnel as a part of the GRC in case of a contractor labour dispute or issue;
- Community representative as a part of GRC in case of community grievance.
- A grieved party can register their grievances with the GRC. The GRC has empowered to take a decision which is to be considered final and binding on RBLTL. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

8.4 FUNCTIONAL PREMISES OF GRC FOR GRIEVANCE REDRESS

794. The GRC meetings will be held in RBLTL project office at site and the same will be widely publicised in project area for the knowledge of general public. The key responsibilities of GRC are as follows:

- Review, consider and resolve grievances related to social and environmental aspects received by the RBLTL Site Office;
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an "complainant" nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution is based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- If needed, may undertake field visits to verify and review the issues, dispute or other relevant matters.

8.5 DISCLOSURE OF THE GRIEVANCE REDRESS MECHANISM

795. The process of existing disclosure mechanism of GRM followed by RBLTL facility, will keep the following aspects in mind:

- The grievance redress process shall be disclosed and the procedures mentioned therein shall be properly disseminated to the identified stakeholders.
- RBLTL shall integrate the grievance redress mechanism as a part of the induction training programme especially those conducted for self-employees and the contractors.
- The disclosure of the information shall clearly mention the name and designation of the grievance redress officials, office location and their respective contact numbers.

8.6 GRIEVANCE REPORTING PROCEDURE

796. An aggrieved person, a group of persons or a community can file grievances without any fear and intimidation. The grievances can be submitted in either in writing or may be submitted orally/ telephonically to the GRC; the whole purpose is to make the GRM easily accessible to the affected population. The decision made by GRC will be communicated to the concerned person/group/community in writing.

797. The GRC will maintain records of the grievances received, in written and oral form, including the details of the complainant, the subject of the grievance, the appropriate department, and the status of the grievance. A sample recording format is provided in the following table

Table 8.1 Sample Recording Format for Grievances Received

S. No	Date	Village	Name of Complainant	Details of Grievance	Concerned Department	Status	Remarks

8.7 MONITORING AND EVALUATION

798. Like the other project components, GRM will be monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the GRC to compile and maintain database on grievances for periodic review. The process of monitoring will include an internal monitoring and an external monitoring process.

799. The internal monitoring will be undertaken by the GRC, on a regular basis (at least six monthly). This process will allow for a review of the GRM to be undertaken, in terms of the efficacy of the mechanism and the average time taken for the redressal of the grievances received. These monitoring reports will be shared with the senior management of RBLTL.

800. In addition to the internal monitoring process, the Project will consider engaging an external agency for undertaking monitoring of the GRM on an annual basis. This monitoring process will allow for an assessment to be undertaken of the number and nature of grievances received, the manner in which the grievances were settled and the number of pending grievances. The external monitoring report will also be disclosed to the local community and other identified stakeholders.

8.8 BUDGETING

801. The RBLTL administration shall ensure adequate budgeting and resource allocation for implementing the grievance redress mechanism.

802. The Project specific Environment and Social Management Plan (ESMP) has been developed with an aim to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures. Reliance Bangladesh's LNG & Power Limited's QHSE Policy is given in ***Figure 9.1***. This includes: mitigation of potentially adverse impacts;
   - monitoring of impacts and mitigation measures during project implementation and operation;
   - institutional capacity building and training;
   - compliance to statutory requirements; and
   - integration of the ESMP with Project planning, design, construction and operation.

Figure 9.1 Reliance Bangladesh LNG & Power Limited's QHSE Policy

Reliance Bangladesh LNG & Power Limited
Quality, Health, Safety & Environment Policy

Reliance Bangladesh LNG & Power Limited is committed to protect the Environment and operate and deliver products & services ensuring health, safety and welfare of its employees, customers, business partners, visitor and any other stakeholder affected by its business.

To accomplish this in a sustainable manner **Reliance Bangladesh LNG & Power Limited** shall proactively adhere to the best industrial practices for QHSE management during construction & operation phases.

- Operate in a sustainable manner and be a learning organisation and seek continual improvement in services that it provides through training of employees.
- Maintain high safety standards, inculcate enthusiasm in safe working practices through participative culture, involving all employees, contract workmen.
- Safeguard the environment, life and equipments from any deterioration of the environment while controlling disposal of waste/emissions.
- Provide safe health working environment and prevent ill health following best practices in occupational health.
- Proactively follow and comply with Federal Laws, State regulations relating to Health, Safety, Environment and Product Quality
- Quality, Health, Safety and Environment will be considered in each decision making Equipment, Process, Raw Materials, Products and Services and Selection of Employees and Contractors
- Constantly strive to upgrade technology and processes and enhance skills and knowledge of each employee for quality improvements in our products and services to exceed customer expectations and improving value to stakeholders.
- Effectively implement the QHSE system involving employees and all stakeholders, constantly review the set objectives, provide resources and improve on its performance.

This Policy shall be followed by all employees and stakeholders involved in our business.
Reliance Bangladesh LNG & Power Limited pledges to remain committed to the Policy.

February 4th, 2017

9.1 MITIGATION MEASURES

803. Key environmental and social impacts have been identified and reported in *Section 5* along with mitigation measures. A summary of mitigation measures identified for the construction[1] and operation phases of the Project is presented in ***Table 9.1***. This also identifies lead responsibility for implementing the mitigation measures and sources of funds for such implementation.

804. The construction phase of project is expected around 2 years, whereas the life span of the Project is 15 years and Reliance Bangladesh LNG Terminal Limited (RBLTL), a subsidiary of Reliance Power, will be responsible for ensuring that the mitigation measures in the ESMP are implemented throughout the life span of the Project.

805. An Engineering, Procurement and Construction (EPC) Contractor will be engaged by RBLTL to design, construction and commission the Kutubdia LNG Project. The EPC Contractor in general will be responsible for implementation of most of the mitigation action plans that have been proposed as part of the ESIA for the construction phase. So it is recommended that using a framework of the mitigation measures and management plans that have been proposed as part of this ESIA, the EPC contractor will develop a site specific EMP and seek approval of RBLTL on the same before the initiation of construction activities.

9.2 ENVIRONMENTAL MONITORING

806. The environmental monitoring programme has been devised with the following objectives:
- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project area.

9.2.1 Performance Indicators and Monitoring Schedule

807. Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each E&S performance indicator has been prepared for all phases of the Project and is presented in ***Table 9.2.*** A separate ecological monitoring program is presented in ***Table 9.3***. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

[1] Social impacts associated with the pre-construction phase of the Project have been covered under the construction phase.

9.2.2 Reporting Mechanism for Environmental and Social Monitoring Program

808. A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flows of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism for ensuring that the measures proposed in the Project's ESMP are implemented.

809. Before the civil works start, the EHS Division of RBLTL will finalise the format for reporting on the status and progress of environmental monitoring. The format will be designed to meet all the compliance conditions associated with the environmental clearance from the Department of Environment and the Government of Bangladesh. The contractor will be required to submit the duly filled up reporting form on a monthly basis to the Project Developer (ie, RBLTL). A further report, detailing the results of pollution monitoring for air, noise, soil, and water will be submitted quarterly as envisaged in the monitoring plan. A health and safety incident/accident report will be prepared and submitted in the event of an incident or accident. The EHS Manager will monitor the effectiveness of the ESMP implementation. The CSR Manager will have responsibility of monitoring the implementation of social components of the ESMP. Both the EHS and CSR Managers will further report to the Plant Manager, who will be overall in-charge of the Plant operations and management.

810. The quarterly reports of the management measures will form an integral part of the Quarterly Progress Reports that can be submitted to the lenders. Additional compliance reports to the Regional Office and Head Office of the DOE required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats.

Table 9.1 Environmental and Social Management Plan (Commitment Register) for Construction & Operation Phase of the Project

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A	*Environmental Issues Associated with Site Preparation and Construction*						
A1.1	Permitting	▪ Construction Works	Legal Non-compliance	High	▪ Environmental Clearance to be obtained from Department of Environment (DoE), Govt. of Bangladesh before any construction works are initiated	RBLTL	Management time
A1.2	Updation of EIA	▪ Dredging (No dredging works are involved in the project)	Impact on marine environment	High	▪ The ESIA-ESMP has been developed considering that no dredging works are required for the project. ▪ No dredging works to be undertaken without corresponding updation of ESIA-ESMP	RBLTL	-
A2.1	Aesthetic and Visual Quality	▪ Storage of construction materials; ▪ Storage and disposal of construction waste, municipal waste; ▪ Physical presence of labour camp; ▪ Earth work along the pipeline route; ▪ Dust deposition in the nearby property/ vegetation ▪ Disposal of HDD cut material generated from pipeline laying	Visual and aesthetic impact on the nearby villages Disposal of MSW in open area around the village will create nuisance.	Moderate	▪ Entire land based CTMS facility will be fenced with bamboo mat or tin sheet; ▪ All the construction activities will be restricted within the designated site; ▪ Fugitive dust will be supressed with periodic water sprinkling; ▪ On completion of work all temporary structures, surplus materials and wastes will be completely removed from site and disposed at a designated area; ▪ Construction wastes and municipal solid waste temporarily stored at the sites will be transported to the designated disposal site/facility at regular intervals.	EPC Contractor	EPC Contractor Cost
A3.1	Soil Quality	Site clearing and preparation	Loss of topsoil	Minor	▪ Top soil from the entire pipeline route and CTMS land based site will be stripped before site development activity;	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Top soil will be stored in a dedicated top soil storage site, having adequate mitigation measures for preventing erosion due to runoff; ▪ Activities will be scheduled (as far as possible) to avoid extreme weather events, such as heavy rainfall and high winds. ▪ Top soil will be restored after completion of the pipeline construction activity ▪ Top soil will be used for landscaping within the CTMS and pipeline route		
A3.2	Soil Quality	Site clearing and preparation	Soil compaction	Minor	▪ Demarcation of routes for movement of heavy vehicles; ▪ Stripping and placing soils when dry, and not when wet.	EPC Contractor	EPC Contractor Cost
A3.3	Soil Quality	Fuelling and operation of heavy machinery and transport vehicles	Soil compaction	Minor	▪ Refer ESMP 3.2	EPC Contractor	EPC Contractor Cost
A3.4	Soil Quality	Fuelling and operation of heavy machinery and transport vehicles	Soil contamination through spills and leaks	Minor	▪ Preparation of guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; ▪ Storage areas for oil, fuel and chemicals to be surrounded by bunds or other containment devices to prevent any spilled oil, fuel or chemicals from contaminating soils, water or groundwater; ▪ Use of spill or drip trays to contain spills and leaks, and use of spill control kits to clean small spills and leaks; and	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Installation of oil/water separators to treat surface run-off from bunded areas prior to discharge to the storm water system.		
A3.5	Soil Quality	Storage and handling of chemicals	Soil contamination through spills and leaks	Minor	▪ Refer ESMP 3.4	EPC Contractor	EPC Contractor Cost
A3.6	Soil Quality	Storage, handling and disposal of construction waste	Soil contamination	Minor	▪ Design processes to prevent/ minimise quantities of wastes generated and hazards associated with the waste generated; ▪ Implement a construction materials inventory management system to minimise over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period; ▪ Segregate hazardous and non-hazardous waste and provide appropriate containers for the waste types generated (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance); ▪ Store wastes in closed containers away from direct sunlight, wind and rain; ▪ Ensure storage area has an impermeable floor and containment, of capacity to accommodate 110% of the volume of the largest waste container; ▪ Dispose of waste by authorised vendor.	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A3.7	Soil Quality	Generation of sanitary effluent	Soil contamination	Minor	▪ Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce; ▪ Septic tank and soak pit will be provided to treat domestic waste water.	EPC Contractor	EPC Contractor Cost
A4.1	Physiography & Drainage	Laying of pipeline along the agricultural land/ crossing of drainage channel/ nalas (minor streams)	CTMS Site grading may disturb drainage. Temporary disturbance of micro drainage channel due to laying of pipeline	Moderate	▪ Provide drainage system CTMS stie to maintain the micro-drainage of area; ▪ Reclaim the site after completion of the pipeline laying; ▪ Maintain the cross drainage structure along the pipeline route.	EPC Contractor	EPC Contractor Cost
A5.1	Surface Water Quality	Erosion from excavation, levelling, filling and other activities	Increased sediment content of surface water	Moderate	▪ Provision of channels, earth bunds or sand bag barriers on site to direct storm water to silt removal facilities; ▪ Protection of stockpiles by plastic sheeting to ensure that they are suitably secured against the wind at the end of each working day if rain is forecasted; ▪ Appropriate surface drainage will be designed and provided where necessary; ▪ Drainage systems, erosion control and silt removal facilities will be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit will be removed regularly;	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Any temporarily diverted drainage will be reinstated to its original condition when the construction work has finished or when the temporary diversion is no longer required; ▪ Oil interceptors will be provided in the drainage system where necessary and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages; and ▪ Temporary and permanent drainage pipes and culverts will be provided to facilitate runoff discharge. These will be designed for the controlled release of storm flows.		
A5.2	Surface Water Quality	Site run-off	Increased sediment content of surface water	Moderate	▪ Ref. ESMP 5.1	EPC Contractor	EPC Contractor Cost
A5.3	Surface Water Quality	Construction of marine structures like twin berth jetty	Disturbance to the sea bed and localised sediment dispersion.	Moderate	▪ Less intrusive piling techniques shall be adopted to minimise turbidity ▪ It will be ensured that suitable piling equipment is deployed to minimise the suspension of fine sediments at the site ▪ Piling activity will be regulated during rough sea conditions ▪ It will be ensured that barges / workboats have slop tanks for collection of liquid / solid waste generated on board. Discharge of wastes into sea will be prohibited.	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Spill control measures will be adopted while fuelling piling equipment, barges, workboats, etc. ▪ Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of construction activity and will be carried out throughout construction period		
A5.4	Surface Water Quality	Fuelling and operation of heavy machinery and transport vehicles	Contamination of surface water	Moderate	▪ Vehicle servicing areas, vehicle wash bays and lubrication bays will, as far as practical, be located within roofed and cemented areas. The drainage in these covered areas will be connected to sewers via an oil/water interceptor; ▪ Any oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal; ▪ Any surplus wastewater from the concrete batching plant will be treated to comply with discharge standards before it is discharged to the Sea;	EPC Contractor	EPC Contractor Cost
A5.5	Surface Water Quality	Storage and handling of chemicals	Contamination of surface water	Moderate	▪ Ref. ESMP 5.4	EPC Contractor	EPC Contractor Cost
A5.6	Surface Water Quality	Storage, handling and disposal of construction waste	Contamination of surface water by sanitary effluent	Moderate	▪ Ref. ESMP 3.7	EPC Contractor	EPC Contractor Cost
A5.7	Surface Water	Generation of sanitary	Contamination	Moderate	▪ Provide sanitation facilities	EPC Contractor	EPC

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
	Quality	effluent	of surface water				Contractor Cost
A5.8	Surface Water Quality	Barge transport	Impact on Sea water environment due to routine discharges of oily bilge and ballast water from barges; dumping of non-biodegradable solid waste and accidental oil/ cargo spills or toxics	Moderate	▪ Barge transport operators who are compliant to the GOB regulations and are permitted to operate barges for transportation purpose by appropriate authorities in Bangladesh will be engaged for providing the transport services.; and ▪ Barges used for Project material transport will be periodically independently inspected and audited by the Project EHS Management Team members periodically. Each barge will be inspected at least once in every 6 months or earlier. If any continued non-compliance with respect to the GOB regulations is observed over two (2) audit inspections, the Project will terminate the services of the barge transporter.	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A5.9	Surface Water Quality	Discharge of hydro-test water	Hydro-testing water is generally characterized by high pH, turbidity, metals, oxygen scavengers (like ammonium or sodium bisulphite etc.), biocide residues, etc. and can adversely affect surface water quality	Moderate	▪ Hydrotesting water shall be collected in a tanks and treated adequately before discharge in surface water bodies ▪ Treatment will include pH correction and reduction of Oxygen demand ▪ The treatment facility will meet IFC EHS Guidelines for discharge of the hydrotest water as well as complying with Bangladesh standards ▪ The treated water will be tested before discharged to any surface water body ▪ A hydrotest water disposal plan will be developed to confirm details, prior to initiating any pipeline constructionstruction activites.	EPC Contractor	EPC Contractor
A6.1	Ground Water Quality	Fuelling and operation of heavy machinery and transport vehicles	Contamination of groundwater	Moderate	▪ Ref. ESMP 3.4 and 3.6	EPC Contractor	EPC Contractor Cost
A6.2	Ground Water Quality	Generation of sanitary effluent	Contamination of groundwater by sanitary effluent	Moderate	▪ Ref. ESMP 3.7	EPC Contractor	EPC Contractor Cost
A6.3	Ground Water Quality	Storage and handling of chemicals	Contamination of groundwater	Moderate	▪ Ref. ESMP 3.4	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A7.1	Air Quality	Operation of heavy machinery and transport vehicles	Exhaust Emissions	Minor	▪ Minimise movement of construction vehicles and enforce a speed limit around the construction site; ▪ Regularly maintain all diesel-powered equipment and reduce idling time to avoid emissions of NOx, PM10 and SO2; ▪ Where available use low sulphur diesel (LSD) in HGVs and diesel powered equipment in collaboration with best management practices; ▪ Implement best practice procedures to control vehicle / equipment air emissions (such as turning off equipment when not in use); and ▪ Vehicle / equipment exhausts observed to be emitting significant black smoke from their exhausts should be serviced/ replaced.	EPC Contractor	EPC Contractor Cost
A7.2	Air Quality	Topsoil and spoil piles management	Dust	Minor	▪ As far as possible, locate the concrete batching plant away from sensitive receptors; ▪ Implementation of a periodic watering and sprinkling regime in particular during the dry season, atleast two times during the day; ▪ Minimise the height from which fill materials are unloaded during site backfilling as far as possible. Where possible, this should be below the height of the hoarding around the Project site boundary; ▪ During construction, the approach road will be regularly maintained	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					to keep it clean, free from mud and slurry. The approach road will be properly shaped and compacted by rolling to an even and uniform surface to receive pavement. ▪ Totally enclose any skips for material transport with impervious sheeting; and ▪ No waste will be burnt on or around the Project site.		

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A8.1	Noise	Heavy machinery operations for construction works	Increase in ambient noise levels	Minor	▪ Normal working hours of the contractor will be between 06:00 and 21:00 hours from Monday to Sunday. If work needs to be undertaken outside these hours, it should be limited to activities that do not lead to exceedance of the noise criteria at nearby sensitive receptors; ▪ Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components should be conducted; ▪ Low noise equipment should be used as far as practicable; ▪ The number of equipment operating simultaneously should be reduced as far as practicable; ▪ Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby sensitive receptors like Ali Fakir Deil settlement as far as practicable; ▪ Acoustic enclosure should be erected around DG sets and other stationary noise generating equipment;	EPC Contractor	EPC Contractor Cost
A8.2	Noise	Increased traffic	Increase in ambient noise levels	Minor	▪ Only those vehicles meeting the standards stipulated in Schedule 5 of the Environmental Conservation Rules, 1997 shall be used; ▪ Vehicles should be regularly maintained;	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A9.1	Occupational Health and Safety	General construction activities	Health and safety of construction workforce	Moderate	▪ The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for working methods, plant utilisation, construction sequence and safety arrangements; ▪ Measures will be implemented to reduce the likelihood and consequence of the following hazards: o falling from height; o falling into water; o entanglement with machinery; o tripping over permanent obstacles or temporary obstructions; o slipping on greasy oily walkways; o falling objects; o contact with dangerous substances; o electric shock; o variable weather conditions; o lifting excessive weights; o A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site; ▪ All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor;	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ All workers will be properly informed, consulted and trained on health and safety issues; ▪ Personal Protective Equipment (PPE) shall be worn at all times on the Site. ▪ Women in the region generally wear "sarees", which is not appropriate while working in hazard prone construction areas. If women will be working in the hazard prone areas, then the contractor needs to ensure proper outfit and PPEs. ▪ Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order; ▪ All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded; ▪ All scaffolding will be erected and inspected in conformity with the Factories Act and the appropriate records maintained by the Contractor; ▪ Safety hoops or cages will be provided for ladders with a height in excess of two metres; ▪ When there is a risk of drowning lifejackets shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are		

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					present when work is proceeding; ▪ The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress.		
A9.2	Occupational Health and Safety	Changes to/existing environmental conditions	Health of construction workforce	Moderate	▪ Provision of clean drinking water in accordance with Schedule 3 (b) of ECR, 1997; and ▪ Ref. ESMP 3.4, 4.1, 5.1 , 5.4	EPC Contractor	EPC Contractor Cost
A10.1	Community Health and Safety	Jetty Design	Seimic risk	Moderate	▪ As per Seismic Zoning Map of Bangladesh, Project site is located in Zone -II, (same as Chittagong), where building design of moderate levels will be necessary and same will be adopted for jetty construction	EPC Contractor	EPC Contractor Cost
A10.2	Community Health and Safety	Influx of construction workers	Increased prevalence of disease	Minor	▪ Barriers will be provided to prevent ingress of persons into the construction site and also to protect the public from exposure to hazards associated with the construction activities; ▪ Screening, surveillance and treatment of workers, through the provision of medical facilities and, where required, immunization programmes; ▪ Undertaking health awareness and education initiatives among workers; ▪ Avoiding collection of stagnant water;	EPC Contractor	EPC Contractor Cost
A10.3	Community Health and	Road transportation	Traffic safety	Minor	▪ Ref. ESMP 7.1 ▪ Road safety awareness building for	EPC Contractor	EPC Contractor

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
	Safety				villagers living along the transportation route.		Cost
A11.1	Terrestrial Ecosystem	CTMS site grading and excavation along pipeline route	Vegetation Clearance	Minor	▪ Land clearing to be kept to a minimum to the extent practicable for the land based facility and gas pipeline; ▪ Wherever feasible, changes in the alignment of the gas pipeline will be made to avoid felling of larger trees and ▪ Topsoil of the site should be preserved for later use in reinstatement activities ▪ Plantation of local species for stabilization of the filled in material and plantation in designated and areas along pipeline and surrounding area in consultation with forest department ; ▪ Strict instruction should be given to the construction workers not to cut trees from the nearby areas for their fuel and timber use; ▪ Use of LPG/ Kerosene for cooking need to be provided/ encouraged in order to reduce the impacts on vegetation from the vicinity of the Project site.	EPC Contractor	EPC Contractor Cost
A11.2	Beach ecosystem	Routing of the Pipeline	Project interaction with fish drying, tutle nesting and anchorage areas	Moderate	▪ Flexibility will be maintained in respect of the local pipeline routing to suitably avoid any such areas encountered	EPC Contractor	EPC Contractor Cost
A11.3	Beach ecosystem	Construction of subsea and subsurface pipeline sections	Disturbance to near shore and beach ecosystem	Minor	▪ Subsea and subsurface pipeline sections will be laid through horizontal directional drilling (HDD). No excavation of seabed	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					material will be required. ▪ HDD will be undertaken away from beach to minimize impact on beach ecosystem ▪ The bow shaped pipeline from FSRU will exit at Kutubdia Island ~100 m from shore from where it will again run as subsurface below 2 m ground level. The depth of pipeline in the beach area will be maintained below 3 m from ground level. ▪ Pipeline construction activities in the beach area during nesting period i.e. Dec – March will be avoided		
A11.4	Marine Fish (particularly Knifetooth sawfish)	Construction of FSRU and subsea pipeline.	Spillage & leakage of fuel & lubricant	Moderate	▪ Proper spill control measures viz. spill kits to be made available on site.	EPC Contractor	EPC Contractor Cost
		Underwater noise and vibration due to piling activities in the sea		Moderate	▪ Periodic monitoring of under water noise during pile driving activity ▪ Big bubble curtain (BBC): Based on the results of under water noise monitoring, if felt necessary, freely rising bubbles injected by perforated pipes encircling the pipe will be used, which reduces underwater noise levels ▪ Using High frequency – low energy piling technology	EPC Contractor	EPC Contractor Cost
		Movement of ship and vessels	Likelihood of fish mortality/injury during due to boat and vessel movement in sea	Moderate	▪ Vessels should use low speed to reduce underwater noise generation ▪ All equipment and engines in vessels should comply with industry noise level standards	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			and channel area.		▪ Study on the frequency and area of occurrence of endangered Knifetooth Sawfish in the area with local fishery expert to be conducted.		
A11.5	Marine Reptiles (specific to Olive Ridley turtle)	Construction of FSRU and subsea pipelines	Spillage & leakage of fuel & lubricant	Moderate	▪ Proper spill control measures viz. spill kits to be made available on site.	EPC Contractor	EPC Contractor Cost
			Impact on turtle nesting sites	Moderate	▪ Survey of turtle nesting habitats at the project location and pipeline route prior to start the activity; ▪ Prohibition under contractual condition for poaching of Turtle eggs by the construction workers; ▪ If turtles are found nesting, then construction works at that location must be prohibited until the nesting is completed	EPC Contractor	EPC Contractor Cost
		Movement of ship and vessels	Likelihood of turtle mortality/injury during due to boat and vessel movement in sea and channel area.	Moderate	▪ Minimize the vessel movement during the nesting periods of December to March; ▪ Vessels should use low speed to reduce underwater noise generation ▪ All equipment and engines in vessels should comply with industry noise level standards;	EPC Contractor	EPC Contractor Cost
		Illumination	Disoriented movement of the turtle hatchlings may occur due to illumination	Moderate	▪ Minimum illumination at the coastal side as they may disrupts the hatchling movement; ▪ Shading and shielding for lights; ▪ Switch off unnecessary lights especially during turtle nesting and hatching season.	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A11.6	Marine mammals (particularly dolphins and porpoises) Aquatic Ecosystem	Construction of FSRUand subsea pipeline.	Spillage & leakage of fuel & lubricant	Moderate	▪ Survey of dolphin sightings in the area and identification of months with higher activity; establishment of dolphin habitat (if any), in proximity to the Project area ▪ Proper spill control measures viz. spill kits to be made available on site. ▪ An ecological watching brief will be considred for all vessels and at jetty works for dolphin sightings to ensure that vessels do not collide with them, ▪ The works will cease when dolphin pod is seen in vicinity.	EPC Contractor	EPC Contractor Cost
A11.7	Aquatic Ecosystem	Illumination	Disoriented movement of the turtle hatchlings may occur due to illumination	Moderate	▪ Minimum illumination at the coastal side as they may disrupts the hatchling movement;	EPC Contractor	EPC Contractor Cost
A11.8	Terrestrial and Aquatic Ecosystem	Construction Works	Disturbance to Terrestrial and Aquatic Ecosystem	Moderate	▪ Following ecological surveys and detailed design a construction method statement will be developed to elaborate on implementation of the ecological mitigation measures set out in the ESIA including those related to piling ▪ The construction method statement will be approved by RBLTL prior to start of construction activity.	EPC Contractor	EPC Contractor Cost
A12.1	Social Forestry	Construction of Land based CTMS facility and laying of pipeline	DisruptionLoss of social forestry sitetrees	Negligible	▪ The Project will avoid felling of big and mature trees as much as possible during the erection of pipelines. It will not cause any impact to the shelter belt trees. ▪ In case of unavoidable	RBLTL	Project Management Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					circumstances, permission to be availedsough from the Forest Department and/ DC (being the ownerdepending on ownership of the land). ▪ Compensation for the trees to be paid at market value and as assessed by the Forest Department ▪ More trees to be planted by the project proponent apart from Green belt that may serve as shelter belts.		
B	***Social Issues Associated with the Pre-construction and Construction Phase***						
	The land acquisition and involuntary resettlement of the Affected Persons (AP) will be guided by a Resettlement Framework (RF) for the entire project (covering all the project components as separately prepared)						
B1.1	Land acquisition	Land acquisition for the Pipeline Route and CTMS site	Loss of Land Change in Land Use Fragmentation of Land Holdings	Minor	▪ The land owners those who will be losing land will receive cash compensation under the law (CCL) which is Mouza Rate additionally with 50 percent of it as premium as per ARIPO. ▪ Cash grant to cover the difference between cash compensation under law (CCL) and the replacement cost. ▪ Provision for stamp duty and land registration cost incurred for replacement land purchase at the replacement value, capital gain tax, and value added tax incurred for replacement land. ▪ Additional compensation for vulnerable household, if any. ▪ Dissemination of information about the acquisition and compensation calculation process; ▪ Preference in employment	RBLTL and District Administration	Part of the RP

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					opportunities for land losers during project construction period; ▪ Provision of training for skill improvement for alternate occupations other than agriculture; ▪ Provide additional support and assistance to land owners deemed landless from the acquisition in terms of temporary financial sustenance, jobs, etc. ▪ Implementation of grievances redress mechanism (as presented in Chapter 8) to address concerns and grievances of the land losers		
B1.2	Migrant Workers & Labourers	Inflow of Migrant labourers & workers expected during construction phase of the project	Potential conflict with local community; Health risks due to spread of communicable diseases and sexually transmitted diseases Issue of Sanitation and hygiene	Moderate	▪ Engage locally available human resources to the maximum extent possible in order to avoid large scale in migration of external labourer. ▪ Provide adequate facilities to the migrant workers and labourers such as properly constructed and well ventilated labour camps, clean and hygienic sanitation facilities, cooking areas etc. to minimize the health related impacts; ▪ Separate toilet and bathing facilities for men and women; ▪ Creating awareness about local tradition and culture among outside migrant and encouraging respect for same; ▪ Conducting awareness programme about sexually transmitted diseases among the migrant workers, labourers and for community around project site;	RBLTL and EPC Contractors	Project Management Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the area;		
B1.3	Community Health & Safety	Project Construction Phase	***Traffic Movement:*** Traffic congestions and potential disruption to community life; Risks associated with traffic movement and community safety; Additional risks to children, women and old people due to traffic movement; Dust and noise caused by the movement of vehicles; ***Health & Safety*** Generation of dust, noise and odour emanating from the construction site	Moderate	▪ Prepare a traffic management plan for managing inflow and outflow of traffic and related safety risks and issues during construction phase; ▪ Train drivers and navigators .on traffic related rules and regulations as well as safety aspects in order to reduce risks of accidents; ▪ Covering of trucks while carrying soil, sand, cement, aggregates etc. to minimise spread of dust and spill over; ▪ Creating awareness among the drivers about speed, traffic safety, honking etc. while driving through settlement area; ▪ Avoid unnecessary movement of vehicle through settlement area to minimise disturbance and traffic safety related issues; ▪ Create awareness among children, women and old people about traffic safety through using the medium of school, women self-help group, village union office; ▪ Regular maintenance of village road to minimise damage to road surface; ▪ Regular sprinkling of water to suppress dust generating from the construction site; ▪ Proper disposal of wastes	RBLTL and EPC Contractors	Community Health & Safety

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			Potential fire hazards in form of flammable chemicals and materials stored during construction ; Improper disposal of sewage and construction wastes into the surroundings posing risk of contamination to local resources utilized by the community Risk of spread of sexually communicable disease		generated from the camp and construction activity to maintain general hygiene in the area; ▪ Disposal of wastes at pre identified waste dumping site to avoid unauthorised dumping; ▪ Create awareness among workers about maintaining health, safety and hygiene in the area; ▪ Prepare a Community Health & Safety Management Plan (CHSMP) that prescribes a chartered plan of action to manage health and safety impacts on the community emanating from the construction and operating phase activities ▪ Disclose the CHSMP to the community under project influence zone and generate awareness about the various impacts envisaged during the project lifecycle ▪ Crate awareness about sexually transmitted disease among larger community around project area		

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
B1.4	Cultural Heritage	Pipeline Construction Activity	Disturbance in Graveyard due excavation of trench, movement of labour and vehicle, restriction in community access during pipeline laying activity	• Moderate	▪ Graveyard area should be avoided if the proposed ROW of the pipeline going through the Graveyard area. ▪ Temporary barricading around the four side of the graveyard should constructed for restricting the movement of labour and vehicle within the graveyard area ▪ Access of the community people to the graveyard may not be restricted due to the pipeline laying activity ▪ It is should be ensured that during the construction phase no spill over takes place due to staging of construction materials. ▪ Restriction in construction activity during the prayer time	RBLTL and EPC Contractors	Project Management Cost
C	***Environmental Issues Associated with the Operation Phase***						
C1.1	Aesthetic and visual quality	Physical presence of the FSRU; Illumination from the LNG facility.	Aesthetic and Visual impact	• Moderate	▪ Light sources used should for the FSRU and Jetty will be of low vapour sodium lamps or light of near red spectra region i.e. > 600 nm of wavelengths ▪ Appropriate shading of lights to prevent scattering ▪ During operation phase no onshore lighting in beach area would be necessary for the project	EHS Team of RBLTL	Project O&M Cost
C2.1	Surface and ground water quality	Oil spills from oil tanks	Impact on soil and ground water environment Contaminated storm water runoff carrying	• Moderate	▪ The secondary containment structures such as berms, dykes, or walls that could hold up to 110 % of the primary containment volume will be made of firm and impervious material at diesel and lubricating oil storage areas; ▪ SOPs will be prepared to manage	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			contaminants to Sea Water		any oil spills, leaks seepages. SOPs will cover transport, handling, storage, use and disposal of oil/ oil wastes/ empty drums etc. Operating personnel will be trained on the SOPs and monitored in their use on a daily basis; ▪ Empty drums will be sent for reuse or for recycling in line with DOE guidelines; ▪ At all oil and diesel storage tank locations, emergency spill kits will be provided for the operating personnel to use. Operating personnel will be trained to use such kits and dispose of them as part of hazardous waste; and		
C2.2	Surface and ground water quality	Oily water-runoff	Contaminated storm water runoff carrying contaminants to Sea Water and Kutubdia Channel	Moderate	▪ Oily water runoff collected in the oil handling & storage area and oil filled motors and pump bases will be collected in different sump and taken to a common oily waste water sump; ▪ The oily wastewater and storm runoff collected from specific areas mentioned above will be treated using an oil water separator; and ▪ Separated oil will be disposed of as part of oily wastes and handled as a hazardous waste stream. The treated de-oiled water will be transferred to waste water chamber	EHS Team of RBLTL	Project O&M Cost
C2.3	Surface and ground water quality	Spills of fuel, oil and chemicals	Impact on soil and ground water environment	Moderate	▪ Acids and other hazardous materials will be stored in a dedicated room as per their MSDS specifications with adequate ventilation;	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			Occupational health and safety hazard Contaminated storm water runoff carrying contaminants to Sea Water and Kutubdia Channel		▪ All chemicals will be stored in primary containers that have in-built secondary containment of capacity that is at least 110% of primary containment; ▪ The Spill prevention and response guidance presented in Sections 1.5 and 3.7 of the General IFC EHS Guidelines (2006) will be followed and implemented.		
C2.4	Surface and ground water quality	Barge transport	Impact on Sea and Kutubdia Channel water environment due to routine discharges of oily bilge and ballast water from barges; dumping of non-biodegradable solid waste and accidental oil/ cargo spills or toxics	Minor	▪ The need for barge transport is likely to be limited during the O&M phase. In case barge transport services are required, the mitigation measures suggested in the construction phase ESMP will be implemented.	EHS Team of RBLTL	Project O&M Cost
C2.5	Surface and ground water quality	Discharge of domestic wastewater	Impact on Sea Water and channel water quality	Minor	▪ The sewage from the entire plant area will be collected and treated in septic tank/soak pit or a mobile STP. No untreated sewage will be directly discharged into Sea water or disposed of on land through the project life cycle; • The treated effluent will comply with GOB ECR 1997 Schedule 9	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					(Standards for Sewage Discharge) and IFC Guidelines before discharge into the Sea water; and • In order to monitor STP performance, continuous evaluation and monitoring of discharge parameters will be undertaken at the outlet point of STP.		
C2.6	Surface and ground water quality	Non-oily site or storm water runoff	Impact on Sea water quality	Minor	▪ Storm water and non-oily surface run off will be collected separately and disposed into Sea through for this stream of wastewater; ▪ The discharge system will be periodically inspected for blockages and cleaned at least once before the monsoon season to ensure its functioning; and ▪ Operating personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective action.	EHS Team of RBLTL	Project O&M Cost
C2.7	Surface Water Quality	Discharge of return cold water from the FSRU and machine cooling water	Impact on marine water quality and marine ecology	Minor	▪ As per EHS Guidelines for LNG Facilities suggested by IFC, discharged cooling or cold water temperature will be ensured within 3 degrees Celsius of ambient temperature at the edge of the mixing zone or within 100 meters of the discharge point ▪ Ensure to follow the monitoring mechanism suggested in environmental monitoring programme	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
C3.1	Air Quality	Stack emissions	Impact on ambient air quality GHG emissions	Negligible	▪ The Project will adopt Gas Engine system for captive power generation which has a relatively high energy-efficiency and low polluting per unit of power produced compared to other thermal power plants; ▪ Three air emission stacks Gas Engine of 35m height onboard FSRU, 14 m for diesel generator at jetty and 15 m for Gas Engine at CTMS will be included - to disperse the air pollutants such that ground level concentration of air pollutants do not exceed the background concentration and meets GOB/DOE norms; ▪ Comply with the Emission guidelines for Combustion engines in the IFC EHS guidelines for Thermal Power Projects. ▪ Monitor ambient air quality in and around the Project site as per the Environment Monitoring Program formulated for the Project which will comply with National Regulatory requirements.	EHS Team of RBLTL	Project O&M Cost
C3.2	Air quality	Indoor air quality	Impact on health of workers and staff	Negligible	▪ Implement leak detection and repair (LDAR) program that will control fugitive emissions. A gas detection system (GDS) will be provided to warn the operational personnel immediately in the event of a leakage within the GTG and skid area. The GDS will be infra-red system suitable for natural gas detection;	EHS team of RBLTL	Project O&M cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					▪ Supply mechanical supply ventilation systems by wall mounted supply air fans at GTG building and chemical storage area to reduce the VOC levels in the ambient environment inside the operational buildings; and		
C4.1	Noise	Plant operations	Impact on health of workers and staff	Negligible	▪ Install gas enine with noise attenuation measures such as air intake silencers and acoustic insulation. At fuel gas skid, sound absorption walls will be erected to reduce the ambient noise levels; ▪ Maintain operator exposure to Ambient Noise Level (ANLs) to less than 85 dB(A) for 8 hour normalised exposure limit as recommended in the IFC EHS guidelines; ▪ Comply with the noise emission criteria as per the Schedule 4 of ECR, 1997; Noise Pollution (Control) Rules, 2006 and noise guidelines prescribed in the General EHS guidelines of the IFC; ▪ Maintain ANLs at office areas at 45-50 dB(A) in line with IFC guidelines; ▪ Monitor ambient noise levels in and around the Project site as per the Environment Monitoring Program formulated for the project which will comply with National Regulatory requirements.	EHS Team of RBLTL	Project O&M cost
C4.2	Noise	Operation of FSRU	Impact on health of workers and staff	Negligible	▪ All noise generating units would be acoustically enclosed; ▪ Use of rubber padding underneath	EHS Team RBLTL	Project O&M cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					high noise and vibration generating machines; ▪ Personnel working onsite in high noise generating areas will use ear plugs /ear muffs;		
C5.1	Greenhouse Gases	Captive Power Plant emissions	GHG emissions from the plant may add to larger global warming issue	Negligible	▪ Natural gas based Power Plant are the least GHG emitting plants among the contemporary thermal power plant technologies and release lower quantities of carbon dioxide, a greenhouse gas; ▪ Project has chosen the best power generation technology for the natural gas fuel to balance the environmental and economic benefits. The project has adopted Gas engine which is relatively higher energy-efficient and lower GHG producer per unit of power produced compared to other thermal power plant technologies; ▪ Commit to good design and maintenance of the natural gas combustion system such that the designed GHG emission performance can be maintained through the project life cycle; ▪ Install a continuous emission monitoring (CEM) system for monitoring AAQ levels in the HRSG stacks and calculating GHG emissions.	EHS Team RBLTL	Project O&M Cost
C6.1	Community Health and Safety	Plant operations	Impact on community assets such as water due to water intake and	Minor	▪ Comply with the Community health and safety guidelines presented in Section 3.0 of the General EHS Guidelines published by IFC;	EHS Team RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			cooking water discharge Increased vehicular traffic in the region Exposure to site accidents and incidents Project Security		▪ Formulate and implement an Off-site Emergency Management Plan in consultation and collaboration with local government authorities to streamline the emergency management response and strategy. ▪ Institute and operate a Community Grievance Redress System in line with ADB SPS and IFC Performance Standard 4 that pertains to Community Health, Safety and Security aspects; and ▪ If required, Project Security personnel will be engaged and trained in line with the recommendations of IFC Performance Standard 4.		
C7.1	Terrestrial Ecosystem	CTMS Operations	Incremental noise	Minor	▪ Attenuate noise levels to the extent possible by proper lubrication of machinery and equipment and installation of noise barriers/acoustic enclosures at appropriate locations.	EHS Team of RBLTL	Project O&M cost
C8.1	Marine Ecosystem	Sea water withdrawal	Impingement/ Entrainment/ Entrapment of aquatic life	Moderate	▪ Intake with proper screens will be provided. ▪ The design of the intake will conform to international good practice guidance for intake design. ▪ Maintaining Low Intake Velocity to minimise the entrainment and impingement (i.e velocity through-screen design intake velocity of 0.15 m/s (i.e. 0.5 ft/s) Ref (such as that included in IFC EHS Draft	EHS Team of RBLTL	Project O&M cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					Guidelines for thermal power plants of June 2017) ▪ Intake is proposed nearer to LNG FSRU and hence entrapment will be insignificant		
C8.2	Marine Ecosystem	FSRU Operations	Spillage & leakage of fuel & lubricant	Moderate	▪ Proper spill control plan to be adopted on site. ▪ Oily water separator to be installed at the point of surface run-off discharge ▪ Suggestions from Oil Spill Contingency Plan to be strictly implemented in case of spillage	EHS Team of RBLTL	Project O&M cost
C8.3	Marine Ecosystem	FRSU Operations	Move of ship and vessels	Moderate	▪ Study on the frequency and area of occurrence of endangered Knifetooth Sawfish in the area with local fishery expert to be conducted. ▪ Vessels should use low speed to reduce underwater noise generation ▪ All equipment and engines in vessels should comply with industry noise level standards;	EHS Team of RBLTL and	Project O&M cost
		FRSU Operations	Discharge of cold water	Minor	▪ Temperature check to be performed regularly before discharge of cold water from FSRU	EHS Team of RBLTL and	Project O&M cost
C8.4	Marine Reptiles (specific to Olive Ridley Turtles)	FRSU Operations	Spillage & leakage of fuel & lubricant	Moderate	▪ Proper spill control plan to be adopted on site. ▪ Oily water separator to be installed at the point of surface run-off discharge ▪ Suggestions from Oil Spill Contingency Plan to be strictly	EHS Team of RBLTL	Project O&M cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					implemented in case of spillage		
		FRSU Operations	Move of ship and vessels	Moderate	▪ Vessels should use low speed to reduce underwater noise generation ▪ All equipment and engines in vessels should comply with industry noise level standards;	EHS Team of RBLTL and	Project O&M cost
		FRSU Operations	Illumination	Moderate	▪ Minimum illumination at the coastal side ▪ There should be no flood lighting, up-lighting, or other forms of directional lighting aimed above the horizon at the FSRU and land based facility; ▪ Switch off unnecessary lights especially during turtle nesting and hatching season. ▪ Support Local Forest Department and Local NGOs for in situ turtle nesting activities	Operation Team of RBLTL	Project O&M cost
		FRSU Operations	Discharge of cold water	Minor	▪ Temperature check to be performed regularly before discharge of cold water from FSRU	EHS Team of RBLTL and	Project O&M cost
C8.5	Marine mammals (particularly dolphins)	FSRU Operations	Spillage & leakage of fuel & lubricant	Moderate	▪ Proper spill control plan to be adopted on site. ▪ Oily water separator to be installed at the point of surface run-off discharge ▪ Suggestions from Oil Spill Contingency Plan to be strictly implemented in case of spillage	EHS Team of RBLTL	Project O&M cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			Movement of ship and vessels	Moderate	▪ Support Local Forest Department and Local NGOs for in situ turtle nesting activities ▪ Support government initiatives in terms of research and monitoring for Dolphin studies in the region.	EHS Team of RBLTL	Project O&M cost
D	***Social Issues Associated with the Operation Phase***						
D1.1	Traditional Fishing Route	Project Operation Phase	Impact on fishing activity	Moderate	• Communicate the problem to the affected community prior to the construction activity • Maintaining healthy relationship with community through CSR activity	RBLTL	Project management Cost
D1.2	Community Health and Safety and other issues	Project Operation Phase	Traffic Movement in newly constructed site approach road	Minor	• Awareness campaign among the community residing adjacent to the road • Maintaining healthy relationship with community through CSR activity	Project Management	O&M Cost
D1.3	Occupational Health and Safety	Project Operation Phase	Risk of accident and fatality to worker	Minor	• On job training for the workers shall be carried out; • Work permit system shall be followed; • PPEs to be provided and use of PPEs shall be encouraged; • SOPs to be developed for operation and maintenance of the project site.	EHS Team of RBLTL	O&M Cost

Note: The Environmental and Social Management Plan (ESMP) as stated above would form the basis for management of environmental and social impacts of the Kutubdia LNG Project. The ESMP would also be used as a guiding framework for RBLTL, EPC contractors and other subcontractors for management of environmental and social issues on site. As stated earlier the EPC contractor will develop a site specific EMP and seek approval of RBLTL on the same before the initiation of construction activities. In addition to the ESMP, RBLTL will develop specific Standard Operating Procedures (SOPs) for proper management of environmental issues. An outline on the SOPs for certain key aspects like waste management, occupational health and safety, fire protection and management, etc. are presented in Annex 12 of this ESIA.

Table 9.2 Environmental Monitoring Programme (Pre-Construction, Construction and Operation Phases)

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Pre- Construction Phase							
Ambient Air Quality	Air pollution	Respirable Particulate Matter (PM_{10}, $PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO)	6 locations within Kutubdia Island: Light House, Ali Fakir Deil; Pachar Para, Dakshin Dhurung; Kata Para, Lemshikhali ; Ismail Haji Para, Kaiyarbil; Uttar Musjit Para, Uttar Dhurung; Uttar Mogdil Para, Boroghop.	Standard analytical methods	6 weeks, once a week at each location during pre-monsoon season (Total 36 samples) CO will be monitored 8 hourly while the rest of the parameters will be monitored over 24 hours.	3rd Party Environmental Consultant / RBLTL	ESMP Budget
Ambient Noise	Incremental noise levels	Noise levels. Results will be analysed to work out Leq hourly, Leq day and Leq night	6 locations within Kutubdia Island: Light House, Ali Fakir Deil; Dakshin Dhurung Union complex, Pachar Para; Nurul Hasan House, Kata Para, Lemshikhali; Kamal Hossain House, Ismail Haji Para, Kaiyarbil; Saju Mia House, Uttar Masjid Para, Uttar Dhurung; Kutubdia Upazila Health Complex.	Standard analytical methods	Once during pre-monsoon continuously for 24 hours	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
Traffic Survey	Incremental traffic density	Traffic count for different categories of vehicles / vessels	Road Traffic – 1 location T1 - Road connecting Ali Fakir Deil with the Uttar Dhurung Road is selected for the road Waterway traffic – 2	Volume count	Once during pre-monsoon continuously for 24 hours	3rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
			locations T2 - Boroghop Ferry Ghat; T3 –Darbarghat Ferry Ghat.				
Soil Quality	Soil contamination	Particle size distribution, Texture, pH, salinity, SAR, electrical conductivity, organic carbon, NPK, TDS, Na, Mg, Ca, Chloride, Fluoride, Permeability, Porosity, Cation Exchange Capacity, Infiltration rate	Two locations in agricultural land in Kutubdia Island Agricultural land near embankment of Ali Fakir Deil village; Agricultural land of Darbar village.	Standard analytical methods	Once during pre-monsoon	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
Ground Water Quality	Groundwater contamination	Temperature, pH, TDS EC, Salinity, Colour, Odour, Turbidity, Total Hardness (as $CaCO_3$), Alkalinity (HCO_3) Chloride (Cl), Sulphate Nitrate , Fluoride (F), Sodium (Na), Potassium (K), Arsenic (As), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), Iron (Fe), Nickel (Ni), Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B), Fecal Coliform, Total Coliform	4 locations (tube wells) within Kutubdia Island Ali Fakir Deil village, Dakshin Dhurung Union; Baitul Sharif Madrasa Complex, Kaiyarbil Union; Darbar village, Lemshikhali Union; Uttar Mogdil village, Boroghop Union.	Standard analytical methods	Once during pre-monsoon	3rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Marine Water Quality	Water contamination	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Salinity, TDS, Suspended Solids, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	6 samples to be collected from Bay of Bengal and Kutubdia Channel 500 m west towards the sea from the landfall point; 3000 m west towards the sea from the landfall point; 1500 m South West towards the sea from the landfall point; 1500 m North West towards the sea from the landfall point; 300 m towards the Kutubdia channel from right bank near to the Dhurung ghat; 300 m towards the Kutubdia channel from left bank near to the Chunura ghat.	Standard analytical methods	Once during pre-monsoon	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
Inland Surface Water Quality	Water contamination	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, BOD_5, COD, Turbidity, Salinity, TDS, Suspended Solids, Nitrate, Nitrite, Manganese, Phosphate, Iron, Oil and Grease	One sample from Pilat Kata Khal	Standard analytical methods	Once during pre-monsoon	3rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Marine Sediment	Sediment contamination	Sand, Silt, Clay, Texture, Dissolved Oxygen, pH, Organic Carbon, Total Sulphur, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	4 locations in Bay of Bengal off Kutubdia Island 500 m west of the landfall point in Bay of Bengal; 500 m North West of landfall point in Bay of Bengal; 300 m towards the Kutubdia channel from right bank near Dhurung ghat; 300 m towards the Kutubdia channel from left bank near to the Chunura ghat.	Standard analytical methods	Once during pre-monsoon	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
Tree Enumeration	Tree felling	Matured trees to be cut for development of the land based facility and onshore pipeline	Land based facilities; onshore pipeline corridor from CTMS to Napura valve station	Frequency count	Once during pre-construction phase	Biodiversity Expert/ RBLTL	ESMP Budget
Site Preparation and Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas[1] and construction workers camp	Visual inspection of all active work areas	Daily	EHS Team of EPC Contractor	EPC Contractor Cost
Ambient Air Quality	Dust generation	$PM_{2.5}$ and PM_{10}	Identified air sensitive receptors within 500 m from the construction site	24-hour	Monthly	3rd Party Environmental Consultant / EPC Contractor	ESMP Budget
	Vehicle exhaust	NO_2, SO_2, CO	Identified air sensitive receptors within 100 m from the activity areas	1-hourly and 24 hourly	Monthly	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
Noise	Increase in ambient noise	Noise levels in Leq, Leq day, Leq nigh	Identified noise sensitive Receptors within 100 m from	24-hour	Once every fortnight	3rd Party Environmental	ESMP Budget

[1] Activity areas are defined as Project site, approach road and gas pipeline alignment.

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
	levels	and hourly Leq	the activity area/s			Consultant/ EPC Contractor	
Soil	Quality of filling earth/ sand	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	Barge/ trawler	Standard analytical methods	The first delivery from any source and then random sampling of deliveries from that source	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
	Contamination of soil	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	Construction site or laydown area or spill area	Standard analytical methods	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
Water	Contamination of surface water	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	Sea and Kutubdia Channel (close to construction area) at 2 locations (upstream and downstream)	Standard analytical methods	Monthly	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
	Ground water quality	Drinking water quality parameters as per Schedule 3 of ECR 1997	Groundwater Bore well in nearest village of the construction area	Standard analytical methods	Monthly	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
	Surface water temperature	Temperature of the water body around the outfall due to discharge of cold and cooling water discharges	2 probes to be located north and south of the jetty	Water Temperature Monitoring using offshore probes	Monthly	3rd Party Environmental Consultant	O&M Cost
	Waste Water	Discharges from FSRU, LNGCs and Tugs	Around discharge locations	Inspection and Record Keeping	Monthly	EHS Team of RBLTL	O&M Cost
Occupational Health and Safety	Accidents or incidents due to construction activities,	Near-misses, incidents, occupational diseases, dangerous	Project activity areas and construction workers camp	Incidents, accidents and community complaints	Based on occurrence	EHS Team of EPC Contractor	EPC Contractor Cost

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
	workers' health	occurrences					
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Newly constructed approach road on the embankment	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost
	Community disturbance and potential safety hazard due to waterway transportation	Accidents, incidents and complaints	Sea and Kutubdia Channel	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	RBLTL	EPC Contractor Cost
Land acquisition and livelihood restoration	Loss of residential house, land, loss of earning	Budget and timeframe, disbursement of entitlements to Aps/ DPs, Disclosure and consultations, grievances and complaints, benefit monitoring	Project activity area	Indicators as covered in RP and mentioned in Resettlement Framework	Regularly during RP implementation and follow up	RBLTL/ District Administration	Part of RP Implementation Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
RP Implementation	Loss of residential house, land, loss of income	Periodic assessment of the RP implementation and impacts to verify internal monitoring and to suggest adjustments in delivery mechanism and procedures as required	Project activity area	Indicators as covered in RP and mentioned in Resettlement Framework	Regularly during RP implementation and follow up and provide biannual reports	External Monitoring Agency to be hired by RBLTL	Part of RP Implementation Budget
Operation Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	EHS Team of RBLTL	Included in operation and maintenance (O&M) cost
Air Pollution	Stack emissions concentrations from captive power plant	NOx, CO, PM	Main stack and by-pass stack	CEM	Continuous	EHS Team of RBLTL	Installation included in EPC Cost. Monitoring and maintenance in O&M cost
	Ambient air quality	NOx, CO, PM10, SO2	3 locations within 2 km from the Project boundary	Standard methods	Monthly	3rd Party Environmental Consultant / RBLTL	ESMP Budget
Noise	Noise generation by Plant equipment	Sound Pressure Level	1 m from the noise generating equipment	Noise monitoring	Monthly Quarterly	RBLTL EHS Team or 3rd Party Environmental Consultant In case of monitoring done by RBLTL, verification by 3rd	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
						Party Environmental Consultant	
	Ambient noise	Ambient noise levels	At Project boundary and at nearest NSRs in all direction from the Plant	Noise monitoring with data logger	24-hour observations with hourly noise levels, monthly once at each location	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
GHG Emissions	Climate change	GHG production	Plant control room	Natural gas consumption	Annual	RBLTL	-
Soil	Soil and Sediment Contamination	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	Accidental spillage area, waste storage area, and Sea	Standard analytical methods	Half Yearly	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
Water	Ground water quality	Drinking water quality parameters as per Schedule 3 of ECR 1997	Bore well water to be used for domestic purposes in the nearest village	Standard analytical methods	Monthly	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
	Wastewater	Temperature, chlorine, pH, BOD5, COD, oil & grease, heavy metals, total faecal coliform	Outlet of discharge channel	Standard methods	Monthly	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
	Surface water quality	Temperature, conductivity, pH, DO, TDS	9 stations. 3 each along 3 transects perpendicular to the shoreline (at 0 m, 200 m and 500 m from the point of discharge of effluent)	Potable water quality analyser	Monthly Quarterly	RBLTL EHS Team or 3rd Party Environmental Consultant In case of monitoring done by RBLTL, verification by 3rd Party Environmental Consultant	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
	Surface water temperature	Temperature of the water body around the outfall due to discharge of cold and cooling water discharges	2 probes to be located north and south of the jetty	Water Temperature Monitoring using offshore probes	Monthly	3rd Party Environmental Consultant	O&M Cost
	Waste Water	Discharges from FSRU, LNGCs and Tugs	Around discharge locations	Inspection and Record Keeping	Monthly	EHS Team of RBLTL	O&M Cost
Occupational Health and Safety	Accidents or incidents due to operation and maintenance activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As to be defined in the H&S Plan to be prepared by RBLTL for the Project	As defined in H&S Plan	EHS Team of RBLTL	O&M Cost
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Newly constructed site approach road	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of RBLTL	O&M Cost
	Community disturbance and potential safety hazard due to waterway transportation	Accidents, incidents and complaints	Sea	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of RBLTL	O&M Cost
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Community Liaison Officer of RBLTL and Station Manager	O&M Cost

Table 9.3 Ecological Monitoring Programme (Pre-construction, Construction & Operation Phases)

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Pre-construction							
Marine Fish	Impact on fish species	Frequency of occurrence of Knifetoofth sawfish in the area	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Monthly	Biodiversity Expert/ EPC Contractor	ESMP Budget
Marine Turtles	Impact on turtle nesting	Nesting frequency of turtles	Kutubdia Island	Frequency count	Monthly in nesting season for turtles	IUCN Expert/ EPC Contractor	ESMP Budget
	Impact on turtle species	Frequency of occurrence of mature olive ridley turtles	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Monthly	IUCN Expert Expert/ EPC Contractor	ESMP Budget
Marine Mammals	Impact on cetacean species	Frequency of occurrence of dolphins and porpoises	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Monthly	Biodiversity Expert/ EPC Contractor	ESMP Budget
Construction							
Marine Fish	Fisheries	Visible fish kills	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Six monthly	Biodiversity Expert/ EPC Contractor	ESMP Budget
Marine Turtles	Impact on turtle nesting sites	Nesting locations and numbers of nests per season	Kutubdia Island	Visual inspection of all active work areas	Monthly during nesting season (December-March)	IUCN Expert Expert/ EPC Contractor	ESMP Budget
	Turtle mortality/injury	Turtle stranding, nesting activities	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Monthly in nesting season	IUCN Expert Expert/ EPC Contractor	ESMP Budget
Marine Mammals	Cetacean mortality/injury	Dolphin/porpoise stranding	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Six monthly	IUCN Expert Expert/ EPC Contractor	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Under Water Noise	Impact on marine species	Hammer Noise in Decibels d(B) [considering peak values; calculating RMS value and SEL]	Offshore Jetty	Continuous monitoring for 24 hours	Twice a week during the period of construction	3rd Party Environmental Consultant	ESMP Budget
Operation							
Marine Fish	Fisheries	Visible fish kills	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Six monthly	Biodiversity Expert/ EHS Team of RBLTL	O&M Cost
Marine Turtles	Impact on turtle nesting sites	Nesting locations and numbers of nests per season	Kutubdia Island	Visual inspection of all active work areas	Monthly during nesting season	IUCN Expert Expert/ EHS Team of RBLTL	O&M Cost
	Turtle mortality/injury	Turtle stranding, nesting activities	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Monthly in nesting season	IUCN Expert Expert/ EHS Team of RBLTL	O&M Cost
Marine Mammals	Cetacean mortality/injury	Dolphin/porpoise stranding	FRSU, offshore pipeline area, ship movement areas	Visual inspection	Six monthly	IUCN Expert Expert/ EHS Team of RBLTL	O&M Cost

811. As mentioned earlier the Environmental and Social Management Plan (ESMP) will be used as a guide for site specific management of environmental and social impacts. This document would also be used as a reference framework for EPC contractors for management of environmental and social issues on site. In addition to the ESMP, the EPC Contractor / RBLTL will also develop specific Standard Operating Procedures (SOPs) for management of environmental issues during construction and operation phases. A brief outline of SOPs on key aspects such as occupational health and safety management, hazardous waste management, solid waste management, fire protection and management, etc. are presented in **Annex 12** of this ESIA.

9.3 ESMP BUDGET

812. Budgetary estimates for environmental and social management for the Kutubdia LNG project includes items envisaged as part of the ESMP. These have been worked out based on details and specifications for mitigation measures. The ESMP budget includes provisions for environmental management and monitoring (other than measures considered under good engineering practices or those integrated as embedded project controls) along with provisions for stakeholder engagement and for implementation of the adopted CSR programs.

813. The budget for environmental management is distributed in three parts. As baseline monitoring during the ESIA study was conducted during post-monsoon; another monitoring programme during pre-monsoon is recommended before commencement of construction activities. The pre-construction phase monitoring should include monitoring for air, noise, groundwater, surface water, soil, traffic etc. The estimated budget for environmental management and monitoring during pre-construction phase is calculated to be **BDT 1,203,000.**

814. Monitoring of physical environment during construction phase will involve air, noise, soil, surface water, groundwater monitoring. Construction phase is expected to continue for 3 years. Total budget for environmental monitoring during construction phase is estimated to be **BDT 14,068,000**.

815. Monitoring of physical environment during operation phase will involve stack, air, noise, soil, surface water, groundwater monitoring. Operation phase is designed for 15 years. Total annual budget for environmental monitoring during operation phase is estimated to be **BDT 2,466,000**.

816. The budget for ecological survey during preconstruction phase would involve a dedicated survey to estimate the nesting frequency of turtles in Kutubdia region is also suggested. Apart from that, three other surveys involving identification of fishing routes near Kutubdia Island, occurrence of Knifetooth Sawfish, dolphins and porpoises in Kutubdia offshore waters and enumeration of trees with respect to pipeline corridor (that is required to be felled) are also considered. The estimated budget for ecological survey would be **BDT 2,500,000**.

817. Budget for ecological survey during construction phase would involve stranding of fish and marine mammals and nesting locations and numbers of nests per season and also turtle stranding. The surveys would be conducted once a year for 3 years by IUCN experts and the estimated total budget for construction phase of 3 years is **BDT 12,00,000**.

818. Budget for ecological survey during operation phase would involve stranding of fish and marine mammals and nesting locations and numbers of nests per season and also turtle stranding. The surveys would be conducted once a year during operation phase by IUCN experts and the estimated budget per year during operation phase is **BDT 4,00, 000**

819. An annual CSR budget of **BDT 10,300,000** is estimated for the proposed project during operation stage which is planned to be utilized in health, education, skill improvement and development of rural infrastructure for the local community. In addition, an annual budget for stakeholder engagement of **BDT 215,000** will be utilized across all stages for community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.

820. The budgetary provisions of the ESMP are presented in ***Table 9.4***. It should be noted that the ESMP budget excludes all costs towards implementation of the Resettlement Plan (RP).

9.4 INFRASTRUCTURE FOR CONDUCTING ENVIRONMENTAL & OHS ANALYSIS

821. RBLTL will engage external 3rd party consultants for conducting environmental monitoring on site. In addition, RBLTL will also procure environmental monitoring equipment and hire environmental analyst for conducting basic environmental analysis on a day to day basis. A small field laboratory will be set up at the land based facility.

822. Field equipment to be procured is listed below;
- Thermometer
- pH meter
- TDS meter
- Electrical Conductivity meter
- DO meter
- Noise meter

823. Basic infrastructure to be developed at the field laboratory
- Distilled water system;
- Digital weighing machine;
- Chemicals;
- Consumables- graduated pipette, burette, conical flasks, beakers etc.;
- Heating system;
- Computer and printer

- Lab furniture etc.

824. Moreover, RBLTL will also coordinate with Chittagong University and other local experts (college professors, NGOs) for undertaking specialized environmental/ecological monitoring and survey for the project.

825. A medical centre will be set up at the RBLTL facility for regular health check-up for the staffs and contractors. Pre-employment medical checks would be conducted for each employee and records will be kept. Training on occupational health and safety aspects, use of personal protective equipment

Table 9.4 ESMP Budget

SN.	Component	Parameters	Frequency	Cost in BDT
A.	**Budget for Pre-Construction Stage**			
1.	Environmental Monitoring			
(a)	Ambient Air Quality	Respirable Particulate Matter (PM_{10}, $PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO)	6weeks, once a week at each location during Pre-monsoon season (Total 36 samples) CO will be monitored 8 hourly while the rest of the parameters will be monitored over 24 hours.	3 locations x2 per week x 6weeks x BDT 20,000= BDT 720,000
(b)	Ambient Noise	Noise levels. Results will be analysed for to work out Leq hourly, Leq day and Leq night	Once during pre-monsoon continuously for 24 hours at 6 locations	6 locations x 1 sample x BDT 5,500= BDT 33,000
(c)	Traffic Survey	Traffic Count for different categories of vehicles / vessels	1 road traffic survey and 2 river traffic survey Once during pre-monsoon continuously for 24 hours	3 locations x 1 sample x BDT 15,000= BDT 45,000
(d)	Soil Quality	Particle size distribution, Texture, pH, salinity, SAR, electrical conductivity, organic carbon, NPK, TDS, Na, Mg, Ca, Chloride, Fluoride, Permeability, Porosity, Cation Exchange Capacity, Infiltration rate	Once during pre-monsoon at 2 locations	2 locations x 1 sample x BDT 25,000= BDT 50,000
(e)	Ground Water Quality	Temperature, pH, TDS, EC, Salinity, Colour, Odour, Turbidity, Total Hardness (as $CaCO_3$), Alkalinity (HCO_3), Chloride (Cl), Sulphate, Nitrate , Fluoride (F), Sodium (Na), Potassium (K), Arsenic (As), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), Iron (Fe), Nickel (Ni), Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B), Fecal Coliform, Total Coliform	Once during pre-monsoon at 4 locations	4 locations x 1 sample x BDT 20,000= BDT 80,000
(f)	Marine Water Quality	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Salinity, TDS, Suspended Solids, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	Once during pre-monsoon at 6 locations	6 locations x 1 sample x BDT 25,000= BDT 150,000
(g)	Inland Surface Water Quality	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, BOD_5, COD, Turbidity, Salinity, TDS, Suspended Solids, Nitrate Nitrite, Manganese, Phosphate, Iron, Oil and Grease	Once during pre-monsoon at 1 location	1 location x 1 sample x BDT 25,000= BDT 25,000
(h)	Marine Sediment	Sand, Silt, Clay, Texture, Dissolved Oxygen, pH Organic Carbon, Total Sulphur, Cadmium, Lead,	Once during pre-monsoon at 4 locations	4 locations x 1 sample x BDT 25,000= BDT 100,000

SN.	Component	Parameters	Frequency	Cost in BDT
		Chromium, Zinc, Copper, Nickel		
2.	Ecology			
a.	Marine Ecology Study	Nesting frequency of turtles	Once during nesting season	BDT 1,000,000 (lumpsum)
b.	Marine Ecology Study	Occurrence of Knifetooth Sawfish, dolphins and porpoises in Kutubdia offshore waters	Once during pre-construction stage	BDT 750,000 (lumpsum)
c.	Tree Enumeration Survey	Matured trees to be cut for development of land based facility and onshore pipeline	Once during pre-construction phase	BDT 250,000 (lumpsum)
3.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 1 year	BDT 215,000
		Total (For Pre-Construction Stage – 1 Year)		**BDT 3,418,000**
B.	**Budget for Construction Stage**			
1.	Environmental Monitoring			
(a)	Ambient Air Quality	$PM_{2.5}$ and PM_{10} , SO_2, NOx and CO	Three sensitive receptors within 500 m from the construction site; once every month	3 locations x 1 per month x 12 months x BDT 2,0000 x 3years= BDT 2,160,000
(b)	Noise	Noise levels in Leq, Leq day, Leq nigh and hourly Leq	Three sensitive receptors within 100 m from the activity area; once every fortnight	3 locations x 2 per month x 12 months x BDT 5,500 x 3years= BDT 1,188,000
(c)	Soil (Fill Material)	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	The first delivery from any source and then random sampling of deliveries from that source	10 samples x BDT 25,000= BDT 250,000
(d)	Soil (Contaminated)	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	Construction site or laydown area or spill area in the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	30 samples x BDT 25,000= BDT 750,000
(e)	Surface Water	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	Sea and Kutubdia Channel (close to construction area) at 2 locations (upstream and downstream); monthly	6 locations x 1 per month x 12 months x BDT 25,000 x 3years= BDT 5,400,000
(f)	Ground Water	Drinking water quality parameters as per Schedule 3 of ECR 1997	Groundwater Bore well in nearest village of the construction area ; fortnightly	3 locations x 2 per month x 12 months x BDT 20000 x 3years= BDT 432,0000
2.	Marine Ecology			

SN.	Component	Parameters	Frequency	Cost in BDT
(a)	Marine Fish/Mammals	Stranding of fish and marine mammals	Once per year by IUCN expert	BDT 200,000 x 3 years – BDT 600,000
(b)	Marine Turtles	Nesting locations and numbers of nests per season Turtle stranding	Once during nesting season by IUCN expert	BDT 200,000 x 3 years – BDT 600,000
©	Under water noise	Hammer Noise in Decibels d(B)	Twice a week during the period of construction	BDT 500,000
3.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 3 years	BDT 645,000
		Total (For Construction Stage - 3 Years)		**BDT 16,413,000**
C.	**Budget for Operation Stage**			
1.	Environmental Monitoring			
(a)	Source Emission (Stack)	NOx, CO, PM	Main stack and by-pass stack; continuous	BDT 0 (Cost included in project budget)
(b)	Ambient Air Quality	NOx, CO, PM_{10}, SO_2	3 locations within 2 km from the Project boundary; monthly	3 locations x 1 per month x 12 months x BDT 20,000= BDT 720,000
(c)	Source Noise	Sound Pressure Level	1 m from the noise generating equipment; monthly	5 locations x 1 per month x 12 months x BDT 3,000= BDT 180,000
(d)	Ambient Noise	Ambient noise levels	At Project boundary and at nearest receptors in all direction from the Plant 24-hour observations with hourly noise levels; monthly	6 locations x 1 per month x 12 months x BDT 5,500= BDT 396,000
(e)	Soil	pH, salinity, NH_4^+, total P, heavy metals, oil & grease	Accidental spillage area, waste storage area, and sea; half yearly	6 samples x BDT 25,000= BDT 150,000
(f)	Ground Water	Drinking water quality parameters as per Schedule 3 of ECR 1997	Bore well water to be used for domestic purposes in the nearest village; monthly	3 locations x 1 per month x 12 months x BDT 20,000= BDT 720,000
(g)	Effluent discharge	Temperature, chlorine, pH, BOD5, COD, oil & grease, heavy metals, total fecal coliform	Outlet of discharge channel; monthly	1 location x 1 per month x 12 months x BDT 15,000= BDT 180,000
(h)	Surface Water	Temperature, conductivity, pH, DO, TDS	9 stations. 3 each along 3 transects perpendicular to the shoreline (at 0 m, 200 m and 500 m from the point of discharge of effluent); monthly	Capital cost BDT 100,000; O& M cost BDT 20,000

SN.	Component	Parameters	Frequency	Cost in BDT
2.	Marine Ecology			
(a)	Marine Fish/Mammals	Stranding of fish and marine mammals	Once per year by IUCN expert	BDT 200,000
(b)	Marine Turtles	Nesting locations and numbers of nests per season Turtle stranding	Once during nesting season by IUCN expert	BDT 200,000
3.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 1 year	BDT 215,000
4.	CSR Plan	Health, education, skill improvement and development of rural infrastructure for the local community	Annually for 1 year	BDT 10,300,000
		Total (For Operation Stage – Per Year)		**BDT 13,381,000**

826. The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Developer's staff, specifically the EHS and CSR Managers, will monitor the implementation of these mitigation measures by the contractors at the site. These two Managers will be responsible for the field level monitoring of the Project. Details of manpower deployed for implementation and monitoring of ESMP is presented in ***Table 9.5.***

Table 9.5 Staffing Details for Implementation of ESMP

Construction Phase			Operation Phase	
Corporate Level	**Project Site**	**EPC Contractor**	**Corporate Level**	**Plant Level**
Head Environment (RPL) Posted at New Delhi	2 EHS Manager (RBIPL) Safety and Environmental Supervisor (RBIPL) 1 CSR Manager with volunteers (RBIPL)	1 EHS Manager for every contractor EHS Supervisor in all shift Number staff will finalized after EPC and package works are awarded	Head Environment (RPL) Posted at New Delhi	1 EHS Manager (RBIPL) Safety Supervisor in each shift (RBIPL) 1 CSR Manager with volunteers (RBIPL)

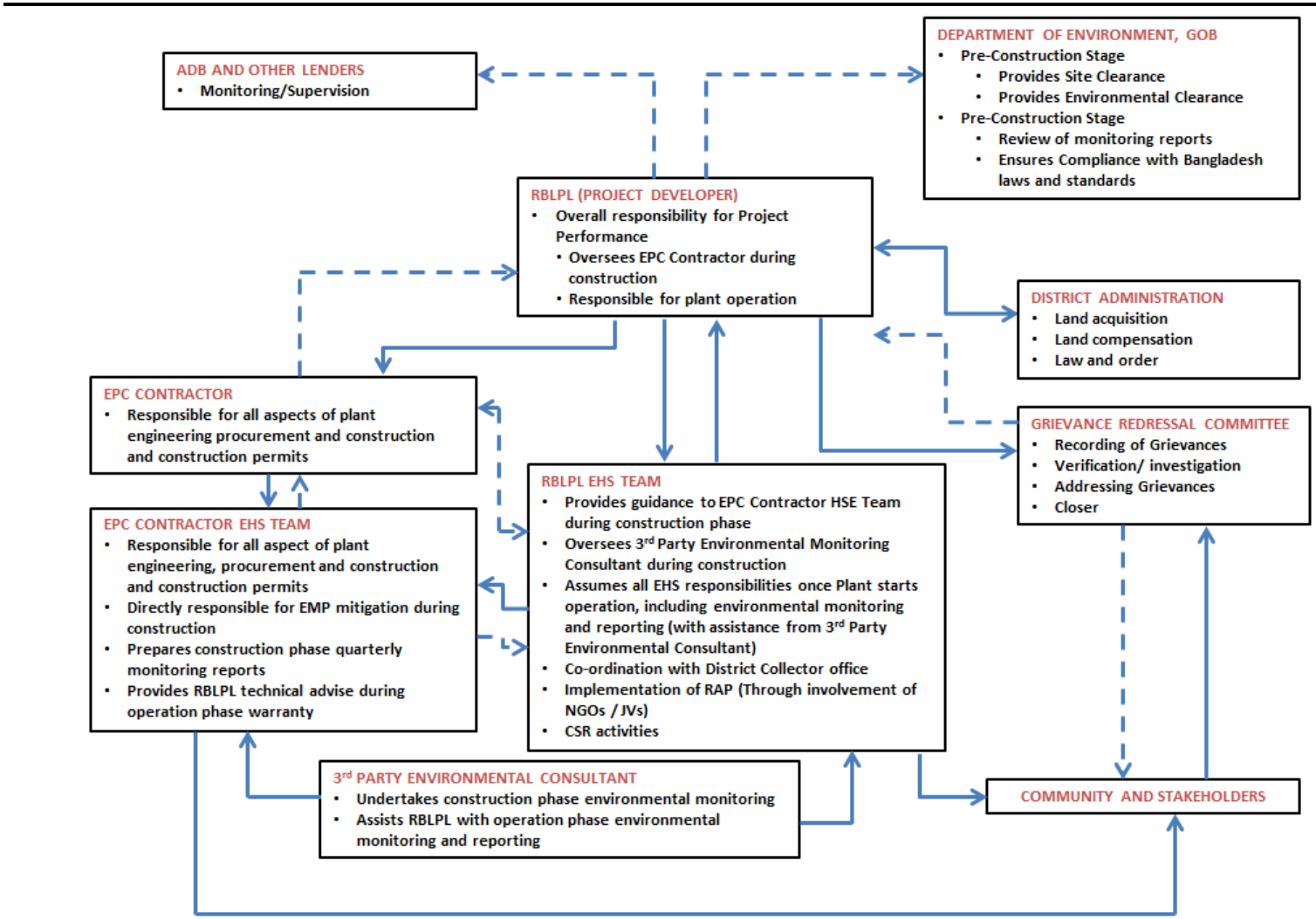
827. The roles and duties of the Project Developer and EPC Contractor for implementation and monitoring have been outlined in ***Table 9.6***. The flow diagram depicting the institutional arrangement for implementation of the ESMP is presented in ***Figure 9.2.***

Table 9.6 Roles and Responsibilities of Project Developer and EPC Contractor

Project Developer (RBLTL)	EPC Contractor
• Obtaining statutory clearances required during pre-construction stage of the Project	• Obtaining permits required during the construction stage
• Overall project co-ordination and management through EPC and supported by the third party environmental consultant/s	• Joint verification with Project Developer and Third Party Environmental Consultant for review of ESMP implementation
• Interaction and reporting to the respective department of GOB	• Interaction with Project Developer and appointed supervision consultant, if any
• Interaction and reporting to lenders	• Filling of reporting formats as per the reporting schedule and submission to Project Developer
• Effective implementation of ESMP and monitoring of ESMP implementation	• Environmental monitoring through Third Party Environmental Laboratory
• Carryout verification/ supervision exercises during the construction phase of the Project for implementation of ESMP	• Preparation of various plans for effective implementation of ESMP as detailed out in the "Specification Manual" by the Project Developer

Project Developer (RBLTL)	EPC Contractor
• Keeping records of all permits obtained by EPC Contractor	• Identification of site for labour camp, batch mix plant, laydown areas
• Overall supervision of ESMP implementation	• Management of labour camp and to provide drinking water, sanitation facility
• Approval of plans prepared by EPC Contractor	
• Addressing grievances of local community and information dissemination	
• Environmental monitoring through laboratory	

Figure 9.2 *Organization Chart for Environmental and Social Management and Reporting Responsibilities during Construction and Operation Phases of the Project*



828. This environmental and social impact assessment of the Kutubdia LNG Project ('Project') has been prepared based on review of draft technical specifications of the Project as provided by Reliance Power. The assessment process included scoping site visits, site surveys for impact assessment based on project level information provided by the Project developer, primary baseline studies and monitoring and extensive stakeholder consultations along with reviewing of Site and Configuration Selection Report, Reconnaissance Survey Report for Onshore Pipelines, Process Layout of LNG Facilities, Cadastral Maps of the locations and studying satellite imageries. Through this process, an assessment has been undertaken of the potential environmental and social risks and impacts that may be attributed by the development of the Project in its pre-construction, construction and operation phases. Assessments of the impacts have been presented with impact rating of each potential impact. Alternatives to the Project and key design aspects were also taken into consideration.

829. The width of the land to be required for laying of ~16 km spur pipeline will be ~ 15m along the pipeline route while for operation and maintenance it will be 8 m width along the pipeline route. The ownership of land will remain with Petrobanlga, RBLTL will get the land on lease for 15 years from Petrobangla. Potential impacts resulting due to land acquisition has been addressed in a separate document, the Resettlement Framework.

830. Fishing is one of the primary livelihood for the large fishing community of the island Upazila. Fishermen practice deepsea fishing, daily fishing and shoreline fishing. During construction phase ~2 km of subsea pipeline will be laid connecting FSRU/jetty to *Kutubdia* Island and further up to *Napura* through ~16 km onshore buried spur pipeline. Impact on shoreline fishing will be limited for two nearby villages i.e. *Ali Fakir Deil* and *Bindapara* in terms of restriction on use of push nets and small setback nets (*choto behundi jal*) during short construction phase (of ~12 months). As no onshore structure at *Kutubdia* Island or close to *Kutubdia* Channel are proposed, hence no potential impact on shoreline fishing activities are anticipated during operation phase of LNG terminal.

831. During the construction phase of the Project, the key environmental issues are noise and dust generation and disturbance to the natural vegetation along the gas pipeline alignment. Underwater noise is expected during pile driving for development of foundation of jetty. The sound pressure level (SPL) and sound exposure levels (SEL) expected during piles driving will be impulsive type that are likely to prevail for ~90 milliseconds with single strike per second in the shallow water of ~15 m depth.There is also a risk of contamination of soil, groundwater and surface water in

Kutubdia channel and the Sea (Bay of Bengal) from accidental spills and leaks of hazardous materials (e.g. oil) during handling, transportation, and storage at the site. In addition, erosion of soil and infill material brought to the site during the rainy season may lead to increased turbidity in the Sea water. Construction of jetty near FSRU will require pilling work which will generate fine sediments and will also result in resuspension of sediments in water in localized area. This expected to increase the turbidity of water and this have an adverse impact on surface water quality. The turbid water may have impact on aquatic ecology; thus affecting primary productivity.

832. Increase noise and dust levels including contamination of groundwater constitute public health concerns. Deterioration of its quality would be considered as a moderate adverse impact. However, these impacts are not unforeseen issues for similar type of Projects during their construction phase. Various mitigation measures will be developed by the Project Developer (RBLTL) for implementation through the EPC Contractor. The adverse impacts identified are generally manageable through good housekeeping and a diligent implementation of the ESMP by the EPC Contractor and its supervision by the Project Developer and their team of consultants. The nearest sensitive receptor will be a focus for monitoring of any impact arising due to the construction activities.

833. There are no protected areas like National Park, Wildlife Sanctuary of Ecologically Critical Areas etc. within the study area of 10 km radius from FSRU location. The terrestrial fauna reported from this region included 17 species of herpetofauna, 91 species of avifauna and 11 species of mammalian fauna. It was found that only two species of fishes were threatened and these were Korat mach (*Anoxypristis cuspidate*) is listed as Endangered and Koiputi (*Anodontostoma chacunda*) is now a rare locally. Hilsa reported to migrate from deep sea to north offshore of *Kutubdia* and then the Hilsa school crosses eastern Nearshore of *Kutubdia* and aggregate near *Banshkhali* at Gandamara point (hilsa nursery). Olive Ridley's Turtle (*Lepidochelys olivacea*) IUCN listed Vulnerable 2017.1 nesting sites are reported from the west coast of *Kutubdia* Island by the locals. Four (04) marine Dolphin species were reported by the local fishermen to be present within 5 km area of *Kutubdia* Island.

834. Project induced impacts are mainly on the species of conservational significance as listed above. It is suggested that pre-survey of Olive ridleys nesting sites on beaches be conducted near to the project site at Kutubdia Island and Kutubdia Channel and subsea pipeline route during the nesting season (December to March) if construction activities are to be started in the nesting season. The Project will ensure that construction activities are reduced during the nesting season. Working labourers will also be instructed to avoid disturbing the Olive ridleys nest. Efforts will also be undertaken to reduce the underwater construction noise. The coast side illumination will also be kept minimal. Proponent should involve in the conservation of species of conservational significance through in situ

conservation measures in consultation of Forest Department and NGOs involved in conservation of species.

835. The Project will have both positive and adverse impacts on social environment. The positive impacts will include temporary employment opportunity for the unskilled labourers during the construction period (the Project Developers plans to hire unskilled labour from the island Upazila), business opportunities for the local people (tea stalls, eateries, shops for general provisions, garages, etc.). Based on the present level of information available from the Project Developer it is anticipated that the Project is likely to have adverse social impacts pertaining to land loss, land fragmentation, potential physical displacement, loss of income (that may include agricultural labourers, sharecroppers, workers/labourers of salt pans), loss of productive land, potential income loss for fishermen and preventing to fishing related activities and fishing routes. The impacts may be localised and some are permanent in nature that can be mitigated with appropriate measures; it is anticipated that vulnerable groups (women headed households, to be identified during Census survey and social impact assessment) may also experience impacts due to the project implementation. The community at large will lose agricultural land, salt pan land, homestead lands and structures, access to near shoreline fishing grounds and use of sea shore for other activities related to fishing. However, the exact impacts and the number of Affected Persons (APs) will be ascertained based on the final technical design and Project footprint adopted by RBLTL.

836. During the construction phase it is anticipated that there will be impacts on community health and safety along the pipeline route and CTMS site due to noise generation. Also influx of unskilled construction workers may cause impacts on public health, especially due to prevalence of communicable diseases, waste disposal system and unhygienic conditions. The magnitude and significance of most of these impacts would be limited to the construction period, with limited spill over to the operation phase. As the project intends to have a construction camp at the facility, the interaction between the community and migrant workers would be limited. Additionally, an increase in traffic during the peak construction activities may create public safety issues for local residents. With mitigation measures as speed control in place the impact can be minimised or reduced significantly. In operation phase the social impacts are anticipated to be considerably less for community health and safety.

837. During the operation phase of the Project, the two key impacts will be from the increase in ambient noise and air quality levels due to operation of plant equipment and auxiliary machinery. It has been demonstrated through air quality dispersion modelling that the incremental ground level concentrations due to the operation of the plant will be well within the applicable GOB and WHO ambient air quality standards. Continuous emission monitoring from the stacks and periodic ambient air quality monitoring throughout operations will verify adherence with the

applicable standards and enable identification of further measures to reduce impacts to ALARP. Under water noise during the operation stage will be generated mainly during mooring of the LNG cargo to the jetty site. The underwater noise is expected to be mainly during 15% of time during ~24 hours of LNG offloading period. In general the incremental noise levels are planned to be within the applicable GOB standards for industries, however, ambient noise monitoring at the nearby sensitive location will be conducted to check and assess the requirements for further mitigation to reduce impact to ALARP.

838. Surface run off from oil storage waste handling unit (waste oil, used oil, etc.) may lead to the pollution of receiving water bodies viz. Bay of Bengal; as the slope of the area is towards. The surface run off may contain oil and lubricant, in case there is spillage from above mentioned areas. However, taking into account the provision of onsite drainage system with sedimentation tank, oil filters, etc., pollution load will not be significant. The sewage generated from the residential facilities or office area of the land based facility will be treated through septic tank and soak pit; therefore, any direct discharge is not envisaged. The grey water, black water, ballast water and bilge water will be discharged into the Chittagong Port facility. However a surface water quality monitoring program, along with quarterly monitoring of aquatic ecology and fisheries has been formulated to further understand the extent of impact, if any, and to alert RBLTL to take additional mitigation measures.

839. The FSRU option would involve use of sea water for vaporisation in the re-gasification process. There will be cold water discharge (maximum of 15,000 m^3/ hour) at 7 degrees Celsius less than ambient temperature and machine cooling water (maximum 3,000 m^3/hour) at 4 degree Celsius more than ambient will be discharged from engine room. Both cold water and machine cooling water will be discharged offshore to allow maximum mixing of the thermal plume to ensure that the temperature is within 3 degrees Celsius of ambient temperature at the edge of the mixing zone as required under the International norms. Separate simulations to consider worst case scenarios for cold water and machine cooling water discharge were done using Steady State three dimensional CORMIX model. The results showed there will be temperature change 0.25 ºC to 0.86 ºC within 100 m from maximum discharge of cold water. Similarly, the machine cooling water discharge will result in change in 0.10 ºC to 0.20 ºC within 100 m from maximum discharge of machine cooling water. Both discharge of cold water and machine cooling water will be well within the permissible IFC standard of change of 3 ºC within 100 m of mixing zone from discharge location.

840. The effective implementation of the EMP and adherence with the GOB and IFC guidelines will assist in minimising the environmental impacts to acceptable levels. Post environmental assessment, surveillance and monitoring are essential to track and sustain the effectiveness of the mitigation measures suggested. A detailed monitoring plan has been

prepared as part of the EMP. The focus areas of monitoring cover air, surface water quality, groundwater quality, noise, soil erosion, soil and groundwater contamination, occupational health and safety, community health and safety. The reporting requirements along with the follow up actions in case of deviation from the norms have been detailed in the EMP. The frequency has also been set in consideration of the likely impacts.

841. The construction phase of the Project will have an important role in the socio-economic development of the area, whereas the operation phase of the Project will play an important role by supplying gas in the region. A reliable and expanded gas supply will support future economic development of dependent sectors like industry and manufacturing enabling them to operate and compete.

842. Based on the analysis conducted in this environmental and social assessment, it is concluded that overall the Project will result in moderate socio-economic benefits and the potential negative environmental and social impacts that have been identified as long term and regional in nature, and can be minimized adequately through resettlement framework, good design, appropriate application of mitigation measures and regular supervision of implementation.