

**Initial Environmental Examination**

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**Project No. 52174-001**  
**August 2019**

**Emergency Assistance Project**  
**ADB Project 52174-001 | Grant 0582-BAN**

**BANGLADESH: Construction and Re-construction of Storm water Drainage  
Network on Primary canal-02 (Camp 20 Extension) Outletting to Naf river,  
under Ukhiya Upazila, Dist. Cox's Bazar**

**Package No.: EAP/LGED/OCB-N/W21**

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# Emergency Assistance Project

ADB Project 52174-001 | Grant 0582-BAN | TA 9546 BAN

## Initial Environmental Examination

### Package

BANGLADESH: Construction and Re-construction of Storm water Drainage Network on Primary canal-02 (Camp 20 Extension) Outletting to Naf river, under Ukhiya Upazila, Dist. Cox's Bazar

**Package: EAP/LGED/OCB-N/W21**

### Implementing Agency

Local Government Engineering Department (LGED)  
**Ministry of Local Government, Rural Development and Cooperatives (MLGRDC)**

**August 2019**

## **BAN: EMERGENCY ASSISTANCE PROJECT**

### **Output 02: Disaster risk management strengthened**

August 2019

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## **ABBREVIATIONS**

ADB	Asian Development Bank
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BREB	Bangladesh Rural Electrification Board
DPHE	Department of Public Health Engineering
EAP	Emergency Assistance Project
EARF	Environmental Assessment and Review Framework
ECA	Environmental Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rules
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ETP	Effluent Treatment Plant
GoB	Government of Bangladesh
H&S	Health and Safety
IEE	Initial Environmental Examination
LGED	Local Government Engineering Certificate
MPEMR	Ministry of Power, Energy and Mineral Resources
NFP	National Forest Policy
NOC	No Objection Certificate
RHD	Roads and Highways
RRRC	The Refugee Relief and Repatriation Commission
SPS	Safeguards Policy Statement
SSC	Site Clearance Certificate
ToR	Terms of Reference
UN	United Nations
US EPA	United States Environmental Protection Agency
WB	World Bank

## Executive Summary

1 The Government of Bangladesh (GoB) requested Asian Development Bank (ADB) for grant support to provide basic infrastructure and essential services to displaced persons. Given the humanitarian need and heart-wrenching condition of the displaced persons, ADB is providing grant financing of \$100 million for the first phase of the project. ADB support will be focused, selective, and well-targeted in the areas of (i) road access to and within camps; (ii) water and sanitation; (iii) energy supply; and (iv) disaster risk mitigation. It will build on the support provided by GoB and complement support provided by the United Nations (UN) agencies, the World Bank (WB) and other agencies. With the principle of putting people first, the project will seek to ease the vulnerabilities and risk of hunger, disease, and disaster. The project is known as Emergency Assistance Project (Project No. 52174-001, Grant 0582-BAN).

2 This report is on the Initial Environmental Impact Assessment (IEE) for the following project: the package title reads "BANGLADESH: Construction and Re-construction of Storm water Drainage Network on Primary canal-02 (Camp 20 Extension) Outletting to Naf river, under Ukhiya Upazila, Dist. Cox's Bazar". The work package includes construction / renovation/ upgradation of 1 primary canals (Natural canal inside the hills of the camp area).

3 The IEE has been prepared based on the Environmental Assessment and Review Framework (EARF) developed by the ADB and endorsed by Bangladesh Government. The IEE also follows the guidelines of the Department of Environment (DoE) as required by the Environmental Conservation Rule (ECR) 1997 (amended 2002) and in accordance with the Safeguard Policy Statement 2009 (SPS 2009) of ADB and will be disclosed in the websites of the ADB and the implementing agencies. This document shall serve as the base of environmental assessment of the proposed sub-project to be implemented by the executing agency and guideline for environmental management activities on-site.

4 Key legislation governing the environmental approvals process for the proposed Project is the Bangladesh Environmental Conservation Act, 1995 (BECA, 1995)<sup>1</sup> and the Environmental Conservation Rules (ECR, 1997)<sup>2</sup>. The proposed canal excavation subproject falls in Orange B. The project has been categorized as B for environment under the ADB's Safeguards Policy Statement 2009 (SPS).

5 **Existing condition:** The original natural canal is more than 8km long of which 5800m has been proposed for excavation and upgradation. The canal is originated from the Camp – 4 Extension inside the Balukhali Mega Camp and drains into Naf river. The canal has several branches and sub-branches including both tributaries and distributaries. The canal is featured with highly dense population on both banks and runs through Camp no 18 Extension (originally survey was possible from this point) and 12 and 10. The canal bed features frequent undulation which causes localized heavy waterlogging during the rains. The earthen sections of this canal have been damaged in last couple of years, especially during monsoon season.

6 **Proposal:** The whole chainage (5800m) has been proposed to maintain 0.14% sloping by excavation and filling for smooth flow of upstream water. Along the canal 10962sqm area of slope has been proposed for cast-in-situ for bank protection. Staircases and grass plantation to prevent erosion has been considered. See arrangement of the project in Figure 4.

7 Ukhiya Upazila is an Upazila under Cox's Bazar District in the Division of Chittagong, Bangladesh. It is located at 21.2833° North, 92.1000° East. It is bounded by Ramu on the north, Myanmar and

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<sup>1</sup> The Act was amended by Act Nos 12 of 2000, 9 of 2002, and 50 of 2010.

<sup>2</sup> The ECR was amended in 2002, 2005, 2010 and 2017.

Naikhongchhari on the east, Teknaf on the south, the Bay of Bengal on the west. Ukhiya thana was established in 1926 and was promoted into an upazila in 1983. The upazilla is consisted of five Union Parishads: (i) Halda Palong; (ii) Ranta Palong; (iii) Raja Palong; (iv) Jalia Palong and (v) Palong Khali. Ukhiya Upazila covers an area of 261.8 sq km, located in between 21°08' and 21°21' north latitudes and in between 92°03' and 92°12' east longitudes (Banglapedia 2018). The area is bounded by Ramu upazila on the north, Teknaf upazila on the south, Arakan state of Myanmar and Naikhongchhari upazila on the east, the Bay of Bengal on the west.

8 **Landform and ecology:** located at Teknaf peninsula. Teknaf Peninsula is one of the longest sandy beach ecosystems (80 km) in the world. It represents a transitional ground for the fauna of the Indo-Himalayan and Indo-Malayan ecological sub-regions. Important habitats at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons and marine habitat. Mangrove forest occurs in Teknaf peninsula both as natural forest with planted stands and mostly distributed in the inter-tidal zone. The Teknaf peninsula mangroves supports the habitat of 161 different species of fish<sup>3</sup>. Teknaf reserved forest is one of the oldest reserved forests in Bangladesh.

9 **Flooding, Water Logging and Drainage Pattern:** Eastern side of the upzila comprising high land and gradually down towards the western side. Matamuhuri River is flowing beside the upazila in north-east and north-west direction. Several natural streams act as the natural drainage system of the region. The mainland surrounding the upazila is generally high from the level of tide. As a result, most of the area is free from flood. Waterlogging problem has been reported within the camp area. The flooding and waterlogging mainly occur during the monsoon when the internal canal system overflow.

10 **Landslides and erosion:** he Kutupalong camp area is prone to land slide and erosion. In fact, land slide is a major problem in the Cox's Bazaar mountain zones, of Bangladesh by killing people every year besides damaging the properties and blocking the public utilities.

11 **Solid waste management:** With the increase population and rapid urbanization, it is natural that generation of solid waste will also increase. If these wastes are not properly managed, it can have detrimental effects on the environmental quality. So, collection and management of solid waste is a great challenge for the Ukhiya Upazila. No specific information on the Upazila is available. However, some information on Cox's Bazar solid waste management is available in the form of literatures, especially focusing on Kutupalong Rohingya Refugee camp. Cox's Bazar district has limited infrastructure for solid waste management.

12 **Flora:** This subproject area is full of natural vegetation. However due to camp establishment and increasing need of firewood by the camp residents, the once thickly vegetated area has been devoid of vegetation. Now a days, some organizations have launched planation programme in the camp areas. The plant species found in Camp area during field visit are are: The plant species found in the subproject are listed in the **Annex 3 List of wildlife recorded in the subproject area** which are: Akashmoni (*Acacia auriculiformis*), raintree (*Albizia saman*), mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), boroi (*Ziziphus mauritiana*), mahogany (*Swietenia mahogany*), guava (*Psidium guajava*), banana (*Musa sp.*), segun (*Tectona grandis*) Bokul (*Mimusops elengi*) and Bamboo (*Disambiguation*). Sessile joy weed (*Alternanthera sessilis*), thorny amaranth (*Amaranthus spinosus*), bermuda grass (*Cynodon dactylon*), smartweed (*Polygonum sp.*), creeping oxalis (*Oxalis corniculata*), etc., are the common weed species.

<sup>3</sup> Chowdhury, N. Shah Nawaz; Hossain, M. Shahadat; Das, Nani Gopal; Barua, Prabal (2010-09-25). "Environmental variables and fisheries diversity of the Naaf River Estuary, Bangladesh". *Journal of Coastal Conservation*. 15 (1): 163–180. doi:10.1007/s11852-010-0130-3. Retrieved 2011-01-01.

Among crop-field vegetation, aman is grown during summer rains and boro (winter rice) cultivated by irrigation in winter.

13 **Fauna:** The Refugee camps have a significant impact on wildlife by shrinking habitats and disruptions in breeding grounds are affecting nocturnal, crepuscular and diurnal wildlife. More than 67% of the mammal wildlife are terrestrial, and of this number, around 63.8% rely on forests as a habitat. Arboreal species are also under severe threat due to the ever-decreasing natural forest area.

14 **Asian Elephants:** The Asian elephant is an endangered species in the South and SE Asian countries they occur in. It is listed as endangered in IUCN's Red List and well as in Bangladesh's red list. There are likely less than 300 animals remaining in the country with about 200 resident (i.e., not crossing international borders) and 100-150 having a transboundary range with India and Myanmar, and about 40,000 animals in the world, with the greatest populations found in Myanmar and India. The presence of elephant in an area is an indicator of a healthy ecosystem, and also one of the key drivers in maintaining a diversity of habitat and inhabitants.

15 **Population:** As of 31 March 2020, the Inter-Sector Coordination Group (ISCG) reported that there are 720,915 Rohingya refugees living in Cox's Bazar. According to ISCG's rapid needs assessment, 58 per cent of new arrivals are children and 60 per cent are women including a high number of pregnant (3 percent) and lactating women (7 percent). With the new influx, the current total number of Rohingya who have fled from Myanmar into Bangladesh, coupled with the affected population in the communities, has reached a staggering 1.2 million.

16 Following the method given in Methodology (Section 6.1) an impact matrix was developed for the subproject as shown in Table 11 below. This matrix serves the basis of the impact assessment and Environmental management plan (EMP).

Table 11 Evaluation of Identified Environmental Impacts (Impact Matrix)

Phase	Impact	Magnitude	Likelihood	Risk score	Mitigation possible?
<b>Beneficial Impacts</b>					
Construction	Employment Generation and Increase in income				
	Enhancement of Community Development Service				
	Skill Enhancement				
Operation	Waterlogging conditions reduced or non-existent				
	Reduction of risk of vector borne diseases				
	Clean water and easy access to the canals by stairs				
	Strengthen of bank areas reducing erosion				
	Safer establishments on the banks of the canal				
<b>Adverse Environmental Impacts</b>					
Construction	Change in Land Use	1	1	1	Yes
	Traffic congestion	2	2	4	Yes
	Slope instability	1	1	1	Yes
	Air, dust and noise pollution	1	4	4	Yes
	Hydrology and surface water congestion	3	4	12	Yes
	Water pollution	3	3	9	Yes
	Quarrying and bed material Extraction	3	4	12	Yes
	Spoil disposal	3	4	12	Yes

	Loss of vegetation	2	2	6	Yes
	Disturbance of wildlife	1	1	1	N/A
	Loss of agricultural land	1	1	1	N/A
	Health and safety of workers	4	4	16	Yes
	Health and safety of the communities	4	4	16	Yes
	Decline in Aesthetic Value	2	2	4	Yes
Operation	Slope instability and management	2	2	4	Yes
	Air and noise pollution	1	1	1	Yes
	Safety issues	1	1	1	Yes
	Disturbance to wildlife	1	1	1	N/A
	Depletion of forest resources	1	1	1	N/A
	People gathering and chaos	1	1	1	Yes

### Impacts during Planning Phase

17 **Consideration of Hill Ecology and camp population:** The proposed alignment runs through highly dense camp area will erosion prone hills and waterlogged areas. If not properly planned, the Excavation may lead to havoc in the area creating more waterlogging and erosion during the rains.

18 **Consideration of Naf river ecosystem:** The wastewater and stormwater drainage will ultimately run towards Naf river. If untreated water is discharged from camp, Naf river ecosystem will be under severe threat of not only organic and silt laden waste, but also possible pathogenic waste. The threat level can be severe negative and long-term if not treated within the camp.

19 **Environment Friendly Procurement Process:** Engagement of environmentally irresponsible contractor for civil works may lead to in compliance of ADB and GoB environmental rules and regulations

20 **Permission and legal procedures:** The entire camp area is under the jurisdiction of the RRRC. The government of Bangladesh has also adopted a few regulations on construction for Rohingya refugee purposes. Therefore, failure to obtain permissions and NOC might lead the project to fail.

### Impacts during Construction Phase

21 **Gas emission and air quality:** Exhaust from vehicles, construction machineries, generator set may pollute local environment. Given the valley condition, local level exhaust may pollute air quality for even a week. Burning of solid waste at camp and at site also create localized pollution. Given the valley and low-level cool air, it could create smog in the area. Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. However, the impacts should be negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.

22 **Impairment of aquatic life:** Base layering and excavation may lead to destruction of any aquatic life that may be of existence in the local streams.

23 **Dust and fine particle pollution:** Dust and fine particles from earth works (clearing, grubbing, levelling, excavation etc.). Transportation of fine aggregates, cements, gravels etc, loading and unloading of fine particles and cement, movement of transport vehicles which emit carbon particles, CO and CO<sub>2</sub>, Stockpile of dry soil, sand, Dry exposed soil, eroded and exposed soils from nearby hills; Construction of structures, hammering etc may generate a fair amount of dust particles. Effects are expected to be negative, short term and reversible by mitigation measures

24      **Slope Erosion and channel sedimentation:** Clearing topsoil in proposed widening/base course areas can lead to loss of nutrient and erosion particularly along the hill cut slopes and dust from unprotected storage sites. The erosion risk at hill cut slopes is possible. Gully erosion along the exposed track slope during rainy season may cause localized sedimentation congestions.

25      **Contamination of surface water resources:** Excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall, which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short term, site-specific within a relatively small area and reversible by mitigation measures. Mismanagement of sediments/silts may lead to surface water pollution in the entire drainage network. Hammering during sit preparation on the hillside roads can lead to localized landslide or accelerate erosion. At hillside Sections there is a potential of erosion due to rainfall-runoff. Earthwork activities during construction at this point may result in drainage congestion. The effects may be short term severe, but manageable by close monitoring and mitigation measures.

26      **Water quality at and around work camp:** Work camp is likely to be set up outside the Balukhali Mega camp. The surface water at workers camp and Project site areas may become pollute due to faecal, organic and other contamination. Disposed wastes and effluents from the construction sites may cause further degradation of surface water. The effects are short term, minor and reversible by mitigation measure.

27      **Local Flooding:** Local flooding may occur due to clogged/blocked drains and impeded routes for surface water runoff. Localized ponding due to excavation. The effects may be short term severe, but manageable by close monitoring and mitigation measures

28      **Community Health and Safety Hazards:** Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.

29      **Ground Water quality:** The area starves in groundwater level. Work camps are likely to sink tube well in the area and contribute to decrease of local groundwater level and increase drawdown. The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer). There are small hilly streams on the RoW potentially be contaminated seepage wastes from workers camp and stockpile materials. The effects are short term, minor and reversible by mitigation measure

30      **Worker's health and safety:** There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in populous areas. Workers need to be mindful of the occupational hazards, which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.

31      **Waste management and spillage:** Construction waste from construction work, Domestic waste from workers; Hazardous waste. The effects are short term, minor and reversible by mitigation measure.

## List of major mitigation measures

**32 Gas emission and air quality:** Reduce vehicle movement through coordinated material transport schedule. Limit engine idling to maximum 5 min. No burning of wastes. No indiscriminate dumping of waste, especially organic wastes, left to decompose. Visually inspect air quality (mainly dust and smoke) and use dust suppression measure. High amount of smoke should trigger the vehicle management plan which includes testing of vehicles for smoke emission rate and restrict number of vehicles that emits high smoke, ban unfit vehicles etc. Use tarpaulins to cover soils, sand and other loose material when transported by trucks. Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. Monitor air quality and vibration during construction works. Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. Plan activities in consultation with Local Authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. Use of high noise generating equipment (e.g. excavator, trucks) shall be stopped during nighttime. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions and ensure that these are maintained to manufacturers' specifications at all times. All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required).

**33 Consideration of hilly topography:** Check if ISCG if they have any erosion/stability map at the moment for the proposed alignment of drainage network. If not available, LGED needs to check erosion potential along the proposed drainage alignment and make a erosion potential map. Ensure grass and steel net/geocell protection before commencement of cutting and filling operation, especially in the areas where erosion potential is high (drawn from the map as suggested earlier). This needs to be considered and planned during the design phase. Ensure the filling materials match with the area's soil characters so that the regional topography gets stability. Give careful attention to this before construction and denote from where the fill materials will be collected before the construction goes onboard. The drainage sites need extensive erosion preventive plantation at every erosion prone hillside. A plantation plan and guideline is provided in the Annex.

**34 Permissions and legal requirements:** The construction must be agreed with the respective CICs for each camp and has to follow the latest Government orders. Necessary permission from the RRRC through the CICs has to be kept for legal safety. Also frequently communicate with the CICs for any legal change or government orders. Prepare a Subproject Aggregates Management Plan (AMP), confirming location of sources, estimating supply of, & demand for, aggregates during construction. This will form basis for Contractor's AMP.

**35 Considerations of Naf river ecosystem:** UNHCR has considered soft ecological approach to treat wastewater in Madhurchara using created wetland full of local aquatic species known as kutipana (duckweed). This "environmental sensitive camp management plan" can be adopted to the current proposal of LGED, since ecological approach is more preferable to chemical treatment in sensitive ecological areas like the camp. A coordination meeting can be arranged with environmental experts from both sides (UNHCR and LGED) with the presence of ADB experts to see the feasibility of the approach and how it can be adopted to LGED's proposal. A copy of the plan is annexed with this document. Constructed wetland with

treatment facilities using duckweed can be constructed by LGED to treat waste water from cam and later discharge to Naf river.

36     **Dust and fine particles:** Confine clearing, grubbing & excavation according to the Staking Plan and Excavation Management Plan. Limit segment length to what can only be excavated and lined. To avoid aggravating the hill erosion, it will be wise to choose segment length case by case for each small hill area. Keep masonry and base course work as close as possible to the excavation works so that dust release is limited. Given the camp's population density, it is suggested that all excavated segments should be backfilled, paved or bedded before the day's work ends. Watering of dry/unpaved/exposed surfaces, stockpiles of sand and excavated materials, at least twice daily.

37     **Slope erosion and channel sedimentation:** Strictly follow the soil and water conservation plan devised during planning and design stage. Topsoil storage areas must be protected during the dry season, wind erosion—by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats should be applied in areas where erosion is noted during the regular monthly inspections. Erosion preventive local tree species like figs should be planted on both sides of the drain site hill slope. Especial attention should be paid of plantation technique and species so that they prove to be helpful in preventing soil erosion. As mentioned earlier, a guide for plantation to prevent erosion is attached with this document as Annex.

38     **Contamination of surface water resource:** Implement eco-friendly waste management system: practice waste minimization, reuse and segregation; provide adequate waste bins, enforce onsite rule of throwing waste into bins; provide separate storage area for solid waste and hazardous waste to contain spill area; and implement measures to mitigate sedimentation/siltation. In all sites follow a Removed Soil Management Plan linked to the Excavation Segmentation/Management Plan, specifying, e.g., separate areas for stockpiling "reusable soils" & "unsuitable & excess soils" appropriate stockpiling areas, on flat grounds & away from or not obstructing main surface drainage routes disposal of unsuitable & excess soils as soon as possible hauling trucks to be required appropriate cover & min 2 ft freeboard employ any combination of the following measures to prevent stockpiled soils & fine aggregates from being eroded or carried away by wind and rain: silt fences, sediment traps, sandbags, barrier nets, earth bunds, speed stilling humps along surface drainage routes, limiting stockpile to a maximum height of 2 m, &/or diversion drains to reroute surface runoff away from stockpiles, whichever would be appropriate for the site & site conditions. Monitor immediate low areas or valleys for drainage congestion. If drainage congestion seems eminent, excavate or clear excess sediment/wash materials to clear congestion. Install silt protection curtain/steel nets alongside hill side roads. All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. All earthworks must to be conducted during dry season/dry spell to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low-lying areas. Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss.

39     **Local flooding:** Before excavation and construction starts, a proper surface topography along the proposed drainage network needs to be updated and always kept in hand. Prior excavation, cover inlets with potentiality of being flooded. Next to inlet use sediment fence, trap and/or sandbags. Stockpile soils and other construction materials away from the drainage route

40     **Wastewater spillage:** A waste management and spillage control plan should be developed before construction. Conduct separate waste collection, promote recycling and reuse. Appropriate disposal of non-recyclable waste according to rules. Hazardous waste should be treated under the related regulation



41 **Worker's health and safety:** There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in populous areas. Workers need to be mindful of the occupational hazards, which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The generic measures suggested are as followed: Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&S). Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records.

42 **Community health and safety:** Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances. Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. Provide medical insurance coverage for workers; Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

43 The full-fledged EMP with mitigation plan is given in **Table 15** and **Table 16**. The EMP implementation cost stands at BDT 5,326,564.

44 **Oversight body:** The RRRC is proposed to act as the coordinator on behalf the government to execute all interventions. RRRC and ADB will conduct regular coordination meetings involving all EA/IAS, relevant stakeholders including deputy commissioner (DC), Cox's Bazar, other development partners and agencies. ADB plans to establish extended mission office in Cox's Bazar for close coordination, facilitation of sub-projects development and implementation.

45 **Grievance redress Mechanism:** The objective the grievance redress mechanism (GRM) is to resolve complaints as quickly as possible and at the local level through a process of conciliation; and, if that is not possible, to provide clear and transparent procedures for appeal. A well-defined grievance redress and resolution mechanism will be established to resolve grievances and complaints in a timely and satisfactory manner. All affected persons will be made fully aware of their rights, and the detailed grievance redress procedures will be publicized through an effective public information campaign.

46 Different stakeholders were consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the

project prior to its start-up. These stakeholders include the central and local authorities, as well as the local population to determine their thoughts, opinions and feedback on the impact of the project. Attendees in the consultation meeting were apprised of the processes through which the project was to proceed toward implementation and the environmental impacts to arise out of such processes along with the steps to be taken toward mitigating the impacts. They were told about the impacts all of which could be easily mitigated. The audience expressed satisfaction of such mitigation measures. The public consultations were held during field visit in 19 August 2029.

47 Information is disclosed through public consultation and making available relevant documents in public locations. The following documents will be submitted to ADB for disclosure on its website:

- (i) IEEs (including subproject EMP);
- (ii) Updated IEEs (including EMP) and corrective action plan prepared during project implementation, if any; and
- (iii) Environmental monitoring reports.

48 The EAs/IAs will send a written endorsement to ADB for disclosing these documents on the ADB website. The PIUs will provide relevant safeguards information in a timely manner, in an accessible place and in a form and language understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used. Disclosure will follow ADB's Public Communication Policy, 2011.

# 1 Introduction

## 1.1 BACKGROUND

49 The Government of Bangladesh (GoB) requested Asian Development Bank (ADB) for grant support to provide basic infrastructure and essential services to displaced persons. Given the humanitarian need and heart-wrenching condition of the displaced persons, ADB is providing grant financing of \$100 million for the first phase of the project. ADB support will be focused, selective, and well-targeted in the areas of (i) road access to and within camps; (ii) water and sanitation; (iii) energy supply; and (iv) disaster risk mitigation. It will build on the support provided by GoB and complement support provided by the United Nations (UN) agencies, the World Bank (WB) and other agencies. With the principle of putting people first, the project will seek to ease the vulnerabilities and risk of hunger, disease, and disaster. The project is known as Emergency Assistance Project (Project No. 52174-001, Grant 0582-BAN).

50 The project known as the Emergency Assistance Project (EAP) will support the Government of Bangladesh in addressing the immediate and urgent needs of the displaced persons from Myanmar in Cox's bazar District, as identified by the United Nations (UN) in its Joint Response Plan (JRP) (displaced persons). The project will mainly support the improvement of water supply and sanitation, disaster risk management, sustainable energy supply, and access roads.

51 The impact of the project will be: Social recovery of affected communities accelerated in the sub-districts of Ukhiya and Teknaf. The outcome will be: Living conditions and resilience of affected communities improved. Four (04) outputs are expected from this project. They are:

- Output 01: Water supply and sanitation improved.
- Output 02: Disaster risk management strengthened
- Output 03: Energy sources provided
- Output 04: Access roads improved.

52 The EAP will restore and strengthen the resiliency of critical public and social infrastructure and services and has the following outputs: Output 1 is water supply and sanitation improved. The output included mini piped water supply, surface water reserves etc. Output 2 of the project is Disaster Risk Management Strengthened. The output includes constructing in and around the camp areas (a) multipurpose cyclone shelters with emergency access roads; (b) food distribution centers; (c) hill slope protection/toe walls to resist landslides; (d) storm water drainage network; and (f) other disaster risk management measures. Output 3 is: Energy sources provided. This output Includes (a) providing retained heat cookers; (b) installation of solar powered streetlights and grid connected streetlights; (c) construction of 33/11kV substation, (d) construction of 11 KV & below line with transformers. Output 4 of the project include a) sub-district and Union roads to connect food storage centers, food distribution centers, field hospitals, primary health care centers, and primary education centers; (b) emergency access roads to the camp areas; (c) existing access roads to and within the camps and drainage systems; and (d) resurfacing the road from Cox's Bazar to Teknaf including improvement of critical sections such as market areas and culverts.

53 This report is on the Initial Environmental Impact Assessment (IEE) for the following project: the package title reads "BANGLADESH: Construction and Re-construction of Storm water Drainage Network on Primary canal-02 (Camp 20 Extension) Outletting to Naf river, under Ukhiya Upazila, Dist. Cox's Bazar".

The work package includes construction / renovation/ upgradation of 1 primary canals (Natural canal inside the hills of the camp area).

54 Location map of the project is given in Figure 1. Storm drainage is shown in **Figure 2**.



Figure 1 Location map of the proposed subproject

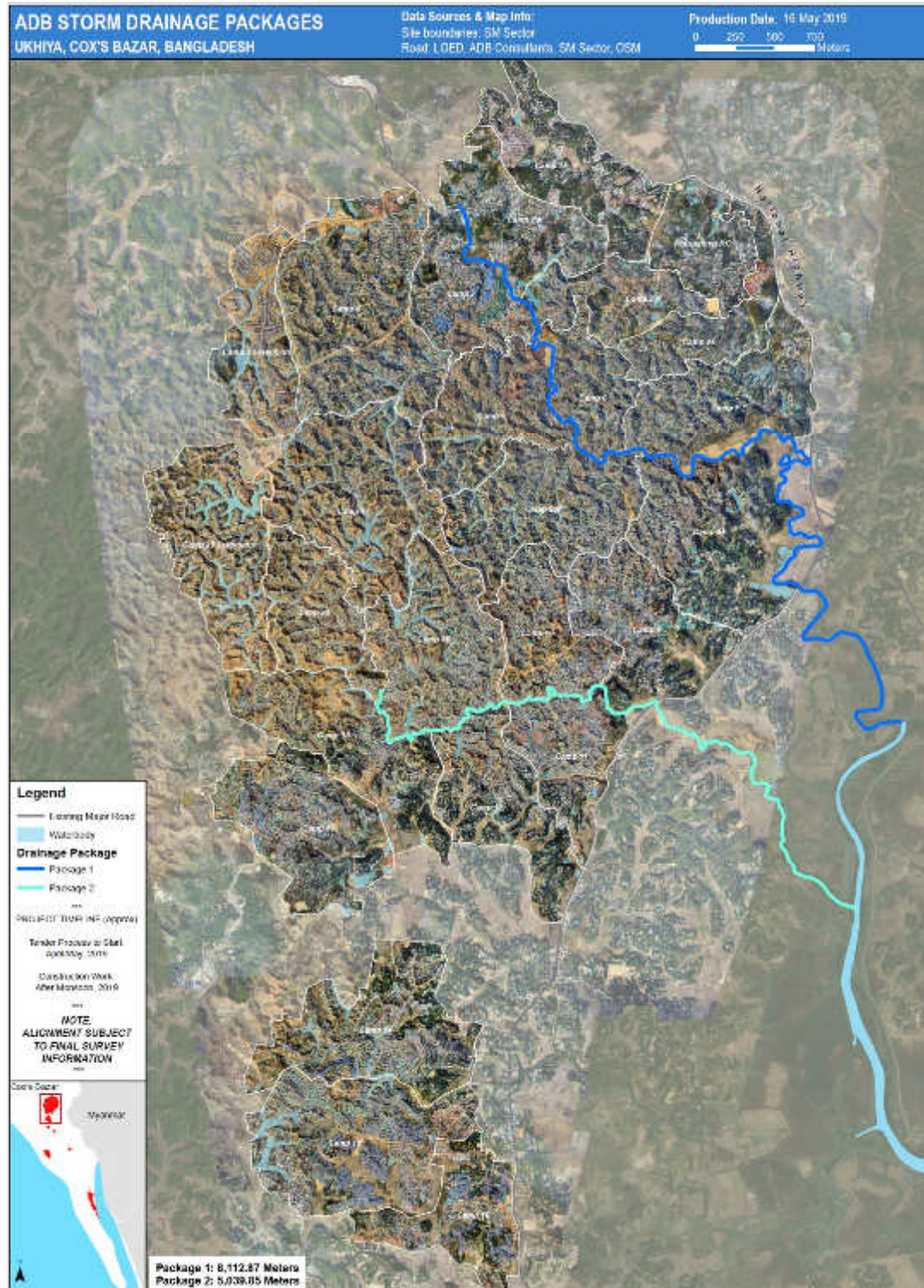


Figure 2 Location of the proposed primary canal (package 2). The final proposed length differs from map as stipulated in text



## **1.2 PURPOSE OF THE REPORT**

55 The IEE has been prepared based on the Environmental Assessment and Review Framework (EARF) developed by the ADB and endorsed by Bangladesh Government. The IEE also follows the guidelines of the Department of Environment (DoE) as required by the Environmental Conservation Rule (ECR) 1997 (amended 2002) and in accordance with the Safeguard Policy Statement 2009 (SPS 2009) of ADB and will be disclosed in the websites of the ADB and the implementing agencies. This document shall serve as the base of environmental assessment of the proposed sub-project to be implemented by the executing agency and guideline for environmental management activities on-site.

## **1.3 SCOPE OF THIS REPORT**

56 The Project require that any proposed development will require that the laws and regulations of Bangladesh are applied in full. The Project is then subject to approval under the Government of Bangladesh's Environment Conservation Act (1995) (ECA) and Environment Conservation Rules (1997).

57 The IEE report aims to provide guidance on safeguard screening, assessment, institutional arrangement and process to be followed for components of the project, where design takes place after Boards approval. This IEE:

- (i) describes the project and its components;
- (ii) explains the general anticipated environmental impacts and mitigation measures for the subprojects;
- (iii) specifies the requirements that will be followed in relation to screening and categorization, assessment, and planning, including arrangements for meaningful consultation with affected people and other stakeholders and information disclosure requirements;
- (iv) assesses the capability of the project proponents to implement national laws and ADB's requirements, and identifies needs for capacity building;
- (v) specifies implementation procedures, institutional arrangements, and capacity development requirements; and
- (vi) specifies monitoring and reporting requirements. Moreover, this IEE is to ensure, in line with ADB EARF, that the sub-project, in the entirety of its project cycle, will not deteriorate or interfere with the environmental sensitivity of the project area, but rather improve environmental quality.

58 This report fulfils the requirements of IEE under the provisions of the ECR. The IEE identifies potential environmental and social impacts and issues associated with undertaking the proposed project. It provides an outline of the potential positive and negative impacts as a result of the Project and proposes suitable mitigation and management measures.

59 The scope of this report and the subsequent IEE is specific to the sub-project. It does not provide any assessment for any other/future developments or activities at the location or anywhere else within Cox's Bazaar Area. Should any further development be planned as result of either this Project or other related

work, additional planning and assessment to the requirements of the Government of Bangladesh must be carried out specifically in relation to that proposed development.

## **1.4 APPROACH AND METHODOLOGY**

60 The primary purpose of the IEE is to investigate and describe impacts of the proposed subproject to the existing environmental elements. Specifically, the study aims to predict the potential impacts of the project activities and recommend mitigation and abatement measures for impacts (in the pre-construction, construction and operational stages of development) that are considered potentially adverse to the surrounding environment.

61 In general, this IEE intends to:

- Examine and describe the existing status of the various ecological, physical and human related components surrounding the project area;
- Predict the potential significant impacts of the project on the surrounding environment during the pre-construction, construction, operations and maintenance stages and recommend appropriate mitigation and abatement measures; and
- Identify residual impacts of the project and recommend appropriate short-term and long-term management plans.

### **1.4.1 Data sources of IEE**

62 The following documents were used as reference in the preparation of the IEE report:

- Available technical reports from various organization
- Available laws, rules, regulations, acts, policies from Bangladesh Government websites
- Maps from open sources and various governmental and non-governmental websites
- Data from secondary literatures in including books and relevant websites

### **1.4.2 Scoping and gathering baseline data**

63 Scoping of issues to be addressed in the IEE was conducted early in the assessment process (i.e. Field visit) to collect the appropriate baseline information so that collected and the IEE report/study can focused on the relevant issues needed.

64 The objectives of undertaking the scoping activities were:

- To provide an early link among the implementing agency, the recipient and affected community and the IEE preparer;
- To ensure that the IEE will address only relevant issues and concerns;
- To present the scope of environmental studies, issues and alternatives that requires thorough examination and consideration in the master plan; and
- To ensure complete coverage of potential environmental and social issues that is required under the ADB Environmental and Social Considerations.

## **1.5 STRUCTURE OF THIS REPORT**

65 Following the ADB SPS 2009, the Report is structured as follows:

### **Executive Summary**

<b>Chapter 1</b>	Introduction provides the background on the project, purpose of this report, approach and methodology
<b>Chapter 2</b>	Policy, Legal, and Administrative Framework presents a review of relevant national laws and policies, international environmental obligations, and ADB's environmental requirements, procedure of environmental clearance, environmental categorization
<b>Chapter 3</b>	Description of the Project provides a brief description of the Project, the location, size and need, description of project components
<b>Chapter 4</b>	Analysis of Alternatives presents the alternatives considered during the feasibility study in order to arrive at the best option.
<b>Chapter 5</b>	Description of the Baseline Environment includes details on the baseline data for environmental conditions in the project area (current features and conditions, pre-project)
<b>Chapter 6</b>	Anticipated Potential Project Impacts identifies the potential environmental, economic and social impacts from pre-construction, construction, and operation phase.
<b>Chapter 7</b>	Environmental Mitigation and Management Plan
<b>Chapter 8</b>	Environmental Monitoring Program and Institutional Responsibilities outlines the environmental monitoring program, institutional responsibilities including the cost of implementing the EMP
<b>Chapter 9</b>	Grievance Redress Mechanism describes the process of addressing complaints
<b>Chapter 10</b>	Stakeholder Consultation and Information Disclosure discusses the issues raised during the consultations, proposed actions to address them, and the information needed to disclose to the public.
<b>Annex 1</b>	List of Participants in FGD
<b>Annex 2</b>	Traffic Management Plan
<b>Annex 3</b>	List of wildlife recorded in the subproject area
<b>Annex 4</b>	IUCN guideline for plantation in the camp



## 2 Policy, Legal and Administrative Framework

### 2.1 INTRODUCTION

66 This section of the IEE details the Administrative Framework for the Project, covering national requirements as well as applicable international treaties and conventions. The intent of this section is to lay out the regulatory and non-regulatory performance requirements for all stages of the Project. For the purposes of this report, only those regulatory elements directly relevant to the proposed Project will be discussed.

### 2.2 ENVIRONMENTAL LEGISLATION FRAMEWORK

#### 2.2.1 Overview of the project approval process

67 Key legislation governing the environmental approvals process for the proposed Project is the Bangladesh Environmental Conservation Act, 1995 (BECA, 1995)<sup>4</sup> and the Environmental Conservation Rules (ECR, 1997)<sup>5</sup>.

68 According to Rule 7 of the ECR, proposed developments within Bangladesh are classified as one of four categories, as follows:

- Green;
- Orange A;
- Orange B; and
- Red

69 These categories define proposed developments according to their potential environmental impact. Section 12 of the ECA states that 'No industrial unit or project shall be established or undertaken without obtaining an Environmental Clearance Certificate from the Director General, in the manner prescribed by the Rules'.

#### 2.2.2 Environmental Approval Framework

70 Key milestones in the approvals process are outlined in **Figure 3**. These comprise:

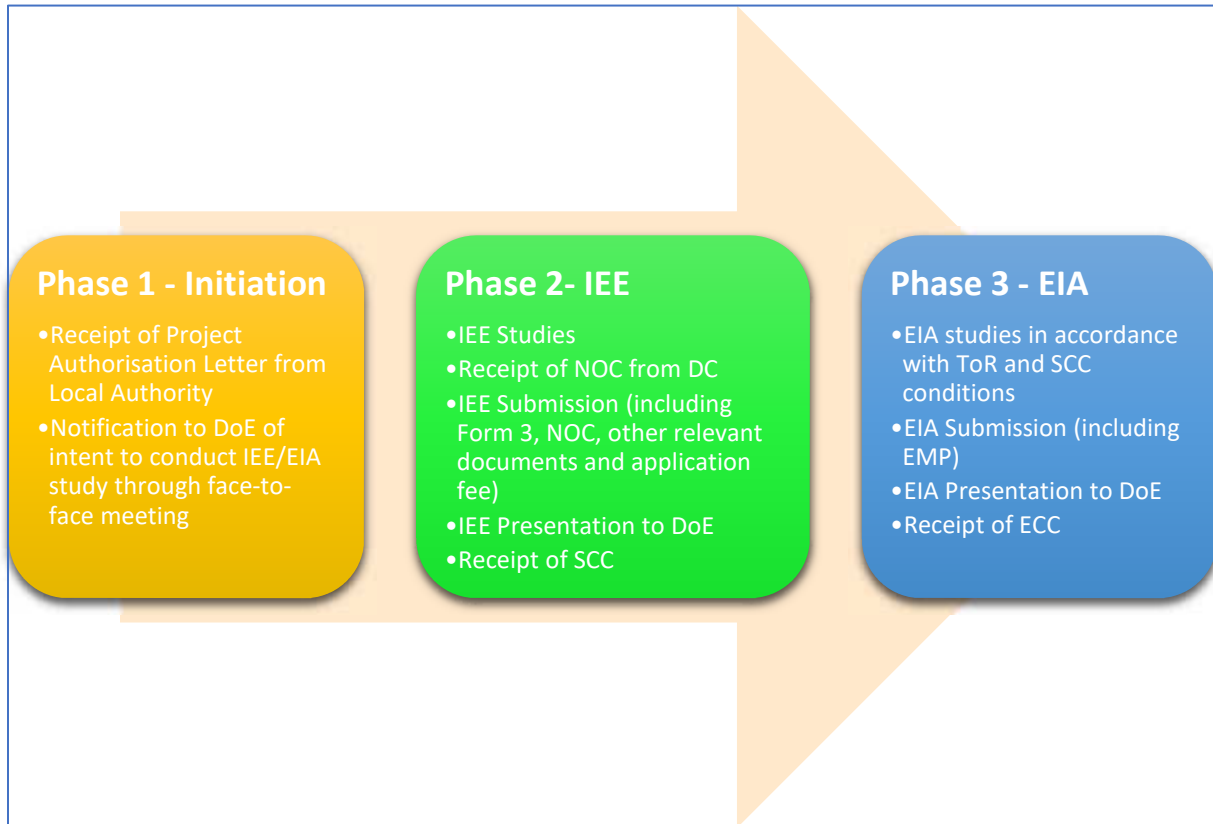
- **Project Authorization Letter:** Formal authorization of the Project by the Department of Energy and Mineral Resources is required in order for the environmental approvals process to formally commence.
- **No Objection Certificate (NOC):** A NOC must be received from the Deputy Commissioner in the sub-project area before the SCC application can be made.
- **Site Clearance Certificate (SCC):** An SCC will be issued by DoE upon approval of the IEE study (note that the IEE submission is to include the Project Authorization Letter, NOC and SCC application form). The SCC will include a ToR for the IEE/EIA study, and typically provides authorization for site establishment works to commence.

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<sup>4</sup> The Act was amended by Act Nos 12 of 2000, 9 of 2002, and 50 of 2010.

<sup>5</sup> The ECR was amended in 2002, 2005, 2010 and 2017.

- **Environmental Clearance Certificate (ECC):** The ECC will be issued by DoE upon approval of the IEE/EIA study (including associated EMP). The ECC allows project construction to commence and contains specific approvals requirements for matters such as pollution control and environmental monitoring.



**Figure 3 Environmental approval framework in Bangladesh**

71 **Table 1** provides an overview of key Bangladesh legislative approvals requirements which are relevant to the Project, and the permissions required under this legislation in order to undertake the subproject works.

**Table 1 Required Permissions for Project under Bangladesh Legislation**

Legislation	Permission Required	Purpose	Permission Given By
Environment Conservation Act (1995) Environment Conservation Rules (1997) and amendments	SCC and ECC	DoE will issue an SCC to allow for a detailed EIA as per Section 12 (ECA), Rule- 7 and Form -3 of the ECR.	Director General of the Bangladesh DoE
Acquisition and Requisition of Immovable Property Act (2017)	Application required	To acquire and compensate for any Project land	Ministry of Land and Deputy Commissioner

72 Rule 7 of ECR indicates the procedure and requirements for the issuance of an ECC. The corresponding requirements per category are described below:

**Green category projects:**

- i. completed application for ECC, and the appropriate fee (shown in Schedule 13);
- ii. general information about the project;
- iii. exact description of the raw materials to be used, and the product to be manufactured (where relevant); and
- iv. No-objection certificate from the local authority.

**Orange-A category projects:**

Same requirements as green category projects, plus the following:

- i. process flow diagram;
- ii. layout plan (showing location of effluent treatment plant or ETP);
- iii. effluent discharge arrangement; and
- iv. outlines of the plan for relocation and rehabilitation (if applicable).

**Orange-B category projects:**

- i. completed Application for ECC, and the appropriate fee;
- ii. report on the feasibility of the project;
- iii. report on the IEE for the project, plus process flow diagram, and in the case of an industrial project, layout plan (showing ETP) and ETP design;
- iv. report on the environmental management plan (EMP);
- v. no objection certificate from the local authority;
- vi. emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and
- vii. outline of the relocation and rehabilitation plan (where applicable).

**Red category projects:**

Same requirements as Orange Category B, except that Item 3 (IEE) is amended to read as follows:

- i. report on the IEE for the project, and terms of reference for the EIA; or EIA report prepared based on ToR previously approved by DOE;
- ii. in the case of an industrial project, layout plan showing location of ETP, process flow diagram, design, and time schedule of the ETP.

## **2.3 NATIONAL RELEVANT POLICIES AND STRATEGIES**

73 This section summarizes the National Laws and describes the procedure for obtaining environmental permits to allow project implementation. Over the years the Government of Bangladesh has enacted environmental acts, rules, policies and regulation toward imposing restrictions facilitating minimization / mitigation of likely impacts due to development projects. The most important Act is Environmental Conservation Act, 1995 (ECA, 1995) and Environmental Conservation Rules (ECR, 1997).

### **2.3.1 National Environmental Policy (1992)**

74 The National Environmental Policy was adopted in 1992 and is now under revision. It embraces different sectors related to agriculture, forest, power, health, transport, housing etc. The central theme of policy is to ensure protection and improvement in environment. The policy gives a thrust to sustainable development and long-term use of natural resources. The National Environment Policy contains policy statements and strategic options with regard to population and land-use management, management and utilization of natural resources and other socio-economic sectors, as well as the necessary arrangements for the implementation of the policy. The policy enables:

- the country to strike a dynamic balance between population and resources while complying with the balance of ecosystems;
- to contribute to sustainable and harmonious socio-economic development such that, both in rural and urban areas, and well-being in a sound and enjoyable environment; and
- To protect, conserve and develop natural environment.

### **2.3.2 National Water Policy (NWP) 2004**

75 The National Water Policy 2004 (NWP) aims for sustainable management of water. The Policy also integrates the environmental impact assessment for water development projects. The policy stresses on issues related to climate change such as:

- Augmentation of dry season flows;
- Awareness raising in consumptive use of surface and ground water;
- Structural and non-structural mitigation measures (early warning systems).

### **2.3.3 National Forest Policy (NFP 1994) and amendments**

76 National Forest Policy (NFP) was established in 1994. Under this policy it is proposed to increase the forest cover and to promote and oversee forestry activities. The policy fixed the target of forest cover at least 20% of geographic area by the year 2015. Tree plantation on the roadside verges courtyards of rural organization such as Union Parishad, school, Eidgah, mosque-Moktob, temple, club, orphanage home, madrassa etc. and other fallow lands around will be encouraged. The government will encourage this type of initiative and extend technical and other supports.

### **2.3.4 Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009)**

77 The Bangladesh climate change strategy and action plan were approved in 2009. The climate change plan is built on six pillars namely i) food security, social protection and health; ii) Comprehensive Disaster Management; iii) infrastructure; iv) research and knowledge management; v) Mitigation and low carbon development; and vi) capacity building and institutional. The strategy and action plan emphasize on ensuring existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure is put in place to deal with the likely impacts of climate change. - enhance the capacity government ministries, civil society and private sector to meet the challenge of climate change.

### **2.3.5 7th Five Year Plan (FYP) 2016–2020 (2015)**

78 Some key objectives and proposed strategies to achieve are:

- To ensure cities are sustainable and more efficient, with development following appropriately structured plans. Proposed strategy: Promote low emissions mass transport options and establish

Environmentally Sustainable Transport (EST) in the country; Implement of Roadmap to introduce low Sulphur diesel; Institutionalize of National Action Plan of Short-Lived Climate Pollutants (SNAP); Incorporate and introduce Green Building Code in Bangladesh's National Building Code to have energy efficient building/green building to address climate change etc.

- To achieve tree cover over 20% of the land surface (with tree density > 70%) and ecologically healthy native forests are restored and protected in all public forest lands (about 16% of land). Proposed strategy: Ensure greater contribution of the forestry sector in the economic development; Strengthen forestry extension activities to transfer improved technology and research information to end-users, e.g., local people and private homesteads etc. To meet energy demands of development through a low carbon strategy. Proposed strategy: Conserve non-renewable resources and sustaining auto and eco-generation of renewable resources; Mass initiative to be taken under Clean Development Mechanism and REDD etc.
- To reduce potential economic losses due to Climate Change (particularly from floods, drought and salinity). Proposed Strategies: Increase facilities for education, need-oriented co-oriented research and experimental works; Promote appropriate environment management system for mitigation and adaptation to climate change and climate vulnerability; Promote implementation of Bangladesh Delta Plan 2100 strategies and investment plans

### **2.3.6 Bangladesh Climate Change and Gender Action Plan (ccGAP) 2013**

79 The ccGAP integrates gender considerations into four of the six main pillars as identified in the BCCSAP: (i) food security, social protection and health; (ii) comprehensive disaster management; (iii) infrastructure and (iv) mitigation and low carbon development. The remaining two pillars of the BCCSAP, those of research and knowledge management and capacity building and institutional strengthening, were main streamed within the above four pillars throughout the document as crosscutting topics.

### **2.3.7 National Plan for Disaster Management 2010-2015**

80 Formulated by the Disaster Management & Relief Division, Ministry of Disaster Management and Relief, is indicative to what the relevant regional and sectoral plans would consider addressing the key issues like risk reduction, capacity building, climate change adaptation, livelihood security, gender mainstreaming, community empowerment and response and recovery management.

### **2.3.8 Coastal Zone Policy 2005**

81 The Coastal Zone Policy, formulated by the Ministry of Water Resources (MoWR), intends provide a general guidance to all agencies and institutions concerned for the management and development of the coastal zone in a manner that provides a secure and conducive environment for coastal communities to pursue their life and livelihoods. Amongst several objectives it identifies the following: the creation of sustainable livelihoods; intensifying the coverage of safe drinking water facilities; reducing vulnerabilities (including to climate change) and closing the gender gap.

## **2.4 LEGAL INSTRUMENTS**

82 The Ministry of Environment and Forests (MoEF) prepare the environmental policies. MoEF also has formulated regulation toward clearance of projects from environmental angles based on environmental impact assessment report. The Department of Environment (DoE) is responsible for environmental issues while forest issues are looked after Department of Forests. Over the years the MoEF has adopted number

of legal instruments in the form Acts for the protection and conservation of the environment. **Table 2** summarizes the Environmental Legislation applicable to the sub-project.

**Table 2 Summary of Environmental Legislations Applicable to the Proposed Project**

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
1	National Environmental Policy, 1992	Ensure that development components do not pollute the environment or degrade resources. It sets out the basic framework for environmental action together with a set of broad sectoral action guidelines.	Restriction on operations which cannot be initiated in ecological critical areas  Regulation on vehicles emitting smoke which is harmful to the environment  Follow standards on quality of air, water, noise and soil  Sets limits for discharging and emitting waste	Ministry of Environment and Forests, and Climate Change
2	National Environmental Management Action Plan (NEMAP), 1995	An action plan to identify key environmental issues affecting Bangladesh, identifies actions for reducing the rate of environmental degradation and improve quality of life.	Sectoral agencies to coordinate with MoEFCC in preparing environmental guidelines	Ministry of Environment and Forests, and Climate Change
3	Environment Court Act, 2000 and subsequent amendments in 2003	Establishment of Environment Court for trial of an offence or for compensation under environmental law, such as environment pollution.	Option to affected persons for grievances related to environment safeguards.	Ministry of Environment and Forests, and Climate Change
4	The Forest Act (1927) and Forest (Amendment) Act (2000)	An act to control trespassing, illegal resource extraction and provide a framework for the forestry revenue collection system;	Requires clearances for any project within forest areas and clearances for any felling, extraction, and transport of forest produce.	Department of Forests
5	National Forest Policy (1994)	To conserve existing forests and bring about 20% of the country's land area under the Forestation Programme and increase reserved forests by 10% per year until 2015	Incorporate tree planting in the subproject  Clearance for any felling, extraction, and transport of forest produce	Department of Forests
6	The Bangladesh Wildlife (Conservation & Security) Act, 2012	To conserve and protect wildlife in Bangladesh including designation of protected areas. Protection of wildlife is provided with lists of species with four schedules: first, second, third and fourth schedule. The fourth schedule species have the highest level of protection.	Consultation and necessary permits required if the project will pass through the wildlife sanctuaries and other protected areas.	Department of Forests
7	National Safe Drinking Water Supply and Sanitation Policy of 1998	Ensures access to safe water and sanitation services at an affordable cost	<ul style="list-style-type: none"> <li>Pourashavas and water sanitation authorities will take actions to prevent wastage of water. They will take necessary steps to increase public</li> </ul>	Ministry of Local Government, Rural Development, and Cooperatives

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
			<p>awareness to prevent misuse of water</p> <ul style="list-style-type: none"> <li>Pourashavas shall be responsible for solid waste collection, disposal and their management</li> </ul>	
8	National Water Act 2013	Ensures Bangladesh water sources are free from any type of pollution. Pollution from water in urban outfalls and reservoirs, e.g. lakes, canals, ponds and ditches may result in amenity losses, fisheries depletion, health problems and fish and aquatic species contamination.	Secure clearance certificate on water resource development subprojects	Ministry of Water Resources
9	Wetland Protection Act 2000	Advocates protection against degradation and resuscitation of natural waterbodies such as lakes, ponds, beels <sup>6</sup> , khals, tanks, etc. affected by man-made interventions or other causes. Prevents the filling of publicly owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.	In case of diversion of water from any wetland nearby, detailed assessment should be done	Ministry of Water Resources
10	Bangladesh Labor Law, 2006	<p>It is a comprehensive law covering labour issues such as: conditions of service and employment, youth employment, benefits including maternal benefits, compensation for injuries, trade unions and industrial relations, disputes, participation of workers in company's profits, regulation of safety of dock workers, penalty procedures, administration and inspection.</p> <p>This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable environment for working. It also includes rules on registration of labourers, misconduct rules, income and benefits, health and fire safety, factory plan</p>	<p>Compliance to provisions on employment standards, occupational health and safety, welfare and social protection, labor relations and social dialogue, and enforcement.</p> <p>Prohibition of employment of children and adolescents.</p>	Ministry of Labor and Employment
11	Bangladesh Labor Rules, 2015	Includes rules on registration of laborers, misconduct rules, income and benefits, health and fire safety, factory plan	<p>Contractors to implement occupational health and safety measures</p> <p>Contractor will be liable for compensation for work-related injuries</p>	Department of Labor
12	The Pourashava Act 2009 / Ordinance issued for the	Provides guidance for subproject integrated community and workers health and hygiene at the construction	Coordinate with pourashava committees on disaster management measures,	Local Authorities

<sup>6</sup> A beel is a billabong or a lake-like wetland with static water (as opposed to moving water in rivers and canals - typically called khaals), in the Ganges - Brahmaputra flood plains of the Eastern Indian states of West Bengal, and Assam and in the country of Bangladesh.

No.	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
	amendment of local government (municipality) ordinance, 2009 and 2010; The Pourashava Ordinance, 1977; Municipal Administration Ordinance, 1960	and operation and maintenance stages of the project	water and sanitation and waste management	
13	Bangladesh Climate Change Strategy and Action Plan of 2009	Enhances the capacity of government ministries, civil society and private sector to meet the challenges of climate change	Integrate adaptation measures for buildings in consideration of extreme climatic events	Ministry of Environment, Forests and Climate Change
14	Standing Order on Disaster, 1999 (Updated 2010)	Enhances capacity at all tiers of government administrative and social structures for coping with and recovering from disasters	Geographical information system (GIS) technology will be applied at the planning stage to select location of roads etc.  Advice from the concerned District Committee should be obtained prior to final decision	Ministry of Disaster Management and Relief
15	National Disaster Management Act of 2012	Establishes a framework for managing disasters in a comprehensive way.	Setting-up emergency response procedures	Ministry of Disaster and Relief

## 2.4.1 Occupational Health and Safety

83 During construction, the project needs to conform to the labor laws and occupational and health related rules as outlined in **Table 3**.

**Table 3 Relevant Occupational Health and Safety Laws and Rules**

Title	Overview
Bangladesh Labor (amendment) Act, 2018	<ul style="list-style-type: none"> <li>Provides for safety of work force during construction period. The act provides guidance of employer's extent of responsibility and the worker's right to compensation in case of injury caused by accident while working.</li> <li>Expectant mothers would mandatorily be entitled to get eight weeks maternity leave and other benefits within three days of submission of necessary documents.</li> <li>prohibited engagement of children and physically challenged persons in any risky job</li> </ul>

## 2.5 APPLICABLE INTERNATIONAL AGREEMENTS

84 Aside from the legal framework on environment, Bangladesh is also a party to several international conventions, treaties and protocols related to environmental protection. The applicable international conventions, treaties and protocols are described in **Table 4**.

**Table 4 Applicable International Conventions, Treaties and Protocols**



	Conventions	Signed	Ratified/ Accessed(AC)/Accepted(AT)	Relevance
1	International Plant Protection Convention (Rome, 1951) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)		01.09.1978 04.12.1974 (AC)	Ensures that component work or construction materials do not introduce plant pests
2	Convention on Wetlands of International Importance, 1971 (Ramsar Convention)		20.04.1992 (ratified)	Protection of significant wetland and prevention of draining or filling during construction
3	Convention Concerning the Protection of World Cultural and Natural Heritage (Paris, 1972)		03.11.1983 (ratified)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.
4	Convention on Biological Diversity, 1992 (Rio de Janeiro)	05.06.1992	03.05.1994	Protection of biodiversity during construction and operation.
5	Convention on Persistent Organic Pollutants, 2001	23.05.2001	In process	Restriction of use of pesticides and herbicides
6	United Nations Framework Convention on Climate Change, 1997	11.12.1997	22.10.2001 13.11.2003 (amended)	Reduce greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system

## 2.6 ENVIRONMENTAL CATEGORIZATION AND STANDARDS

### 2.6.1 Environmental Category: Bangladesh

85 For the purpose of issuance of Environmental Clearance Certificate, the industrial units and projects shall, in consideration of their site and impact on the environment, be classified into the following four categories: (a) Green; (b) Orange – A; (c) Orange – B; and (d) Red. The Industries and projects included in the various categories are specified in sub-rule (1) have been described in Schedule – 1. The ECA indicates that all industrial units or projects must obtain a Location Clearance Certificate (LCC) and Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). No industrial unit or project shall be established or undertaken without obtaining environmental clearance from DoE in the manner prescribed by the rules.

86 The environmental category of the sub-project is listed in Schedule – 1 of ECR. The proposed canal excavation subproject falls in Orange B. **Table 5** describes DoE classification for canal construction and upgradation.

**Table 5 DoE Classification of construction project according to ECR 1997**

Sl.No	Components	Items in Schedule-1 of ECR	DOE Classification
1	Engineering works (up to 10 hundred thousand Taka capital.)	Sl. No. 45 of ECR	Orange-B

Source: ECR 1997

### 2.6.2 Environmental Category: ADB

87 The Safeguards Policy Statement (SPS 2009) of ADB provides guidance on the environment category of projects based on the degree of anticipated environmental impacts. ADB environmental safeguards objectives are: (i) to ensure the environmental soundness and sustainability of projects and (ii) to support the integration of environmental considerations into the project decision-making process. ADB environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. The initial process of categorization involves filling out a sectoral Rapid Environmental Assessment

(REA) checklist. A project is classified as one of the four environmental categories (A, B, C, or FI) based on the most environmentally sensitive component. Categories are as follows:

**Category A:** Project that is likely to have significant adverse environmental impacts which are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

**Category B:** Project with potential adverse environmental impacts that are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

**Category C:** Project that is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

**Category FI:** Project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

88 The project has been categorized as B for environment under the ADB's Safeguards Policy Statement 2009 (SPS).

## 2.7 INSTITUTIONAL CAPACITY

89 The Refugee Relief and Repatriation Commission (RRRC) is proposed to act as the coordinator on behalf the government to execute all interventions. RRRC and ADB will conduct regular coordination meetings involving all Implementing Agencies (IAs), relevant stakeholders including deputy commissioner (DC), Cox's Bazar, other development partners and agencies. ADB plans to establish extended mission office in Cox's Bazar for close coordination, facilitation of sub-projects development and implementation. A steering committee comprising higher officials from relevant ministries coordinated by ERD will be formed to provide necessary guidance to expedite the sub-project development and implementation. The steering committee will have a safeguards focal person.

90 The Local Government Engineering Department (LGED), the Department of Public Health Engineering (DPHE), the Roads and Highways Department (RHD), and the Bangladesh Rural Electrification Board (BREB) will be the executing agencies and implementing agencies. responsible for project oversight and coordination. There will be a safeguards focal person in the EA/IA. The EA/IA will be assisted by PMCs. The EAs/IAs will form project implementation units (PIU). The PIUs will identify a focal person for environmental safeguards. The focal person will be assisted in the conduct of the environmental assessment, the development and implementation of EMPs, and compliance monitoring by project consultants. All the implementing agencies are currently implementing ADB projects under this institutional arrangement (further defined in Section VI). ADB also conducts safeguards training for project executing and implementing agencies. Thus, the government has sufficient capacity in implementing ADB requirements and strengthening of capacity, other than through the course of the consultant's work with local counterparts, is not required. ADB will continue to conduct capacity building programs during implementation.



## **3 Description of the project**

### **3.1 INTRODUCTION**

91      The work package includes construction / renovation/ upgradation of 1 primary canal (Natural canal inside the hills of the camp area). Total 5800m will be excavated.

### **3.2 SUB PROJECT FEATURES**

92      **Package Title:** BANGLADESH: Construction and Re-construction of Storm water Drainage Network on Primary canal-02 (Camp 20 Extension) Outletting to Naf river, under Ukhiya Upazila, Dist. Cox's Bazar.

93      **Existing condition:** The original natural canal is more than 8km long of which 5800m has been proposed for excavation and upgradation. The canal is originated from the Camp – 4 Extension inside the Balukhali Mega Camp and drains into Naf river. The canal has several branches and sub-branches including both tributaries and distributaries. The canal is featured with highly dense population on both banks and runs through Camp no 18 Extension (originally survey was possible from this point) and 12 and 10. The canal bed features frequent undulation which causes localized heavy waterlogging during the rains. The earthen sections of this canal have been damaged in last couple of years, especially during monsoon season.

94      **Proposal:** The whole chainage (5800m) has been proposed to maintain 0.14% sloping by excavation and filling for smooth flow of upstream water. Along the canal 10962sqm area of slope has been proposed for cast-in-situ for bank protection. Staircases and grass plantation to prevent erosion has been considered. See arrangement of the project in Figure 4.

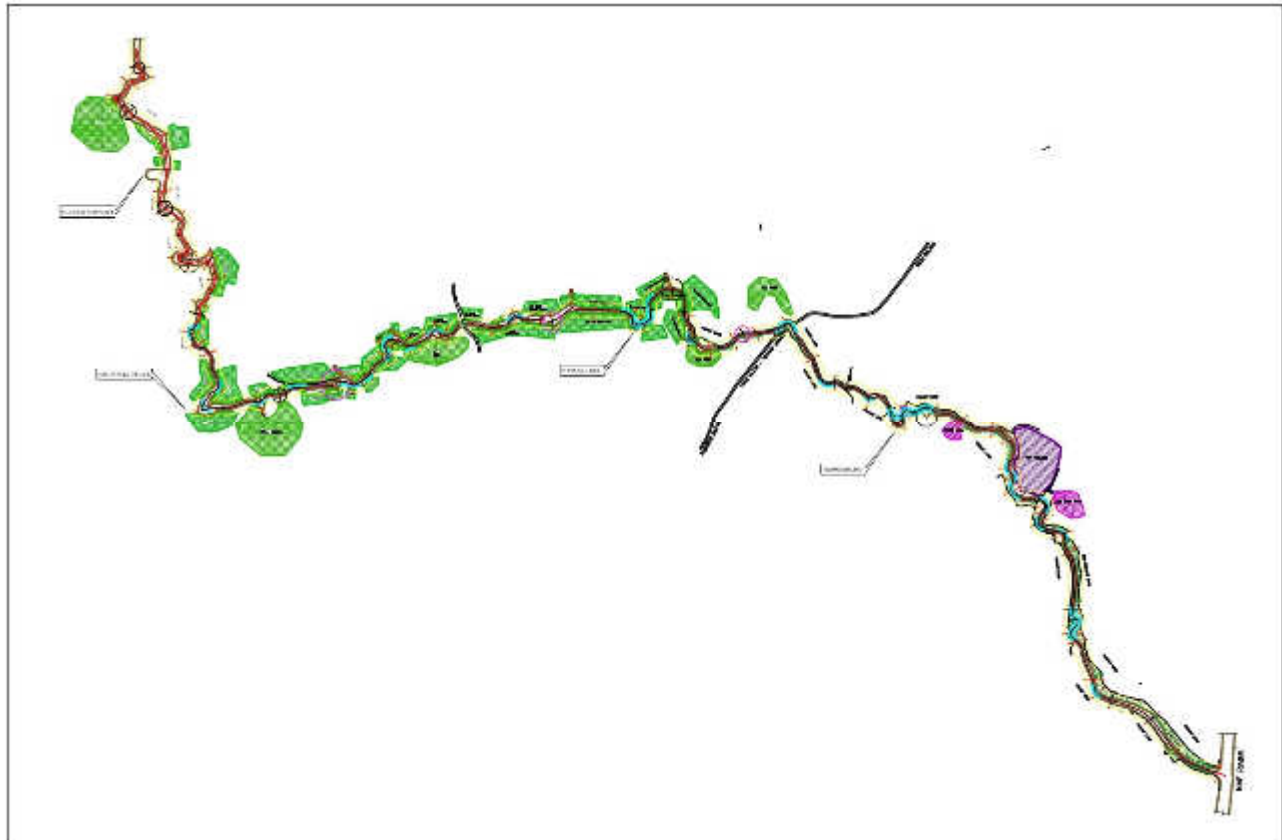


Figure 4 Arrangement of the package, blue shed indicating existing house, green indicate hills

## 4 Analysis of alternatives

### 4.1 PRELUDE

95 The primary objective of the “analysis of alternatives” is to identify the location/technology for a particular sub-project that would generate the least adverse impact and maximize the positive impacts. The preliminary assessment of the project included an analysis of alternatives, addressing the optimal match between required technical specifications and site conditions, as well as addressing any concerns for environmental, social, and economic features in each location.

### 4.2 CURRENT PROPOSAL

96 The canal alignment is predominantly dense camp area.

97 Based on the Rapid Environmental Assessment (REA) Checklist provided in the Environmental Assessment and Review Framework (EARF) of ADB for this Emergency Assistance Project (EAP), it was found that the current proposal will have the minimal effect on environment and society. Summary of the impacts of current proposal is given in **Table 6**.

**Table 6 Impact of current proposal on environment and society**

Sector	Impact
Presence Important features along the route	No
Land (Government-owned land are to be given priority)	Existing road alignment
Presence Agricultural/cropped land	Close by, no impact will occur if EMP is followed
Village affected	No
Families affected	No
Loss of structures	No
Impact on Common properties	No
Trees to be chopped down	About 10, ornamental acacia trees
Presence of sensitive ecosystem	No
Presence of waterbody	None
Tribal population affected	No

### 4.3 ‘DO NOTHING’ OPTION

98 From a purely physical and environmental point of view, the ‘do-nothing’ approach is preferable to any project implementation since it would avoid creation of any of the adverse impacts associated with a new road. The without project alternative is not acceptable since this will strongly reduce the potential for socio-economic development of the country. The Rohingya camp is known to be waterlogged every year due to overflow and drainage congestion. Since, more than a 1 million people took shelter in the camp, such waterlogging and drainage congestion can spread vector borne diseases and affect the densely populated camp areas. If the capacity of the drainage canals are not strengthen, waterlogging can be more severe in the coming years.

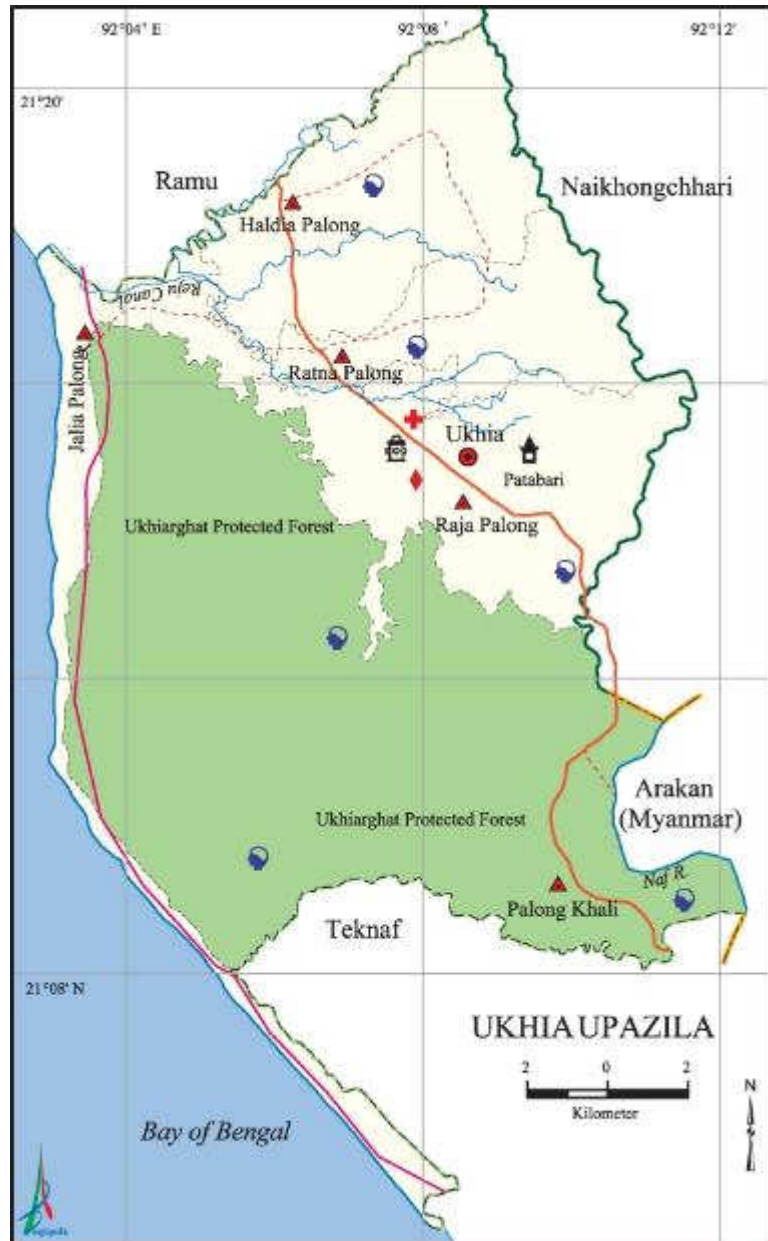
99 Therefore, the ‘no-build’ alternative is unacceptable, and the potential socio-economic benefits of implementation of such Project far outweigh the adverse impacts, all of which can be controlled and minimized to an acceptable level.

## 5 Description of baseline environment

### 5.1 LOCATION SETTING AND EXTENT

100 Ukhiya Upazila is an Upazila under Cox's Bazar District in the Division of Chittagong, Bangladesh. It is located at 21.2833° North, 92.1000° East. It is bounded by Ramu on the north, Myanmar and Naikhongchhari on the east, Teknaf on the south, the Bay of Bengal on the west. Ukhiya thana was established in 1926 and was promoted into an upazila in 1983. The upazilla is consisted of five Union Parishads: (i) Halda Palong; (ii) Ranta Palong; (iii) Raja Palong; (iv) Jalia Palong and (v) Palong Khali. Ukhiya Upazila covers an area of 261.8 sq km, located in between 21°08' and 21°21' north latitudes and in between 92°03' and 92°12' east longitudes (Banglapedia 2018). The area is bounded by Ramu upazila on the north, Teknaf upazila on the south, Arakan state of Myanmar and Naikhongchhari upazila on the east, the Bay of Bengal on the west. See **Figure 5** for details.

101 More than half of the upazila is under Ukhiarghat protected forest. The refugee camp situated in Ukhiya is within the protected forest.



**Figure 5** Location map of the subproject

Source: <http://en.banglapedia.org/images/e/ee/UkhiyaUpazila.jpg>



## 5.2 EXISTING CONDITION

102 The proposed canal is full of waste and congested due to sedimentation and solid waste. The existing alignment mostly runs through the busy premises of the camps. The canal is clear of trees in most parts although camp establishments and unstable agricultural fields observed on the banks. Attached distributaries were also found in some parts of the canal. The adjoining canals are narrow, bearing the waste laden water from the camps. The hilly streams also drain water through these small channels. **Figure 6** presents a photographic view of the project location.



**Figure 6 Existing condition at the proposed canal**

## 5.3 PHYSICAL ENVIRONMENT

### 5.3.1 Landform and ecology

103 Ukhiya is located at Teknaf peninsula. Teknaf Peninsula is one of the longest sandy beach ecosystems (80 km) in the world. It represents a transitional ground for the fauna of the Indo-Himalayan and Indo-Malayan ecological sub-regions. Important habitats at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons and marine habitat. Mangrove forest occurs in Teknaf peninsula both as natural forest with planted stands and mostly distributed in the inter-tidal zone. The



Teknaf peninsula mangroves supports the habitat of 161 different species of fish<sup>7</sup>. Teknaf reserved forest is one of the oldest reserved forests in Bangladesh.

104 The hill area covers 14,602 ha, accounting for 41.8% of the total area. According to its height and morphology, the hill area can be divided into two types: medium-high hills and medium-low hills. The area of medium-high hills is approximately 6940 ha, and the heights of the hills range from 150 to 300 m. The slopes of these hills range from steep (30–50% slopes) to excessively steep (>70% slopes). The hill ranges, which are interrupted by streams and valleys, are oriented from north to south, and they developed over sedimentary rocks. The area of medium-low hills, which developed over soft sedimentary rocks, is 7436 ha, and the hill heights are less than 150 m. The slopes range from excessively steep by steep to slightly steep (<5% slopes). Erosion is very common in steep to very steep areas, while it is less common in flatter areas. Deep soils only developed in flatter areas. Narrow and broad ridges are found alongside the low hills<sup>8</sup>.

<sup>7</sup> Chowdhury, N. Shah Nawaz; Hossain, M. Shahadat; Das, Nani Gopal; Barua, Prabal (2010-09-25). "Environmental variables and fisheries diversity of the Naaf River Estuary, Bangladesh". *Journal of Coastal Conservation*. 15 (1): 163–180. doi:10.1007/s11852-010-0130-3. Retrieved 2011-01-01.

<sup>8</sup> A.Z.M. Moslehuddin, Md. Abiar Rahman, S.M.A. Ullah, M. Moriyama, and Masakazu Tani (2017) *Chapter 2 Physiography, Forests, and People* in Teknaf in Deforestation in the Teknaf Peninsula of Bangladesh, Masakazu Tani and Md. Abiar Rahman (eds.)

### 5.3.2 Disasters

105 Most of the areas of Cox's Bazar district surrounded by hills, rivers and being adjacent to the Bay of Bengal, natural disaster visited the district every year. Subsequently, the inhabitants of the district suffer much by the disaster. Adding this, climate change effect has speed up the frequency natural disaster like, cyclone, tidal surge, flesh flood, excessive rainfall, rising temperature, increase salinity, land slide, erosion of riverbanks, thunder storm, earth quake etc. and these are the major disaster for Cox's Bazar district. As part of history of natural disaster for the region there are few events are most remarkable and historic.

106 The most historic and destructive cyclone of 1991 severely affected the whole Cox's Bazar district. All the 8 Upazilas of the district hit by the cyclone. Mostly St. Martin, Kutubdia, Materbari, Dhalghat, many parts of Moheshkhali and Teknaf was severely affected. In an average the tidal surge by the wind speed rise from 20 to 30 feet, and 72 hours continuous water stagnated by the high tide of the sea. There was cyclone in 1994 and 1997 too which were also affected the overall resources, community life, household, cattle head, crops, infrastructure, green trees, communication system etc.

107 The following areas are identified by the Cox's bazar District Disaster management Plan<sup>9</sup>: Under Ukhiya-Jaliapalong, Sonarpara, Dailpara, Lamburipara, Sonaichari, Nidania, Inani, Shafir bil, Ruppoti,

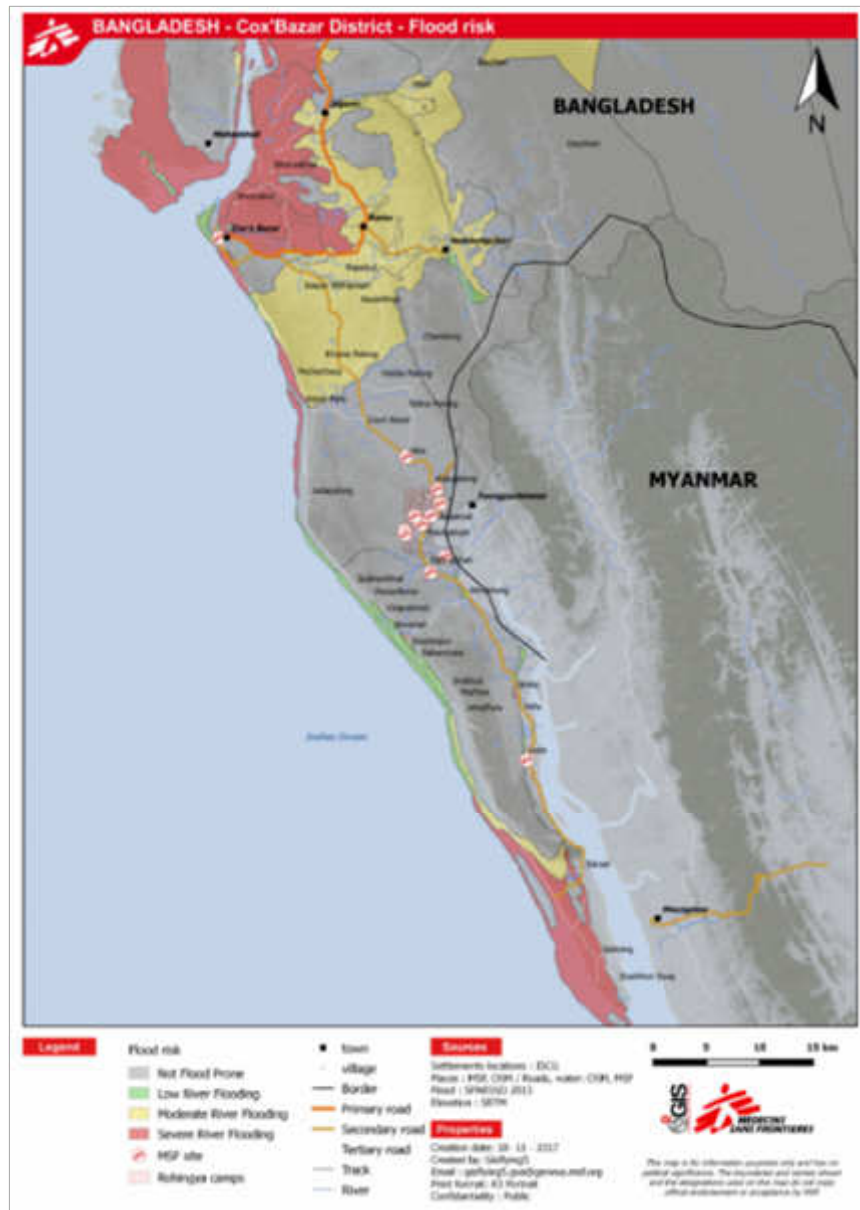


Figure 7 Flood risk in Cox's bazar

Source: <https://reliefweb.int/map/bangladesh/bangladesh-coxs-bazar-flood-risk>

<sup>9</sup> Development of District Disaster Management Plan District: Cox's Bazar, District Disaster Management Committee, Cox's Bazar. August 2014. Government of Bangladesh.

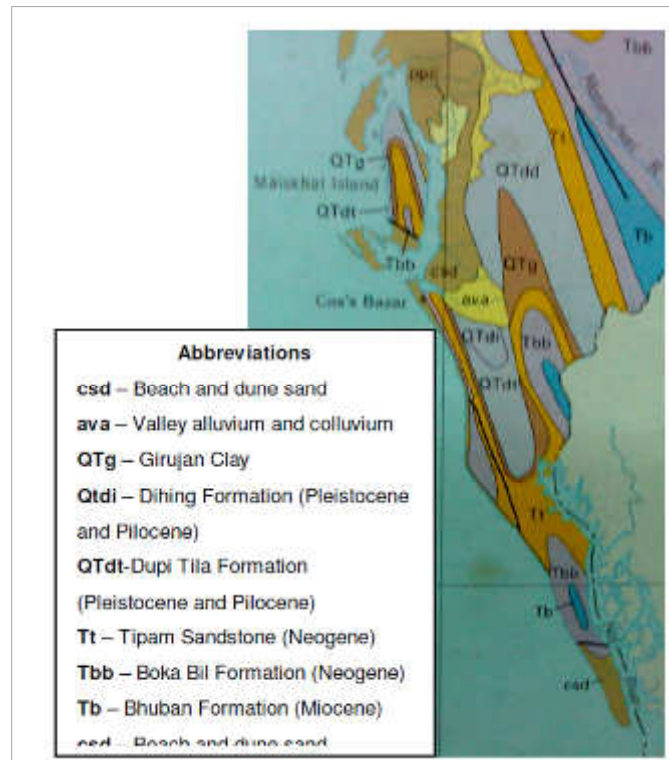
Bailyakhali, Imamerdail, Sepotkhali, Maderbonia, Monkhal, Nalbila, Balukhali, Goalmara, Thainekhali and Rahmoter bil. **Figure 7** presents a map of flood risk in Cox's Bazar District.

### 5.3.3 Geology, Topography, and Soils

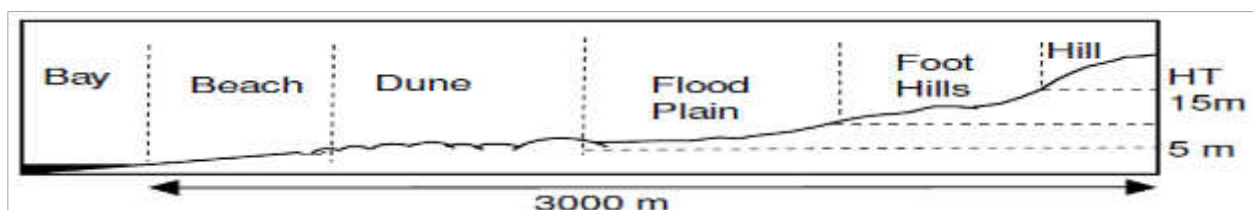
108 The Teknaf piedmont plain covers 3034 ha (8.6% of the total area). It is situated alongside the hills, mainly on their western side, but is found sporadically on the eastern and south sides of the hills. The landscape is a nearly level high ridge, which is subject to flash floods during the rainy season. See **Figure 8** for geological formation of Cox's Bazar.

109 The tidal floodplain, which runs from north to south through the peninsula, comprises 6838 ha of land (19.57% of the total area). This is located between the hills and the Naf River (on the eastern side of the hills). The area consists of broad, high, and low ridges and depressions. Numerous canals divide the landscape, some of which are subjected to tidal flooding. During the rainy season, most of the areas become mildly inundated with rainwater and occasionally suffer flash floods during heavy rainfall.

110 Beaches cover 9.03% (3155 ha) of the total area, and they lie on the west side of the peninsula along the sea. The landscape is mostly flat with some undulating relief consisting of sandy soil. The coral beach is a minor area (1%) that is located approximately 12 km from the mainland. It is located on St. Martin's Coral Island. The landscape consists of very gently undulating old beach ridges and inter-ridge depressions, which are surrounded by sandy beaches. See **Figure 9** for morphological cross section<sup>10</sup> of Cox's Bazar.



**Figure 8 Geology of Cox's Bazar**



**Figure 9 Morphological cross section of Cox's Bazar**

111 There are four main soils or physiographic units can be recognized, viz. I) The higher hill ranges occupy a narrow belt: the most common soils are strong brown, friable, silty clay loams and silty clays, which grade into broken shale rock at 2-4 feet. All soils are strongly acid in reaction. II) The lower hill ranges are developed in unconsolidated sands and clays. Soils are mainly deep red, friable, clay loams to clays.

<sup>10</sup> Alam M.S., Huq N.E. and Rashid M.S. 1999. Morphology and sediments of the Cox's Bazar coastal plain, south-east Bangladesh. Journal of Coastal Research, 15(4) : 902-908.

All the soils are strongly acid and sandy soils are droughty. III) The coastal plains are underlain by heavy marine or tidal clays characterized by more sandy and silty deposit near the foot of the hills and along the course of rivers and streams which cross the plains. Near the coast, some of these soils become saline at the end of the dry seasons. IV) The tidal mangrove swamps are most extensive at the mouth of the Matamuhuri River Here the soils are grey clay flooded twice daily by saline water and unsuitable for agriculture. According to Geological Survey Bangladesh (GSB, 1978) the falls in medium intensity seismic zone (Zone-II, Basic Seismic Coefficient 0.05g).

112 The major soil types are red, alluvial, muddy and sandy soil. The soils of the Dupitila formations were formed on unconsolidated and compact rocks, moderately well to excessively drained and probably the oldest of the area. See **Figure 10** for details.

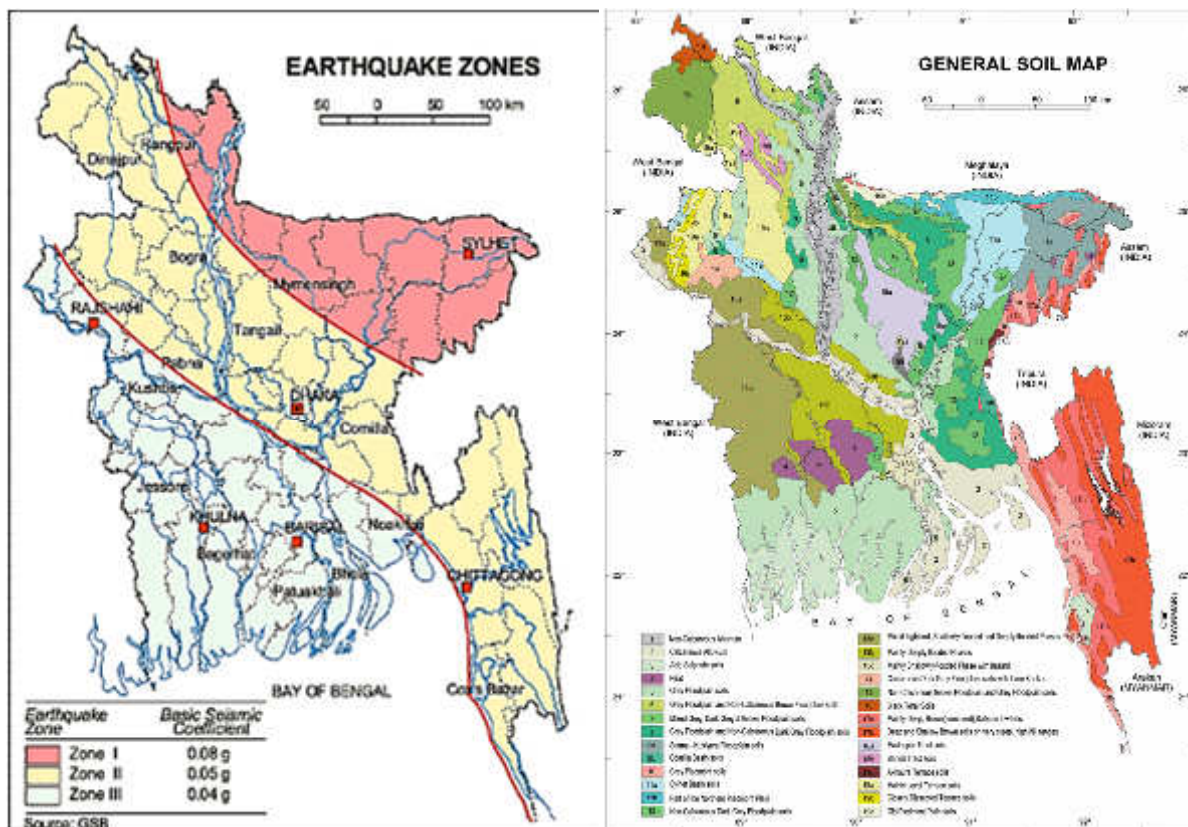


Figure 10 Earthquake zone and general soil map of Bangladesh

### 5.3.4 Climate and Meteorology

113 Generally, maximum temperature in the year reach between the last week of March and end of May. Temperature data is recorded at station Cox's Bazar. As dis discussed above, Ukhiya is a upazilla (subdistrict) of the Cox's Bazar zilla (District). The average maximum temperature in Cox's Bazar is 31.28°C in April and minimum is 22.0°C in January (Data from BMD 2016). See **Figure 11** for details<sup>11</sup>.

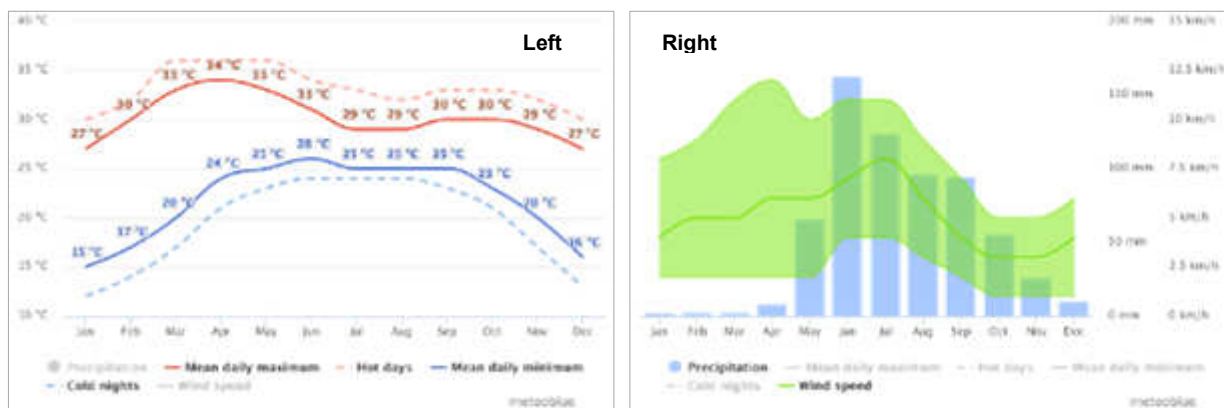


Figure 11 Left: Temperature pattern in Cox's Bazar; Right: Rainfall pattern in Cox's Bazar

114 The trend of rainfall of Cox's Bazar district was as usual and normal before 1991, however, radical changes have been observed in the recent years, in particularly after the year 2000. Once, the rainfall and its continuation were steady according to the seasons of the year. Interestingly, 1994 a remarkable change in rainfall has observed. In general, there was not much rain during the month of January to April, and it happened during from April to June of the year. On the contrary, sometime rainfall occurs during the month of December which creates flooding. The variation in the precipitation between the driest and wettest months is 401 mm. See **Figure 12** for details<sup>12</sup>.

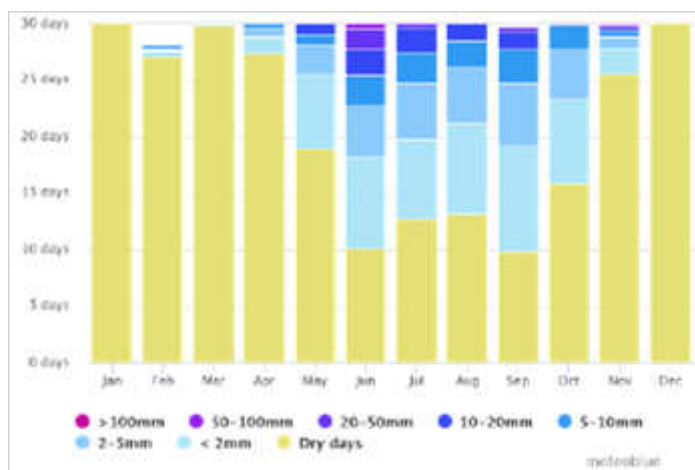


Figure 12 Rainfall analysis (amount) for Cox's Bazar station

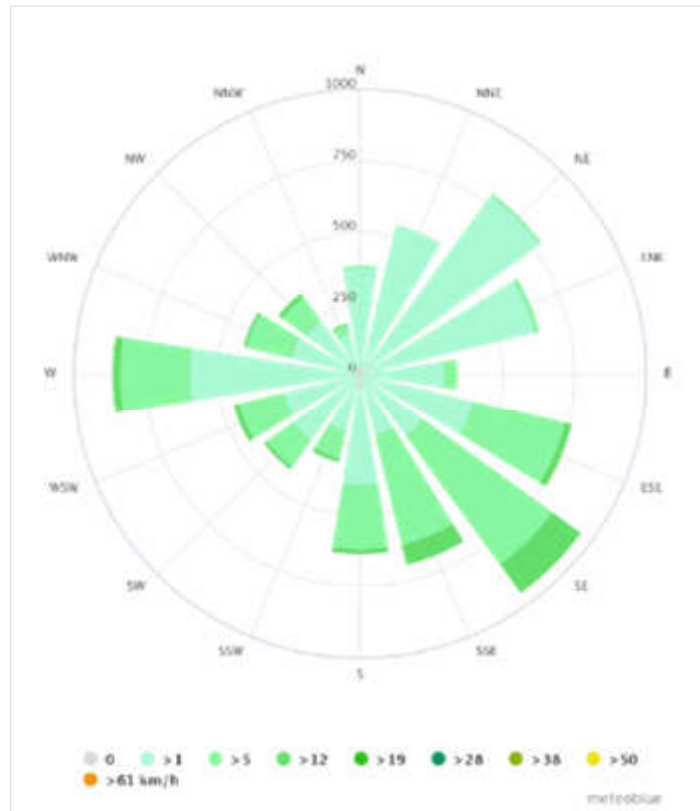
<sup>11</sup> Source: <https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine-cox-s-bazar,Bangladesh> Date Accessed: 7 Nov 2018

<sup>12</sup> Same as 6.



115 The humidity is high throughout the year. March and April are the least humid months in the region. The relative humidity is found over 80% during June, July, August and September. The least humid month in the area is January, February and March. Lowest average humidity is recorded 62% at Cox's Bazar.

116 South-east and westerly winds are strong in Cox's Bazar. The wind rose (**Figure 13**) shows how many hours per year the wind blows from the indicated direction. From all the wind rose diagrams it can be said that the region is predominantly characterized by North-east, East-Southeast, South-East, and West wind flow. The average wind speed ranges from 5 to 19 km/h during maximum period in a year.



**Figure 13 Wind rose of Cox's Bazar Station**

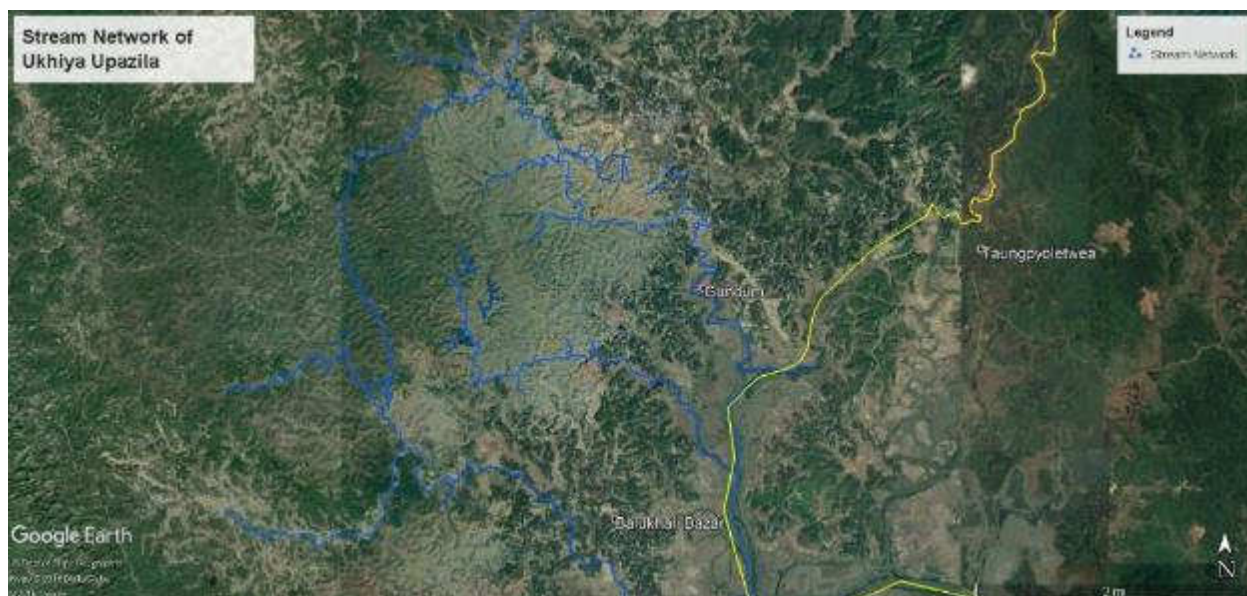
### 5.3.5 Hydrology

117 The Moheshkhali Channel, Baak Khali and Naf rivers and Bay of Bengal are the main waterways of the region. The Moheshkhali Channel flows into the Bay of Bengal near Cox's Bazar and passes the north western boundary of the area of influence. The Bakkhali River originates from the Chittagong Hill Tracts and flows into the Bay near Cox's Bazar. Five other canals run through the hilly hinterland. They are the Reju, Inani, Mankhali, Rajachora and Mathabanga canals. In addition, a stream network runs through the camp area.

118 Naf It flows along the southernmost border line of the country. It originates in the northern hills of Myanmar and enters Bangladesh near Palong Khali of Ukhia upazila of Cox's Bazar district. The river flows through Ukhia and Teknaf and discharges into the Bay of Bengal near Sabrang (Teknaf upazila, Cox's Bazar). Most of the downstream reach of the river demarcates the Myanmar-Bangladesh border. The river is 62 km long. BWDB has one hydrometric station on the river at Teknaf and data from 1968 are available.

119 There are 14 canals in the Upazila, which flow throughout the Upazila. Reju Canal-starting from Rejur mukh crosses painnasia, sonaichoara, sonarpara, chorpara, jummapara and lamburi para. It has length of 7 kilometres. Monkhali Canal-starting from Monkhali mouth up to Nuton Chaka para. It is 8 kilometres. Sowankhali Canal- it is 8-kilometer-long started from Swankhali area and stretched upto Bay of Bengal. Chepokhali Canal-It is 10 kilometre long started from Madarbonia and arrives to Chepotkhali. Inani Canal-it is 15 kilometre long started from Chenchuli to Inani. Inani Choto Canal-It is 20 kilometre long started from Chenchuli to Inani. Paglir Canal- 8-kilometer-long canal started from Guarerdeep and stretches to Patabari area. Duchori Canal-the canal is 15 kilometre long started from Tuturbil to Madhurghona. Goyalmara Canal-it is 18 kilometer long starting from Tuturbil and up to Modhurghona. Balikhali Canal-the canal starting from Modhurchara and reached to the Naf river covering a length of 7 kilometre. Thiankhali Canal-It is 8-kilometer-long starting from Achortoli to Naf river crossing through Tarulapara and Fashiakhali. Palongkhali Canal- This is 14-kilometer-long starting from Nojumora falls into Naf river crossing different

parts of Ukhia and Teknaf Upazila. Balukhali Canal: a 6-kilometer-long started from Madhuchara reaches to the Naf river crossing through BGB camp, Chowdhur para and Barua para. **Figure 14** represents the stream network in the region.



**Figure 14 Stream network in the Sub-project area**

120 **Reju Khal:** The khal has originated from Arakan boarder of Myanmar and Wading hills, it has flowed through Nihongchoriupazila of Bandarban entering into Holodiapalong of Ukhia Upazila and Khunia union of Ramu Upazila. It has finally entered Jaliapalong of Ukhia and arrives at Bay of Bengal. It is about 20 kilometres long within Bangladesh.

121 Bangladesh is considered rich in ground water resources. Properties of ground water storage reservoirs and volumes of annual recharge determine ground water resources. In this region, ground water level is shallow, usually ranges between 5-7m<sup>13</sup>.

### 5.3.6 Flooding, Water Logging and Drainage Pattern

122 Eastern side of the upzila comprising high land and gradually down towards the western side. Matamuhuri River is flowing beside the upazila in north-east and north-west direction. Several natural streams act as the natural drainage system of the region. The mainland surrounding the upazila is generally high from the level of tide. As a result, most of the area is free from flood.

123 Waterlogging problem has been reported within the camp area. The flooding and waterlogging mainly occur during the monsoon when the internal canal system overflow. **Figure 15** shows a waterlogged area in the camp.

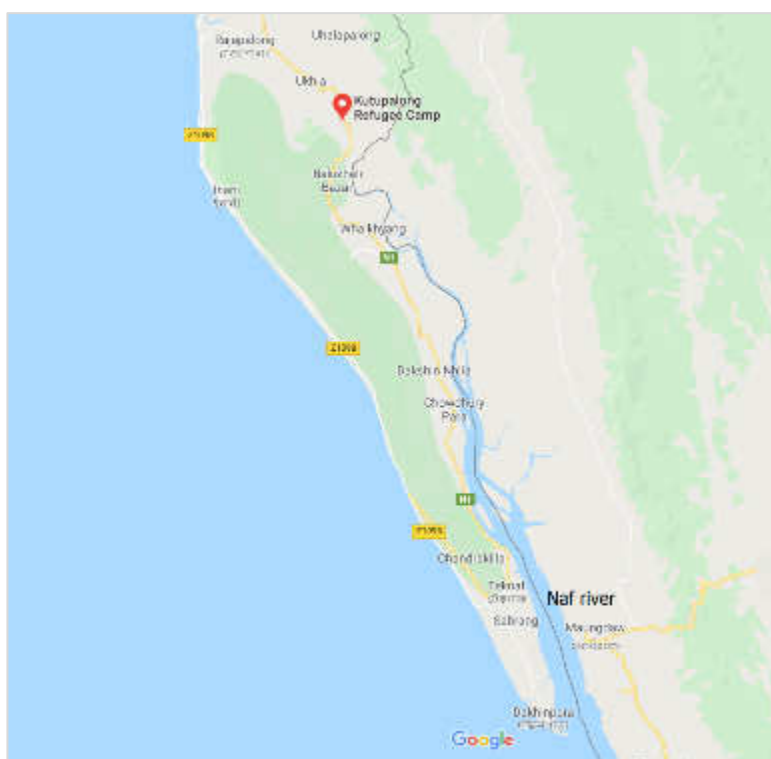
<sup>13</sup> BARC, Bangladesh agricultural research council, September 2015. URL: <http://www.barc.gov.bd/>



**Figure 15 Flood vulnerability in the Rohingya camp**

(Source: left photo <https://www.dhakatribune.com/bangladesh/crisis/2018/07/26/rohingyas-face-starvation-waterborne-diseases-as-monsoon-floods-hit-refugee-camps>; right photo <https://www.thedailystar.net/supplements/child-alert-unicef-2018/news/facing-the-monsoon-and-uncertain-future-1630903>)

124 As mentioned in the earlier sections, Reju khal is the mainstream waterbody that flows through the Upazila in conjunction with 14 canals. However, the water from the hilly areas of the camp is drained to the Naf river. See **Figure 16** for details.



**Figure 16 Naf river and location of Rohingya camp (Courtesy: Google map)**



### 5.3.7 Land Slides and erosion

125 The Kutupalong camp area is prone to land slide and erosion. In fact, land slide is a major problem in the Cox's Bazaar mountain zones, of Bangladesh by killing people every year besides damaging the properties and blocking the public utilities. **Figure 17** shows the landslide prone areas around the subproject area.

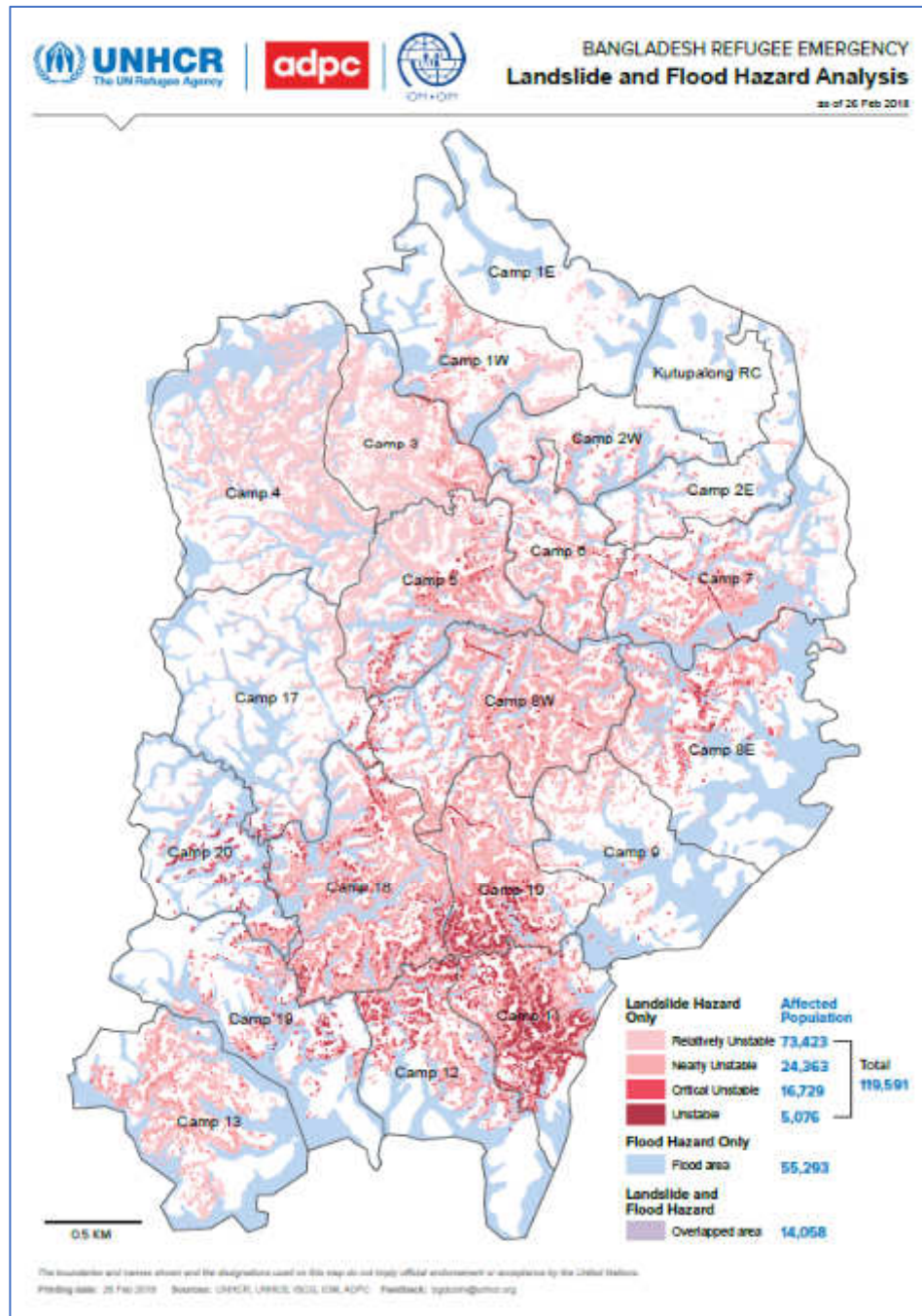


Figure 17 Landslide vulnerability areas around the subproject

### 5.3.8 Ground water quality

126 The Kutupalong camp depends on the groundwater in the region and uses tube wells to access the resource (Sikder, 2010)<sup>14</sup>. Grant (2013)<sup>15</sup> studied 38 sampled wells in the Kutupalong area where pH ranged from 3.9 to 7.7. Water that has a pH less than 5 raises concern for those areas that contain toxic heavy metals (Grant, 2013). The safety standard for arsenic-contaminated water by WHO is 10µg/L, although the Government of Bangladesh has a regulation of 50µg/L. Flanagan et al. (2012) found that 45%-62% of arsenic-related deaths are from drinking water within the 10µg/L and 50µg/L concentration guidelines.

### 5.3.9 Air Quality and Dust

127 As there are no major industries in subproject area as well as Ukhiya Upazila, the main sources of air pollution are vehicles movement and non-point sources such as open burning and black smoke emission from vehicles. During dry season the windblown dust also degrades the air quality. However, the air quality in the camp has slightly deteriorated along the roadside areas because of increased traffic. Brick kilns in Ukhiya and Teknaf may also be contributing to the problem. In accordance to the inhabitants, they suffer from the dust generated from the loose soil when strong winds blow; serious dust pollution during stormy winds is an issue. From a health point of view, this should not be a great concern as the size of the dust particles does not allow them to penetrate into the respiratory tract.

### 5.3.10 Noise Level

128 Noise level data is not available for the region. The major causes for noise in the subproject area are the vehicle movement (motorcycles, pick-up, mini-trucks, CNG rickshaw and auto-rickshaws), playing of loud-speaker and mass people gathering (for advertising of products and political, social and religious aspects) and local market. This is a common experience of the peri-urban population that noise poses a threat to the ill / physically weak people health and nerves.

### 5.3.11 Health and Sanitation

No reliable data available on health and sanitation.

### 5.3.12 Solid Waste Management

129 With the increase population and rapid urbanization, it is natural that generation of solid waste will also increase. If these wastes are not properly managed, it can have detrimental effects on the environmental quality. So, collection and management of solid waste is a great challenge for the Ukhiya Upazila. No specific information on the Upazila is available. However, some information on Cox's Bazar solid waste management is available in the form of literatures, especially focusing on Kutupalong Rohingya Refugee camp. Cox's Bazar district has limited infrastructure for solid waste management. This is particularly the case within the rural communities near to the Kutupalong Camp. There are currently no landfill sites available for the camp or host communities and Bangladesh has banned the use of waste

<sup>14</sup> Sikder, A. (2010). Access to water and sanitation in refugee settings: Success and setbacks in Bangladesh. *In Proc. of International Conference on Environmental Aspects of Bangladesh (ICEAB10)*, (pp. pp. 149-151). Japan.

<sup>15</sup> Grant, K. (2013). *Effect on nitrogen on lead release in an iron and manganese rich aquifer in Kutupalong refugee camp, Bangladesh. (Master's Thesis)*. Bangladesh.

incinerators. There are a number of solid waste management projects either proposed or planned by the government of Bangladesh and other agencies including landfill construction and waste collection.

## 5.4 BIOTIC ENVIRONMENT

### 5.4.1 Flora

130 This subproject area is full of natural vegetation. However due to camp establishment and increasing need of firewood by the camp residents, the once thickly vegetated area has been devoid of vegetation. Now a days, some organizations have launched planation programme in the camp areas. The plant species found in Camp area during field visit are are: The plant species found in the subproject are listed in the **Annex 3 List of wildlife recorded in the subproject area** which are: Akashmoni (*Acacia auriculiformis*), raintree (*Albizia saman*), mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), boroi (*Ziziphus mauritiana*), mahogany (*Swietenia mahogany*), guava (*Psidium guajava*), banana (*Musa sp.*), segun (*Tectona grandis*) Bokul (*Mimusops elengi*) and Bamboo (Disambiguation). Sessile joy weed (*Alternanthera sessilis*), thorny amaranth (*Amaranthus spinosus*), bermuda grass (*Cynodon dactylon*), smartweed (*Polygonum sp*), creeping oxalis (*Oxalis corniculata*), etc., are the common weed species. Among crop-field vegetation, aman is grown during summer rains and boro (winter rice) cultivated by irrigation in winter.

131 Near to the settlements, the most common trees are the raintree (*Albizia saman*), mango (*Mangifera indica*), coconut (*Cocos nucifera*), mahogany (*Swietenia mahogany*), gogon siris (*Albizia richardiana*), betel palm (*Areca catechu*) and guava (*Psidium guajava*) plus banana (*Musa sp.*). Sessile joy weed (*Alternanthera sessilis*), thorny amaranth (*Amaranthus spinosus*), bermuda grass (*Cynodon dactylon*), smartweed (*Polygonum sp*), creeping oxalis (*Oxalis corniculata*), etc., are the common weed species. See **Figure 18** for photos of vegetation in the sub-project area.



**Figure 18** Terrestrial flora around the proposed site

### 5.4.2 Fauna

132 The Refugee camps have a significant impact on wildlife by shrinking habitats and disruptions in breeding grounds are affecting nocturnal, crepuscular and diurnal wildlife. More than 67% of the mammal



wildlife are terrestrial, and of this number, around 63.8% rely on forests as a habitat. Arboreal species are also under severe threat due to the ever-decreasing natural forest area.

133 Apart from the degradation, this forest area still houses rich biodiversity including megafauna like the Asian elephant (*Elephas maximus*) and many different bird species. It has been confirmed that more than 50% of the country's wildlife species are living in the forests of Ukhiya, Teknaf, Inani and Himchari within the Cox's Bazar South Forest Division.

134 Common bird species noted in the subproject area were Asian crow, myna, cuckoo, kingfisher, pigeon and dove satare, drongo, weaver bird choro, babui, and dahuk. The mammals include fox, monkey, mongoose, Bengal monitor, various rodents etc. There are also several species of frog, lizard and snake. See Figure 19 for couple of faunal species commonly found in the subproject area.



**Figure 19 Terrestrial fauna around the proposed site**

### **5.4.3 Fisheries**

135 Local villagers reported catching fish in all the water bodies in the Project area. Major fishes in the rivers and canals in the Project area are carps (rui, catla, mrigal, ghania, kalbausa, and kalia), catfish (boal, pangas, silon, ayeir, and bacha) and snake head (shol, gazar, and taki), freshwater shrimp and several other tropical whitefish species. These species are well adapted to the silt-load extreme water temperature oxygen conditions in the subproject waterbodies.

### **5.4.4 Asian Elephants**

136 The Asian elephant is an endangered species in the South and SE Asian countries they occur in. It is listed as endangered in IUCN's Red List and well as in Bangladesh's red list. There are likely less than 300 animals remaining in the country with about 200 resident (i.e., not crossing international borders) and 100-150 having a transboundary range with India and Myanmar, and about 40,000 animals in the world, with the greatest populations found in Myanmar and India. The presence of elephant in an area is an indicator of a healthy ecosystem, and also one of the key drivers in maintaining a diversity of habitat and inhabitants.

137 There is evidence of presence of elephants in the subproject area. A few incidents of human-elephant conflict have been reported in 2018. The IUCN has conducted a study on such conflict and suggested a few mitigation measures to reduce such conflicts. **Figure 20** presents a map of recent human-elephant conflicts prepared by the IUCN.

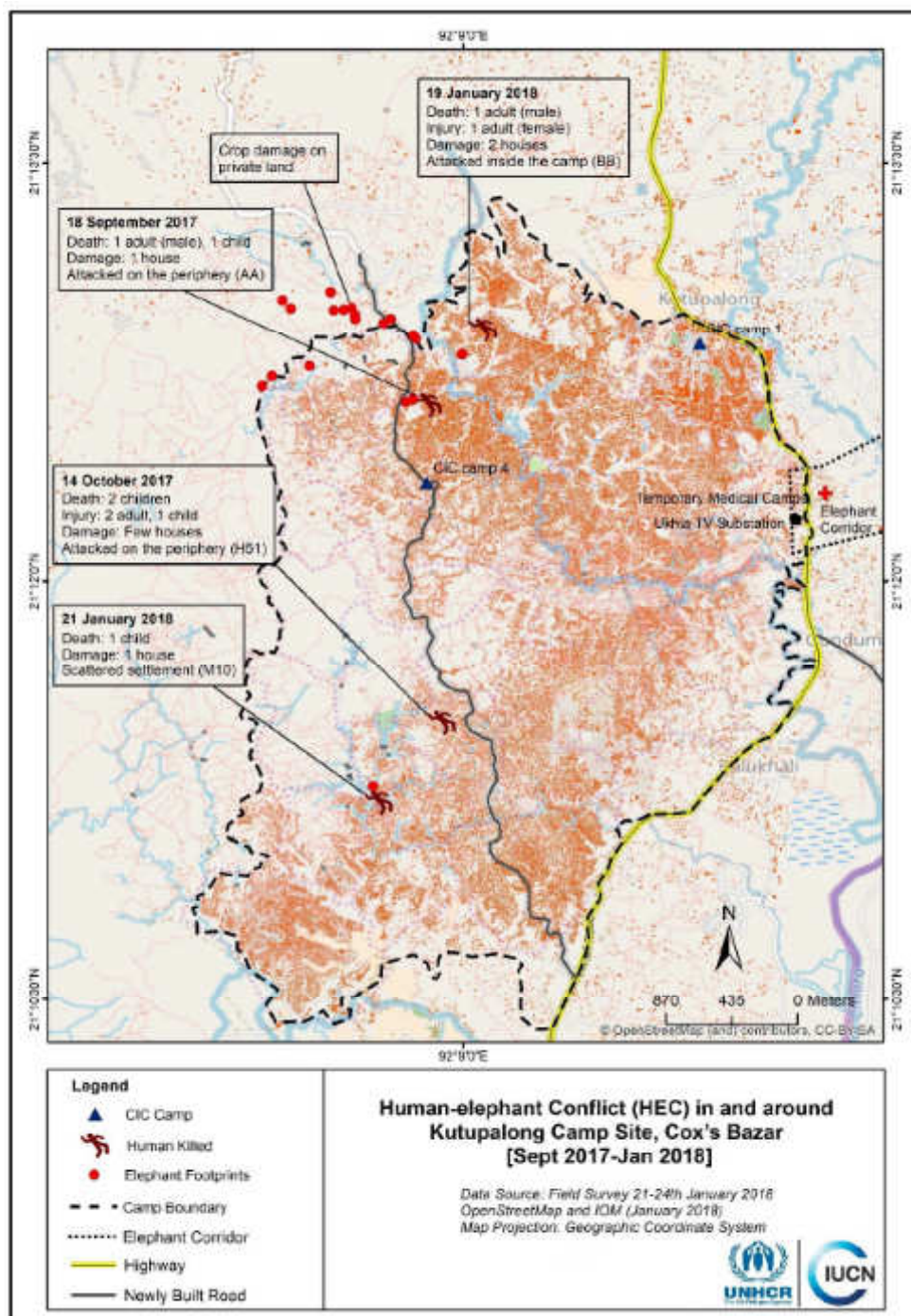


Figure 20 Human-Elephant conflict map around the sub-project area

## 5.5 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

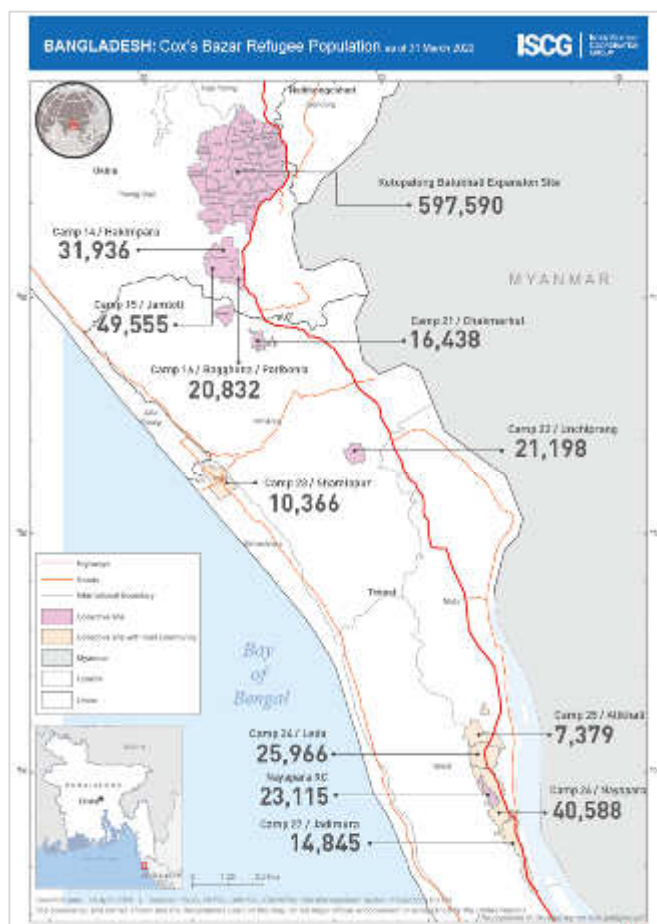
### 5.5.1 Population

138 As of 31 March 2020, the Inter-Sector Coordination Group (ISCG) reported that there are 720,915 Rohingya refugees living in Cox's Bazar. According to ISCG's rapid needs assessment, 58 per cent of new arrivals are children and 60 per cent are women including a high number of pregnant (3 per cent) and lactating women (7 per cent). With the new influx, the current total number of Rohingya who have fled from Myanmar into Bangladesh, coupled with the affected population in the communities, has reached a staggering 1.2 million.

### 5.5.2 Income and expenditure:

**A guidance recommended by the RRRC is the approach for humanitarian stakeholders working in Rohingya refugee camps and settlements (**

139 Table 7). This guidance provides a uniform, harmonized approach to definitions of refugee volunteer engagement. There are two main ways in which refugees are engaged in labor the current context: Cash for Work programming, and engaging refugee volunteer labor to achieve set operational objectives (including unskilled, semi-skilled and skilled volunteers).



**Figure 21 Map of Rohingya population distribution in Cox's Bazar (Source: ISCG)**

**Table 7 Rohingya volunteer incentive rates recommended by RRRC**

Category	Criteria and Competencies	Current Rate
Cash-for-Work	Principles of Cash for Work Programming, including: <ul style="list-style-type: none"> <li>Beneficiary selection criteria (usually vulnerability)</li> <li>Days of work predetermined (16 days consecutively, or 32 days scattered over a quarter)</li> <li>Predetermined daily flat rate</li> </ul>	350 BDT/day (Revised April 2018, yet to be endorsed by the HCTT. This amount represents 75% of the Minimum Expenditure Basket)
Unskilled Volunteer	Unskilled labor engaged to meet operational needs: <ul style="list-style-type: none"> <li>Porters</li> <li>Physical/construction laborers</li> <li>Truck loading/unloading</li> <li>Gatekeepers</li> <li>General labor e.g. cleaners</li> </ul>	50 BDT per hour



### 5.5.3 Land Use Pattern, Status of Housing and Built-up Infrastructure

**Figure 1. Land use and land cover maps of the study area.**

**(A) Present Land Use Map of Ukha, Ukha District, Cox's Bazar.** This map shows the land use and land cover of the Ukha area. The map is color-coded to represent different land use categories: Forest (green), Barilla (yellow), Non-Forest (grey), Waterbody (blue), International Boundary (dashed line), and Union Boundary (solid line). A bar chart at the bottom shows the percentage of land use for various categories: Forest (35.5%), Barilla (15.5%), Non-Forest (10.5%), Waterbody (5.5%), International Boundary (2.5%), and Union Boundary (1.5%).

**(B) Present Land Use Map of the study area.** This map shows the land use and land cover of the study area. The map is color-coded to represent different land use categories: Forest (green), Barilla (yellow), Non-Forest (grey), Waterbody (blue), International Boundary (dashed line), and Union Boundary (solid line). The map also shows the location of the study area relative to the Bay of Bengal and Myanmar.

**Figure 22 Land use map of Ukhiya (left), forest cover and waterbodies in the Cox's Bazar region (right)**

<sup>16</sup> Source: <https://www.thebangladesh.net/chittagong-division/coxs-bazar-district/ukhia-upazila-coxs-bazar.html> (Left image); <https://www.mdpi.com/2072-4292/10/5/689/htm#cite> (Right image)

### 5.5.4 Education

141 In the subproject area, literacy rate is higher (61.3%) than the total average (51.8%) of country. The literacy rate for male (62.6%) is higher than female (59.8%). (Population and Housing Census, 2011). However, there is no reliable data on literacy rate in Rohigya population in the camps.

### 5.5.5 Tribal Communities

142 There are no indigenous or tribal people settlement in the subproject area.

### 5.5.6 Cultural Heritage and Protected Areas

143 Within the influence area of the subproject no historical sites were identified. Religious center (such as Mosques, temples), educational institutions and local bazar bring cultural values to the community people. **Figure 23<sup>17</sup>** shows the protected areas of Bangladesh.

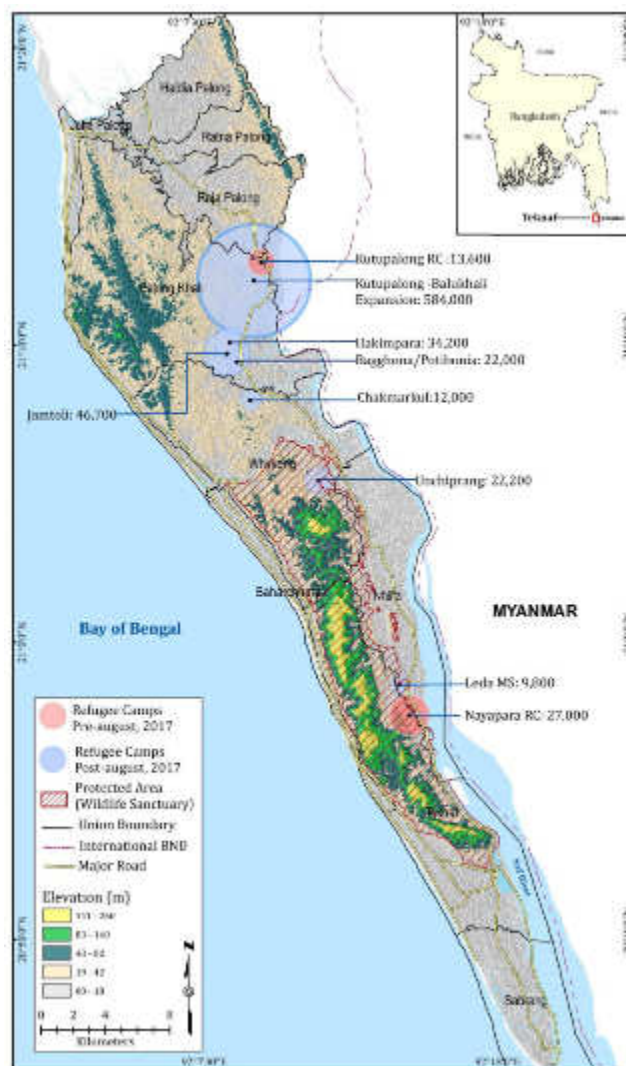


Figure 23 Protected areas around the subproject

<sup>17</sup> See footnote 14



## 6 Potential Impacts

### 6.1 METHODOLOGY

144 This section identifies the potential impacts that the various elements of the proposed Project may have on aspects of the physical, biological and socio-economic environment. The identification of the potential impacts will be considered for the two distinctive Project stages (construction and operation) as detailed in **Section 3**. The activities undertaken during each of these Project stages form the basis for potential impact identification and analysis.

145 Assessment of potential impacts requires a multi-disciplinary approach in which a wide range of issues are taken into consideration to identify and determine which potential Project impacts may be significant and therefore require the application of reasonable and effective management and/or mitigation. Most projects result in positive and negative potential impacts on the environment, society and economy, all of which are identified and assessed in this section.

146 Certain impacts identified in this section have the potential to be significant. The determination of whether a given potential impact is significant depends on several factors:

- The potential for on-site and off-site impacts;
- The potential for direct and indirect impacts;
- The frequency and duration of a potential impact;
- The geographic area affected by a potential impact
- The period of time affected by any potential impact;
- The sensitivity of the receiving environment; and
- The degree of confidence with which the potential impacts of the action/activity are known and understood.

147 Measures of potential impact significance as part of the Project planning and assessment phase presented in this IEE have been determined using a risk-based model. The risk-based model is a two-dimensional matrix of 'magnitude of impact' and 'likelihood'. Both are assigned score between 1 and 5 based on severity or probability and multiplied to obtain the 'risk band'.

148 The 'magnitude of impact' is a 5-point based scale set by expert's judgement. The scale and its explanation are given in **Table 8**.

**Table 8 Explanation and assignment of scores to 'magnitude of impact'**

Colour Band	Incidental	Minor	Moderate	Major	Severe/catastrophic
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Impacts such as localized or short-term effects on habitat, species or environmental media.	Localized, long term degradation of sensitive habitat or widespread, short-term impacts to habitat, species or environmental media	Impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species or environmental media	Widespread and persistent changes in habitat, species or environmental media	Persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.

The 'likelihood' is also a 5-point based scale set by expert's judgement. The scale and its explanation is given in **Table 9**.

**Table 9 Explanation and assignment of scores to 'likelihood'**

Colour Band	Rare	Unlikely	Seldom	Occasional	Likely
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Rare or unheard of	Reasonable to expect that the consequence will not occur during this project though has occurred several times in industry	Exceptional conditions may allow consequences to occur within the project lifetime	Conditions may allow the consequence to occur during the project lifetime, or the event has occurred within similar projects	Consequence can reasonably be expected to occur in life the project

149 Therefore, "Risk" factor is derived from the following equation:

$$\text{Risk} = \text{Magnitude} \times \text{likelihood} \quad (1)$$

150 The score of 'Risk' ranges from 1 to 25. The score is classified in 3 classes. The explanation is given in **Table 10**. The score matrix for risk assessment has been used to identify the priority environmental impact and their mitigation plan.

**Table 10 Two-dimensional risk assessment matrix**

			MAGNITUDE OF IMPACT				
			Incidental	Minor	Moderate	Major	Severe/cats.
			Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
LIKELIHOOD	Rare	Score: 1	1	2	3	4	5
	Unlikely	Score: 2	2	4	6	8	10
	Seldom	Score: 3	3	6	9	12	15
	Occasional	Score: 4	4	8	12	16	20
	likely	Score: 5	5	10	15	20	25

## 6.2 POTENTIAL IMPACT MATRIX

151 Following the method given in Methodology (Section 6.1) an impact matrix was developed for the subproject as shown in Table 11 below. This matrix serves the basis of the impact assessment and Environmental management plan (EMP).

**Table 11 Evaluation of Identified Environmental Impacts (Impact Matrix)**

Phase	Impact	Magnitude	Likelihood	Risk score	Mitigation possible?
<b>Beneficial Impacts</b>					
Construction	Employment Generation and Increase in income				
	Enhancement of Community Development Service				
	Skill Enhancement				
Operation	Waterlogging conditions reduced or non-existent				
	Reduction of risk of vector borne diseases				
	Clean water and easy access to the canals by stairs				
	Strengthen of bank areas reducing erosion				
	Safer establishments on the banks of the canal				
<b>Adverse Environmental Impacts</b>					
Construction	Change in Land Use	1	1	1	Yes
	Traffic congestion	2	2	4	Yes
	Slope instability	1	1	1	Yes
	Air, dust and noise pollution	1	4	4	Yes
	Hydrology and surface water congestion	3	4	12	Yes
	Water pollution	3	3	9	Yes
	Quarrying and bed material Extraction	3	4	12	Yes
	Spoil disposal	3	4	12	Yes
	Loss of vegetation	2	2	6	Yes
	Disturbance of wildlife	1	1	1	N/A
	Loss of agricultural land	1	1	1	N/A
	Health and safety of workers	4	4	16	Yes
	Health and safety of the communities	4	4	16	Yes
	Decline in Aesthetic Value	2	2	4	Yes
Operation	Slope instability and management	2	2	4	Yes
	Air and noise pollution	1	1	1	Yes
	Safety issues	1	1	1	Yes
	Disturbance to wildlife	1	1	1	N/A
	Depletion of forest resources	1	1	1	N/A
	People gathering and chaos	1	1	1	Yes

## 6.3 DISCUSSION ON POTENTIAL IMPACTS

### 6.3.1 Sector where no significant impact envisaged

152 Some aspects of the environment that are not expected to be significantly affected by the construction process have been screened out and will not be mentioned further in assessing the impacts of the construction process (Table 12).

**Table 12 Sectors where no significant impacts envisaged**

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Industries	There are no major industries in any areas to be affected by the project

### 6.3.2 Impacts during Planning Phase

153 **Consideration of Hill Ecology and camp population:** The proposed alignment runs through highly dense camp area will erosion prone hills and waterlogged areas. If not properly planned, the Excavation may lead to havoc in the area creating more waterlogging and erosion during the rains.

154 **Consideration of Naf river ecosystem:** The wastewater and stormwater drainage will ultimately run towards Naf river. If untreated water is discharged from camp, Naf river ecosystem will be under severe threat of not only organic and silt laden waste, but also possible pathogenic waste. The threat level can be severe negative and long-term if not treated within the camp.

155 **Environment Friendly Procurement Process:** Engagement of environmentally irresponsible contractor for civil works may lead to incompliance of ADB and GoB environmental rules and regulations

156 **Permission and legal procedures:** The entire camp area is under the jurisdiction of the RRRC. The government of Bangladesh has also adopted a few regulations on construction for Rohingya refugee purposes. Therefore, failure to obtain permissions and NOC might lead the project to fail.

### 6.3.3 Impacts during Construction Phase

157 **Gas emission and air quality:** Exhaust from vehicles, construction machineries, generator set may pollute local environment. Given the valley condition, local level exhaust may pollute air quality for even a week. Burning of solid waste at camp and at site also create localized pollution. Given the valley and low-level cool air, it could create smog in the area. Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. However, the impacts should be negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.

158 **Impairment of aquatic life:** Base layering and excavation may lead to destruction of any aquatic life that may be of existence in the local streams.

159 **Dust and fine particle pollution:** Dust and fine particles from earth works (clearing, grubbing, levelling, excavation etc.). Transportation of fine aggregates, cements, gravels etc, loading and unloading of fine particles and cement, movement of transport vehicles which emit carbon particles, CO and CO<sub>2</sub>, Stockpile of dry soil, sand, Dry exposed soil, eroded and exposed soils from nearby hills; Construction of structures, hammering etc may generate a fair amount of dust particles. Effects are expected to be negative, short term and reversible by mitigation measures

160 **Slope Erosion and channel sedimentation:** Clearing topsoil in proposed widening/base course areas can lead to loss of nutrient and erosion particularly along the hill cut slopes and dust from unprotected storage sites. The erosion risk at hill cut slopes is possible. Gully erosion along the exposed track slope during rainy season may cause localized sedimentation congestions.

161 **Contamination of surface water resources:** Excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall, which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short term, site-specific within a relatively small area and reversible by mitigation measures. Mismanagement of sediments/silts may lead to surface water pollution in the entire drainage network. Hammering during sit preparation on the hillside roads can lead to localized landslide or accelerate erosion. At hillside Sections there is a potential of erosion due to rainfall-runoff. Earthwork activities during construction at this point may

result in drainage congestion. The effects may be short term severe, but manageable by close monitoring and mitigation measures.

162      **Water quality at and around work camp:** Work camp is likely to be set up outside the Balukhali Mega camp. The surface water at workers camp and Project site areas may become pollute due to faecal, organic and other contamination. Disposed wastes and effluents from the construction sites may cause further degradation of surface water. The effects are short term, minor and reversible by mitigation measure.

163      **Local Flooding:** Local flooding may occur due to clogged/blocked drains and impeded routes for surface water runoff. Localized ponding due to excavation. The effects may be short term severe, but manageable by close monitoring and mitigation measures

164      **Community Health and Safety Hazards:** Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.

165      **Ground Water quality:** The area starves in groundwater level. Work camps are likely to sink tube well in the area and contribute to decrease of local groundwater level and increase drawdown. The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer). There are small hilly streams on the RoW potentially be contaminated seepage wastes from workers camp and stockpile materials. The effects are short term, minor and reversible by mitigation measure

166      **Worker's health and safety:** There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in populous areas. Workers need to be mindful of the occupational hazards, which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.

167      **Waste management and spillage:** Construction waste from construction work, Domestic waste from workers; Hazardous waste. The effects are short term, minor and reversible by mitigation measure.

## 7 Environmental Management Plan (EMP)

### 7.1 PURPOSE OF THIS EMP

168 The objective of this Environmental Management Plan (EMP) is to formulate measures, which will:

- Mitigate adverse impacts on various environmental components, which have been identified during observation;
- Protect environmental resources where possible;
- Enhance the value of environmental and social components where possible.

169 The EMP also includes a monitoring plan to enable evaluation of the success or failure of environmental management measures, and to carry out reorientation of the plan if found necessary. It is emphasized that many of the protective and enhancement measures can be implemented by adopting suitable planning and design criteria for construction of the project. This EMP is also made site specific with guidelines for the contractors to be able to operate according to the Bangladesh Government and ADB requirements to comply with their relevant policies.

### 7.2 SUMMARY OF PRIMARY OBSERVATION ON ENVIRONMENT

170 A summary environmental observation of the proposed road package, the basis of this EMP, is presented in **Table 13**.

**Table 13 Summary observation of Environment**

SL. No	Sector	Summary Description
1	Topography and landform	Soil: Brown Hill soil, magnesium rich; topography: hilly, erosion prone
2	Hydrology and drainage	Above flood level, however drainage congestion is prominent
3	Water quality	Not known
4	Flora and fauna	The project area is under densely populated camps (mostly semi-permanent establishments). Grass and shrubs are commonly found. No medicinal plant or plant of significant conservation value was found.
5	Air quality	No data available.
6	Land use	Elevated, vegetated, road mouths are busy premised with commercial structures

### 7.3 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

171 The EMP is necessary on the grounds that it will manage the environment by offsetting the negative impacts with possible mitigation measures and enhancing the positive impacts within the allocated fund from the project. Thus, the main objectives of the EMP for the construction of the access road project are:

- Define the responsibilities of the project proponents in accordance with the three project phases (design, construction and operation);
- Facilitate the implementation of the mitigation measures by providing the technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;

- Identify training requirements at various levels and provide a plan for the implementation of training sessions;
- Identify the resources required to implement the EMP and outline corresponding financing arrangements; and Providing a cost estimate for all proposed EMP actions

172 The Environmental Management Plan (EMP) presented in **Table 15**. Only the prioritized risks are presented in the EMP for specific measures. The key risks considered in the EMP are given in Table 14.

**Table 14 Key risks considered in the EMP**

Environmental Component	Key Risks/Indicators
Air quality	Dust degeneration from excavation and landfilling pollution from transport
Acoustic Environment	Noise from road transport
Ground water	Ground water depletion due to water extraction Ground water contamination by filtrate from latrines and waste dumps
Surface water	Changes in water hydrology Changes in water quality
Soils and Terrain	Soil removal and erosion Land Changes in terrain that may cause land slides
Vegetation	Landscape and vegetation community diversity (land cover classes) Location of rare and threatened plants
Wildlife	None found inside camp until now
Aquatic biology	Degradation of Naf river ecosystem via wastewater discharge Degradation of freshwater ecosystems
Human health	Risk to human health from activities and living conditions in camps

### 7.3.1 List of major mitigation measures

173 **Gas emission and air quality:** Reduce vehicle movement through coordinated material transport schedule. Limit engine idling to maximum 5 min. No burning of wastes. No indiscriminate dumping of waste, especially organic wastes, left to decompose. Visually inspect air quality (mainly dust and smoke) and use dust suppression measure. High amount of smoke should trigger the vehicle management plan which includes testing of vehicles for smoke emission rate and restrict number of vehicles that emits high smoke, ban unfit vehicles etc. Use tarpaulins to cover soils, sand and other loose material when transported by trucks. Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. Monitor air quality and vibration during construction works. Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. Plan activities in consultation with Local Authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. Use of high noise generating equipment (e.g. excavator, trucks) shall be stopped during nighttime. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions and ensure that these are

maintained to manufacturers' specifications at all times. All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required).

**174 Consideration of hilly topography:** Check if ISCG if they have any erosion/stability map at the moment for the proposed alignment of drainage network. If not available, LGED needs to check erosion potential along the proposed drainage alignment and make a erosion potential map. Ensure grass and steel net/geocell protection before commencement of cutting and filling operation, especially in the areas where erosion potential is high (drawn from the map as suggested earlier). This needs to be considered and planned during the design phase. Ensure the filling materials match with the area's soil characters so that the regional topography gets stability. Give careful attention to this before construction and denote from where the fill materials will be collected before the construction goes onboard. The drainage sites need extensive erosion preventive plantation at every erosion prone hillside. A plantation plan and guideline is provided in the Annex.

**175 Permissions and legal requirements:** The construction must be agreed with the respective CICs for each camp and has to follow the latest Government orders. Necessary permission from the RRRC through the CICs has to be kept for legal safety. Also frequently communicate with the CICs for any legal change or government orders. Prepare a Subproject Aggregates Management Plan (AMP), confirming location of sources, estimating supply of, & demand for, aggregates during construction. This will form basis for Contractor's AMP.

**176 Considerations of Naf river ecosystem:** UNHCR has considered soft ecological approach to treat wastewater in Madhurchara using created wetland full of local aquatic species known as kutipana (duckweed). This "environmental sensitive camp management plan" can be adopted to the current proposal of LGED, since ecological approach is more preferable to chemical treatment in sensitive ecological areas like the camp. A coordination meeting can be arranged with environmental experts from both sides (UNHCR and LGED) with the presence of ADB experts to see the feasibility of the approach and how it can be adopted to LGED's proposal. A copy of the plan is annexed with this document. Constructed wetland with treatment facilities using duckweed can be constructed by LGED to treat waste water from camp and later discharge to Naf river.

**177 Dust and fine particles:** Confine clearing, grubbing & excavation according to the Staking Plan and Excavation Management Plan. Limit segment length to what can only be excavated and lined. To avoid aggravating the hill erosion, it will be wise to choose segment length case by case for each small hill area. Keep masonry and base course work as close as possible to the excavation works so that dust release is limited. Given the camp's population density, it is suggested that all excavated segments should be backfilled, paved or bedded before the day's work ends. Watering of dry/unpaved/exposed surfaces, stockpiles of sand and excavated materials, at least twice daily.

**178 Slope erosion and channel sedimentation:** Strictly follow the soil and water conservation plan devised during planning and design stage. Topsoil storage areas must be protected during the dry season, wind erosion—by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats should be applied in areas where erosion is noted during the regular monthly inspections. Erosion preventive local tree species like figs should be planted on both sides of the drain site hill slope. Especial attention should be paid of plantation technique and species so that they prove to be helpful in preventing soil erosion. As mentioned earlier, a guide for plantation to prevent erosion is attached with this document as Annex.

**179 Contamination of surface water resource:** Implement eco-friendly waste management system: practice waste minimization, reuse and segregation; provide adequate waste bins, enforce onsite rule of



throwing waste into bins; provide separate storage area for solid waste and hazardous waste to contain spill area; and implement measures to mitigate sedimentation/siltation. In all sites follow a Removed Soil Management Plan linked to the Excavation Segmentation/Management Plan, specifying, e.g., separate areas for stockpiling "reusable soils" & "unsuitable & excess soils" appropriate stockpiling areas, on flat grounds & away from or not obstructing main surface drainage routes disposal of unsuitable & excess soils as soon as possible hauling trucks to be required appropriate cover & min 2 ft freeboard employ any combination of the following measures to prevent stockpiled soils & fine aggregates from being eroded or carried away by wind and rain: silt fences, sediment traps, sandbags, barrier nets, earth bunds, speed stilling humps along surface drainage routes, limiting stockpile to a maximum height of 2 m, &/or diversion drains to reroute surface runoff away from stockpiles, whichever would be appropriate for the site & site conditions. Monitor immediate low areas or valleys for drainage congestion. If drainage congestion seems eminent, excavate or clear excess sediment/wash materials to clear congestion. Install silt protection curtain/steel nets alongside hill side roads. All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. All earthworks must to be conducted during dry season/dry spell to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low-lying areas. Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss.

180 **Local flooding:** Before excavation and construction starts, a proper surface topography along the proposed drainage network needs to be updated and always kept in hand. Prior excavation, cover inlets with potentiality of being flooded. Next to inlet use sediment fence, trap and/or sandbags. Stockpile soils and other construction materials away from the drainage route

181 **Wastewater spillage:** A waste management and spillage control plan should be developed before construction. Conduct separate waste collection, promote recycling and reuse. Appropriate disposal of non-recyclable waste according to rules. Hazardous waste should be treated under the related regulation

182 **Worker's health and safety:** There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in populous areas. Workers need to be mindful of the occupational hazards, which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The generic measures suggested are as followed: Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&S). Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records.

183 **Community health and safety:** Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. Provide medical insurance coverage for workers; Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; Provide visitor orientation if visitors to the site can gain access to areas where hazardous

conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

184      The full-fledged EMP with mitigation plan is given in **Table 15** and **Table 16**.

**Table 15 Environmental Management Plan (EMP) for the Subproject**

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
<b>1.0 DESIGN PHASE</b>					
1.1	<b>Consideration of Hill Ecology and camp population</b> <ul style="list-style-type: none"> <li>The proposed alignment runs through highly dense camp area will erosion prone hills and waterlogged areas. If not properly planned, the Excavation may lead to havoc in the area creating more waterlogging and erosion during the rains.</li> </ul>	<ul style="list-style-type: none"> <li>At design phase, development of an excavation plan is a necessity. Not all contractors may have the experience of excavating hill tract streams. Therefore, careful consideration of contractor's experience needs to be incorporated in the bidding documents and contract awards.</li> </ul>			LGED
1.2	<b>Consideration of Naf river ecosystem</b> <ul style="list-style-type: none"> <li>The wastewater and stormwater drainage will ultimately run towards Naf river. If untreated water is discharged from camp, Naf river ecosystem will be under severe threat of not only organic and silt laden waste, but also possible pathogenic waste.</li> <li>The threat level can be severe negative and long-term if not treated within the camp</li> </ul>	<ul style="list-style-type: none"> <li>UNHCR has considered soft ecological approach to treat wastewater in Madhurchara using created wetland full of local aquatic species known as kutipana (duckweed). This "environmental sensitive camp management plan" can be adopted to the current proposal of LGED, since ecological approach is more preferable to chemical treatment in sensitive ecological areas like the camp.</li> <li>A coordination meeting can be arranged with environmental experts from both sides (UNHCR and LGED) with the presence of ADB experts to see the feasibility of the approach and how it can be adopted to LGED's proposal. A copy of the plan is annexed with this document.</li> <li>Constructed wetland with treatment facilities using duckweed can be constructed by LGED to treat waste water from camp and later discharge to Naf river.</li> </ul>	Entire stormwater drainage network proposed	Entire project life	ADB, LGED, contractor, RRRC
1.3	<b>Environment Friendly Procurement Process</b> <ul style="list-style-type: none"> <li>Engagement of environmentally irresponsible contractor for civil works may lead to non-compliance of ADB and GoB environmental rules and regulations</li> </ul>	<ul style="list-style-type: none"> <li>The proposed subproject is quite sensitive since it will run through the hills, discharge the wastewater of the camp to Naf river. Excavation in hills and green bank protection measures as stipulated in the LGED's plan needs high level expertise to execute. Required bidders need to be well qualified with environmental expertise. The bidders need to draft their CEMP in advance with site monitoring and restoration plan along with hazard management plan in advance which needs to be scrutinized by the LGED and ADB expert team.</li> <li>AOB to clear CEMP of winning bid before award of Contract.</li> <li>Contract to require Contractor's submission of monthly environmental monitoring report, outline appended in Contract.</li> </ul>	Not Applicable	Before project Implementation	ADB, LGED, Contractor

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
1.4	<b>Permission and legal procedures</b> <ul style="list-style-type: none"> <li>The entire camp area is under the jurisdiction of the RRRC. The government of Bangladesh has also adopted a few regulations on construction for Rohingya refugee purposes. Therefore, failure to obtain permissions and NOC might lead the project to fail.</li> </ul>	<ul style="list-style-type: none"> <li>The construction must be agreed with the respective CICs for each camp and has to follow the latest Government orders. Necessary permission from the RRRC through the CICs has to be kept for legal safety. Also frequently communicate with the CICs for any legal change or government orders.</li> </ul>	Not Applicable	Before project Implementation	LGED, Contractor
1.5	<b>Consideration of hilly topography</b> <ul style="list-style-type: none"> <li>The camp is established on hilly area through hill cutting. The cutting has opened bare face of the sedimentary rock and lack of enough grass cover protection and vegetation the hills are prone to erosion and instability.</li> <li>Drainage channels are planned to run through hills, where both sides are faced to the hill. Cutting and filling operation may lead to land slide and trigger local erosion.</li> </ul>	<ul style="list-style-type: none"> <li>Check if ISCG if they have any erosion/stability map at the moment for the proposed alignment of drainage network. If not available, LGED needs to check erosion potential along the proposed drainage alignment and make a erosion potential map.</li> <li>Ensure grass and steel net/geocell protection before commencement of cutting and filling operation, especially in the areas where erosion potential is high (drawn from the map as suggested earlier). This needs to be considered and planned during the design phase.</li> <li>Ensure the filling materials match with the area's soil characters so that the regional topography gets stability. Give careful attention to this before construction and denote from where the fill materials will be collected before the construction goes onboard.</li> <li><b>The drainage sites need extensive erosion preventive plantation at every erosion prone hillside. A plantation plan and guideline is provided in the Annex.</b></li> </ul>	Not applicable	before construction goes on-board	LGED, contractor
1.6	<b>EMP Implementation Training:</b>	<ul style="list-style-type: none"> <li>Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; health and safety (H&amp;S), core labour laws, and applicable environmental laws.</li> </ul>	Project office	Before construction goes on-board	LEGD
<b>2.0 DURING CONSTRUCTION PHASE</b>					
2.1	<b>Dust and fine particle pollution</b> <ul style="list-style-type: none"> <li>Dust and fine particles from earth works (clearing, grubbing, levelling, excavation etc.)</li> <li>Transportation of fine aggregates, cements, gravels etc, loading and unloading of fine particles and cement, movement of transport vehicles which emit carbon particles, CO and CO<sub>2</sub>, Stockpile of dry soil, sand, Dry exposed soil, eroded and exposed soils from nearby</li> </ul>	<ul style="list-style-type: none"> <li>Confine clearing, grubbing &amp; excavation according to the Staking Plan and Excavation Management Plan. Limit segment length to what can only be excavated and lined. To avoid aggravating the hill erosion, it will be wise to choose segment length case by case for each small hill area.</li> <li>Keep masonry and base course work as close as possible to the excavation works so that dust release is limited</li> </ul>	Project location	During the project period	Contractor, supervised by LGED

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
	<p>hills; Construction of structures, hammering etc may generate a fair amount of dust particles</p> <ul style="list-style-type: none"> <li>Effects are expected to be negative, short term and reversible by mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>Given the camp's population density, it is suggested that all excavated segments should be backfilled, paved or bedded before the day's work ends.</li> <li>Watering of dry/unpaved/exposed surfaces, stockpiles of sand and excavated materials, at least twice daily.</li> </ul>			
2.2	<p><b>Impairment of aquatic life</b></p> <ul style="list-style-type: none"> <li>Base layering and excavation may lead to destruction of any aquatic life that may be of existence in the local streams</li> </ul>	<ul style="list-style-type: none"> <li>While the excavation and surface layering is unavoidable, drainage design needs to be done such a way that fisheries and other aquatic life can migrate easily from one channel from another channel.</li> <li>At least 1.5 m depth is proposed at the drainage network for smoother aquatic life movement</li> </ul>	Along the alignment	During the entire cycle of construction	LGED
2.3	<p><b>Slope Erosion and channel sedimentation</b></p> <ul style="list-style-type: none"> <li>Clearing topsoil in proposed widening/base course areas can lead to loss of nutrient and erosion particularly along the hill cut slopes and dust from unprotected storage sites.</li> <li>The erosion risk at hill cut slopes is possible. Gully erosion along the exposed track slope during rainy season may cause localized sedimentation congestions</li> </ul>	<ul style="list-style-type: none"> <li>Strictly follow the soil and water conservation plan devised during planning and design stage</li> <li>Topsoil storage areas must be protected during the dry season, wind erosion—by covering.</li> <li>Rapid revegetation and use of hydro-seeding and jute erosion protection mats should be applied in areas where erosion is noted during the regular monthly inspections</li> <li>Erosion preventive local tree species like figs should be planted on both sides of the drain site hill slope. Especial attention should be paid of plantation technique and species so that they prove to be helpful in preventing soil erosion. As mentioned earlier, a guide for plantation to prevent erosion is attached with this document as Annex.</li> </ul>	Alongside the drainage alignment	During the entire cycle of construction	Contractor, supervised by LGED
2.4	<p><b>Contamination of surface water resources:</b></p> <ul style="list-style-type: none"> <li>Excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall, which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short term, site-specific within a relatively small area and reversible by mitigation measures.</li> <li>Mismanagement of sediments/silts may lead to surface water pollution in the entire drainage network</li> </ul>	<ul style="list-style-type: none"> <li>Implement eco-friendly waste management system: <ul style="list-style-type: none"> <li>Practice waste minimization, reuse and segregation</li> <li>Provide adequate waste bins, enforce onsite rule of throwing waste into bins</li> <li>Provide separate storage area for solid waste and hazardous waste to contain spill area</li> </ul> </li> <li>Implement measures to mitigate sedimentation/siltation. In all sites follow a Removed Soil Management Plan linked to the Excavation Segmentation/Management Plan, specifying, e.g., separate areas for stockpiling "reusable soils" &amp; "unsuitable &amp; excess soils"</li> <li>appropriate stockpiling areas, on flat grounds &amp; away from or not obstructing main surface drainage routes</li> <li>disposal of unsuitable &amp; excess soils as soon as possible</li> </ul>	Alongside drain, Labour Camp	During entire construction period	Contractor, supervised by LGED

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
	<ul style="list-style-type: none"> <li>Hammering during sit preparation on the hillside roads can lead to localized landslide or accelerate erosion.</li> <li>At hillside Sections there is a potential of erosion due to rainfall-runoff. Earthwork activities during construction at this point may result in drainage congestion</li> <li><b>The effects may be short term severe, but manageable by close monitoring and mitigation measures</b></li> </ul>	<ul style="list-style-type: none"> <li>hauling trucks to be required appropriate cover &amp; min 2 ft freeboard</li> <li>employ any combination of the following measures to prevent stockpiled soils &amp; fine aggregates from being eroded or carried away by wind and rain: silt fences, sediment traps, sandbags, barrier nets, earth bunds, speed stilling humps along surface drainage routes, limiting stockpile to a maximum height of 2 m, &amp;/or diversion drains to reroute surface runoff away from stockpiles, whichever would be appropriate for the site &amp; site conditions.</li> <li><b>Monitor immediate low areas or valleys for drainage congestion. If drainage congestion seems eminent, excavate or clear excess sediment/wash materials to clear congestion.</b></li> <li><b>Install silt protection curtain/steel nets alongside hill side roads.</b></li> <li><b>All other effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out.</b></li> <li>All earthworks must to be conducted during dry season/dry spell to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff.</li> <li>Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low-lying areas.</li> <li>Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss;</li> </ul>			
2.5	<b>Water quality at and around work camp</b> <ul style="list-style-type: none"> <li>Work camp is likely to be set up outside the Balukhali Mega camp. The surface water at workers camp and Project site areas may become pollute due to faecal, organic and other contamination.</li> <li>Disposed wastes and effluents from the construction sites may cause further degradation of surface water.</li> <li><b>The effects are short term, minor and reversible by mitigation measure</b></li> </ul>	<ul style="list-style-type: none"> <li>The work camp should be established outside the mega camp, which is likely. However, natural vegetation and small streams are around the mega camp. Workforce camp will be located away from natural water resources.</li> <li>All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas.</li> <li>Wells used for drinking will be tested quarterly to ensure potability. The wells will be designated during labour camp establishment. If possible, potable water should be supplied for the labours living in the sheds.</li> </ul>	At work camp	During entire construction period	Contractor, supervised by LGED

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>Take all precautions to minimize the wastage of water in the construction activities. In this case there is no waterbody nearby. However, it needs to be noted that, no temporary or long-term waterlogging during the construction should be allowed.</li> </ul>			
2.6	<b>Local Flooding</b> <ul style="list-style-type: none"> <li>Local flooding may occur due to clogged/blocked drains and impeded routes for surface water runoff</li> <li>Localized ponding due to excavation</li> <li><b>The effects may be short term severe, but manageable by close monitoring and mitigation measures</b></li> </ul>	<ul style="list-style-type: none"> <li>Before excavation and construction starts, a proper surface topography along the proposed drainage network needs to be updated and always kept in hand</li> <li>Prior excavation, cover inlets with potentiality of being flooded. Next to inlet use sediment fence, trap and/or sandbags</li> <li>Stockpile soils and other construction materials away from the drainage route</li> </ul>	Along the drainage channel	During entire construction period	Contractor, supervised by LGED
2.7	<b>Ground Water quality</b> <ul style="list-style-type: none"> <li>The area starves in groundwater level. Work camps are likely to sink tubewell in the area and contribute to decrease of local groundwater level and increase drawdown</li> <li>The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).</li> <li>There are small hilly streams on the RoW potentially be contaminated seepage wastes from workers camp and stockpile materials</li> <li><b>The effects are short term, minor and reversible by mitigation measure</b></li> </ul>	<ul style="list-style-type: none"> <li>Few narrow hilly streams run out of the camp area. It is expected that, ground water level will be high, especially during the monsoon season. Works camp needs to be established away from the area and will not sink any tubewell nearby.</li> <li>Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas.</li> <li>Wells used for drinking will be tested once a year to ensure portability.</li> </ul>	At work camp	During entire construction period	Contractor, supervised by LGED
2.8	<b>Gas emission and air quality:</b> <ul style="list-style-type: none"> <li>Exhaust from vehicles, construction machineries, generator set may pollute local environment. Given the valley condition, local level exhaust may pollute air quality for even a week.</li> <li>Burning of solid waste at camp and at site also create localized pollution. Given the</li> </ul>	<ul style="list-style-type: none"> <li>Reduce vehicle movement through coordinated material transport schedule</li> <li>Limit engine idling to maximum 5 min</li> <li>No burning of wastes. No indiscriminate dumping of waste, especially organic wastes, left to decompose.</li> <li>Visually inspect air quality (mainly dust and smoke) and use dust suppression measure. High amount of smoke should trigger the</li> </ul>	Alongside hills and alignment	During entire construction period	Contractor, supervised by LGED

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
	<p>valley and low level cool air, it could create smog in the area</p> <ul style="list-style-type: none"> <li>Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulphur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites.</li> <li><b>However, the impacts should be negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</b></li> </ul>	<p>vehicle management plan which includes testing of vehicles for smoke emission rate and restrict number of vehicles that emits high smoke, ban unfit vehicles etc.</p> <ul style="list-style-type: none"> <li>Use tarpaulins to cover soils, sand and other loose material when transported by trucks.</li> <li>Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free.</li> <li>Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject).</li> </ul>			
2.9	<p><b>Noise Environment:</b></p> <ul style="list-style-type: none"> <li>Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</li> <li><b>The effects are short term, minor and reversible by mitigation measure</b></li> </ul>	<ul style="list-style-type: none"> <li>Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.</li> <li>If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection.</li> <li>Monitor air quality and vibration during construction works. Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times.</li> <li>Plan activities in consultation with Local Authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.</li> <li>Use of high noise generating equipment (e.g. excavator, trucks) shall be stopped during nighttime.</li> <li>Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</li> <li>Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions and ensure that these are maintained to manufacturers' specifications at all times.</li> </ul>	Alongside road	During entire construction period	Contractor, supervised by LGED



Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required).</li> </ul>			
2.10	<b>Waste management and spillage</b> <ul style="list-style-type: none"> <li>Construction waste from construction work, Domestic waste from workers; Hazardous waste</li> <li><b>The effects are short term, minor and reversible by mitigation measure</b></li> </ul>	<ul style="list-style-type: none"> <li>A waste management and spillage control plan should be developed before construction</li> <li>Conduct separate waste collection, promote recycling and reuse.</li> <li>Appropriate disposal of non-recyclable waste according to rules</li> <li>Hazardous waste should be treated under the related regulation</li> </ul>	Alongside road	During entire construction period	Contractor, supervised by LGED
2.11	<b>Community Health and Safety:</b> Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	the Generic Measures suggested are as follows: <ul style="list-style-type: none"> <li>Contractor's activities and movement of staff will be restricted to designated construction areas.</li> <li>Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction.</li> <li>Consult with the Local Authority on the designated areas for stockpiling of, soils, gravel, and other construction materials.</li> <li>If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the environment management specialist and landowner.</li> <li>Use small mechanical excavators to attain faster excavation progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.<sup>18</sup></li> <li>Under no circumstances may open areas or the surrounding bushes be used as a toilet facility.</li> <li>Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.</li> <li>A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules:</li> </ul>	Labour camp, Alongside road	During entire construction period	Contractor, supervised by LGED

<sup>18</sup>These products come in powder forms, and once mixed with water (being the catalyst) simply expand and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>(i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do.</li> <li>Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction.</li> <li>The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance.</li> <li>Create traffic regulation and diversion zones during construction work. The proposed site is on the main road, and it is expected that heavy vehicle movements can cause traffic nuisance. Therefore, traffic regulation and diversion will be important to avoid traffic nuisance.</li> </ul>			
2.12	<b>Road safety</b> <ul style="list-style-type: none"> <li>During construction works, large and heavy vehicles will move through the narrow roads of the camp which may lead to traffic congestion and pose threat on road safety</li> <li>During the construction period and operation period, lack of proper road signages,</li> </ul>	<ul style="list-style-type: none"> <li>Prepare a traffic movement plan prior construction</li> <li>Install Proper signages along the road</li> <li>Speed bump near the villages/ community</li> <li>Reflector at the risky turns, trees to avoid accident</li> </ul>	Alongside drainage network	After construction	Contractor, supervised by LGED

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
	especially in the hilly areas with twists and turns, may lead to road accidents				
2.13	<b>Worker's health and safety:</b> There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in populous areas. Workers need to be mindful of the occupational hazards, which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.	The generic measures suggested are as followed; <ul style="list-style-type: none"> <li>• Comply with requirements of Government of Bangladesh Labour Law of 2006 (amended in 2013) and all applicable laws and standards on workers' health and safety (H&amp;S).</li> <li>• Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear.</li> <li>• Produce and implement a site H&amp;S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&amp;S training <sup>19</sup> for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records.</li> <li>• Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances</li> <li>• Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times.</li> <li>• Provide medical insurance coverage for workers;</li> <li>• Provide H&amp;S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</li> <li>• Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</li> </ul>	Labour camp, Site office	During entire project period	Contractor, supervised by LGED

<sup>19</sup>Key areas that are to be covered during training shall be in compliance with the Health and Safety Manual according to site specific requirements and shall be conducted by LGED:

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</li> <li>Ensure moving equipment is outfitted with audible back-up alarms;</li> <li>Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and - Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</li> </ul>			
<b>3.0 Post-construction phase</b>					
3.1	<b>Post-construction clean-up:</b> Damage due to debris, spoils, excess construction materials.	<p>The following generic measures should be taken:</p> <ul style="list-style-type: none"> <li>Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required;</li> <li>All excavated roads shall be reinstated to original condition;</li> <li>All disrupted utilities restored;</li> <li>All affected structures rehabilitated/compensated;</li> <li>The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up;</li> <li>All hardened surfaces within the construction camp area shall be ripped;</li> <li>All imported materials removed, and the area shall be top soiled and regressed using guidelines set out in the re-vegetation specification that forms part of this document;</li> <li>The contractor must arrange the cancellation of all temporary services;</li> <li>Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.</li> </ul>	Alongside the drainage network	Before site demobilization	Contractor, supervised by LGED
<b>4.0 Others</b>					

Ref. No.	Impact/Issue	Measure	Location	Duration	Responsibility
4.1	<b>Submission of EMP implementation Report:</b> Unsatisfactory compliance to EMP	<ul style="list-style-type: none"> <li>Appointment of Supervisor to ensure EMP implementation;</li> <li>Timely submission of monitoring reports including pictures.</li> </ul>	LGED Office	During project period	Contractor, supervised by LGED

## **8 Environmental Monitoring Plan**

### **8.1 ENVIRONMENTAL MONITORING PLAN**

185 Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors. The following areas should be monitored to check if the proposed project is having any impact:

A. Forest Area and Tree Plantation

The proposed sites are covered with more or less thick vegetation. Hilly vegetation is sensitive to erosion and running polluted water. The adjacent forest areas need to be monitored to detect any changes due to the implementation of the project. Tree plantation is also suggested in the EMP and need to be monitored when planted so that the planted vegetation survives.

B. Soil Erosion and Drainage Congestion

This is another important issue that needs be monitored during project implementation. The entire area around the site is prone to erosion. Also, a hilly stream runs around the area. Therefore, monitoring soil erosion around the project site will be a major task to undertake. Any change in stability at the adjacent hill or hint of erosion needs to be noted and information must be sent to the Environmental Officer in charge for further action

186 The full-fledged Environmental Monitoring Plan with frequency and responsibilities is detailed in **Table 16**.

Table 16 Environmental Monitoring Plan for the subproject

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsibility	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
Pre-Construction Phase								
1.1	EMP Implementation Training	Better understanding of environmental safeguards and how they are to be implemented is needed. LGED needs to provide this briefing to the contractor	Implementation of EMP	Obtain record of presentation	At LGED Office	Prior to contractor mobilization	LGED	LGED
Construction Phase								
2.1	Trees and Landscape	No tree cutting is expected but tree plantation is proposed for green bank protection during monsoon and unexpected flooding	<ul style="list-style-type: none"><li>Erosion preventive plantation. Make sure the plantation guideline attached to this document is properly followed.</li><li>Confirm that this planting plan is being followed during the construction period also.</li></ul>	Tree replanting plan according to the attached guideline. Total 7740 trees to be planted	Along the alignment of the canal	During the pre-construction period	Contractor	LGED
2.2	Topography and Landscape Changes	Visual intrusion will be due to large piles of embankment materials obstructing views; Excavation along the edge of the alignment will leave large unsafe holes.	<ul style="list-style-type: none"><li>Restoration of changes due to construction activities</li><li>Visual amenity</li></ul>	Inspection/consultation with adjacent households and LGED authority to get opinion on work being completed	Along the alignment	Construction stage/ Weekly inspection	Contractor	Construction Supervision Engineer, LGED
2.3	Air Quality	<ul style="list-style-type: none"><li>Dust resulting from construction work</li><li>Exhaust gas from construction machinery and vehicles used for mobilization of equipment</li></ul>	<ul style="list-style-type: none"><li>Evaluation of effect of the mitigation measure towards air pollution</li></ul>	Visual inspection for dust accumulation	Along the alignment	<ul style="list-style-type: none"><li>Daily dust inspection</li></ul>	Contractor	Construction Supervision Engineer, LGED
2.4	Water quality	<ul style="list-style-type: none"><li>Run-off from stockpiled wastes and end-products of composting which may</li></ul>	<ul style="list-style-type: none"><li>Evaluation of effect of the mitigation measure towards water pollution</li></ul>	Visal inspection for water	2 sites Along the alignment, to be	<ul style="list-style-type: none"><li>Quarterly during construction.</li></ul>	Contractor	Construction Supervision



No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsibility	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
		cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures ▪ Runoffs from camps	▪ Quarterly test of TDS, FC, TC, BOD, Na and Cl	congestion and colour Quarterly Laboratory test results for aother measures	established under permission of Environmental Expert fro LGED and ADB	estimated 1.5 year = 6 times during project construction period		Engineer, LGED
2.5	Wastes and drainage congestion	▪ Construction waste from construction work ▪ Erosion and sedimentation along the drainage channels ▪ Domestic waste from workers ▪ Hazardous waste such as dry batteries, etc.	Evaluation of effect of the mitigation measure for waste, erosion and sedimentation	Record of kinds and quantity of waste, and the disposal method	Along the drainage channels	Weekly	Contractor	Construction Supervision Engineer, LGED
2.6	Disturbance to Existing Social Infrastructure and Services	▪ Increased road traffic may disturb the local residents ▪ Traffic jams caused by increased vehicles during construction	Evaluation of effect of construction schedule	Record of numbers construction vehicles	Project site	Continuous Record	Contractor	Social Safeguards Expert, LGED
2.7	Infectious Diseases such as HIV/AIDS	Temporary influx of migrant labor during construction may increase risk of infection	Evaluation of sanitation for labor	Labor health record	Related institutions	Twice a year	Contractor	Social Safeguards Expert, LGED
2.8	Work condition (including work safety)	Labor accidents	Evaluation of effect of the work safety plan	Record of accidents	Contractor's office	Continuous Record	Contractor	Social Safeguards Expert, LGED
2.9	Accidents	Traffic accidents	Evaluation of effect of traffic schedule	Record of accidents	Contractor's office	Continuous Record	Contractor	Social Safeguards Expert, LGED
2.10	Disturbance to Community traffic and installation of proper road signage	Traffic accidents	Evaluation of effect of the work safety plan, Evaluation of effect of traffic schedule	Records of road signage implemented, visual inspection	Along the access roads	Continuous record	Contactor	Environmental /social safeguards specialist, LGED
<b>Operation Phase</b>								

No	Environmental Issues	Significant Impact	Purpose of the Monitoring	Monitoring Method			Responsibility	
				Method of Collecting and Reporting Data	Location	Duration and Frequency	Implementation	Supervision
3.1	Air Quality	<ul style="list-style-type: none"> <li>Exhaust gas from vehicles used for mobilization of equipment and workers</li> <li>Dust from road</li> </ul>	Evaluation of effect of the mitigation measure towards air pollution	Collecting samples at the site, analyzing at the lab.	Residential area around the road	Once after one year	LGED/ Environmental Consultant	LGED
3.2	Noise and vibration	<ul style="list-style-type: none"> <li>Noise caused by vehicles moving along the road carrying passengers and goods.</li> </ul>	Evaluation of effect of the mitigation measure towards noise level	Measurement using noise level meter	Along the road and Forest area	Once after one year	LGED / Environmental Consultant	LGED
3.3	Accidents	<ul style="list-style-type: none"> <li>Traffic accidents</li> </ul>	Evaluation of effect of the work safety plan	Record of accidents and fire	Along the road	Continuous Record	LGED	LGED

## 8.2 EMP IMPLEMENTATION COST

187 The IEE prescribes the mitigation measures in order to minimize adverse impacts and to enhance beneficial impacts. Environmental monitoring plan is an important tool to ensure the implementation of mitigation measures for minimizing adverse impacts and maximizing the beneficial impacts. Environmental monitoring generates useful information and improves the quality of implementation of mitigation measures.

188 The EMP implementation cost is presented in **Table 17**.

**Table 17 EMP Implementation cost**

Sl. No	Monitoring and Management Issue	Volume/Frequency	Unit cost (BDT)	Calculation	Cost (BDT)
1	<b>Grass turfing and erosion protection</b> Turfing on approach embankment Top & slope, building compound with good quality turf supplied by the contractor of not less than 225 mm x 225 mm in dimension including leveling, dressing, placing, anchoring turf with pegs, and watering till grass is fully grown, etc. all complete as per direction of the Engineer-in-Charge. (Payment to be made only when grass is fully grown)	44,460 sqm, as identified by LGED survey	21.29 as per LGED guide	44,460 @BDT 21.29	946,564
2	<b>Dust suppression measures</b> Dust Suppression Measures like water sprinkling on aggregates/ unpaved roads, in and around the work sites.	Daily at excavation and stockpile points under construction		Lump sum	30,000
3	<b>Soil erosion and drainage congestion measures</b> Soil Erosion and drainage congestion monitoring	Monthly		Lump sum	50,000
4	<b>Waste disposal measures</b> Waste Disposal site waste disposal facility improvement as per direction of EIC.	Weekly		Lump sum	15,000
5	<b>EMP Implementation Training:</b> Providing Safety gear package like hand gloves, eye protection glasses, helmets, rubber shoes, light reflecting dress etc. all complete as per direction of EIC.	Once before commencement of construction		Lump sum	15,000
6	<b>Traffic signs and other equipment mobilization</b> Mobilization & Demobilization of Equipment during construction and Traffic management etc. all complete as per direction of EIC.	Entire project life		Lump sum	200,000
7	<b>Labour camp measures</b> Making a) Labour camp establishment b) Soak pit establishment C) water supply establishment including water filter d) electrification e) first Aid Box other facilities as per direction of the EIC.	Once before commencement of construction		Lump sum	200,000
8	<b>Tree plantation measures</b> Please strictly follow <b>Annex: Tree Plantation plan for erosion prevention</b> as guideline 1.0m Height Tree Plantation around the Hill top, Slope, Berm and Ramp side including 0.5m dia bamboo casing of 1.5m height with two bamboo sticks, nursing using fertilizer & care taking as per direction of the E-I-C. (Payment will be made after full survival of tree.)	7740 nos.	500	7740 @ BDT 500	3,870,000
9	Wastewater treatment and constructed wetland As per discussion with UNHCR, ADB and LGED environmental experts, constructed wetlands with capacity to treat wastewater with duckweed shall be installed where possible	Included in the civil works cost			
<b>Total</b>					<b>5,326,564</b>

189 The EMP implementation cost stands at BDT 5,326,564.

## 8.3 INSTITUTIONAL RESPONSIBILITIES

### 8.3.1 Oversight Body

190 The RRRC is proposed to act as the coordinator on behalf the government to execute all interventions. RRRC and ADB will conduct regular coordination meetings involving all EA/IAs, relevant stakeholders including deputy commissioner (DC), Cox's Bazar, other development partners and agencies. ADB plans to establish extended mission office in Cox's Bazar for close coordination, facilitation of sub-projects development and implementation.

191 A steering committee comprising higher officials from relevant ministries coordinated by ERD will be formed to provide necessary guidance to expedite the sub-project development and implementation. An organogram of the institutional arrangements is presented in **Figure 24**.

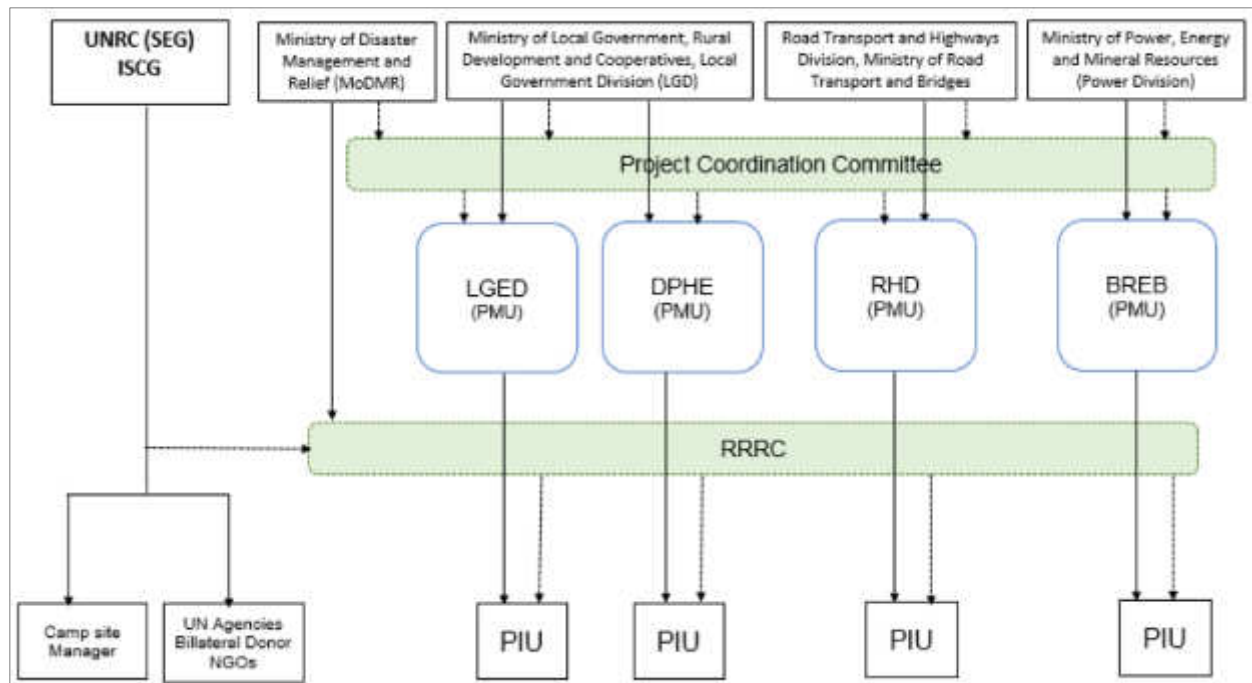


Figure 24 Project Organization Structure

### 8.3.2 Executing Agency / Implementing Agency

192 The Local Government Engineering Department (LGED), the Department of Public Health Engineering (DPHE), the Roads and Highways Department (RHD), and the Bangladesh Rural Electrification Board (BREB) will be the EA/IA for the Project. The EA/IA will coordinate environment safeguards planning and implementation and ensure that the environmental assessment and review framework is followed during subproject implementation. There will be a safeguards focal person in the

EA/IA. The EA/IA will be assisted by PMCs. Consultants will include an Environment Specialist engaged during project implementation.

### **8.3.3 Project Implementing Unit (PIU)**

193 PIUs will be formed in each of the IAs, with a dedicated safeguards focal person. PIUs will be assisted by DSC. Consultants will include Environment Specialists engaged during project implementation.

### **8.3.4 Design and Supervision Consultants (DSC)**

194 The DSCs together with the PIU, will assist in developing and updating IEEs through the conduct of the DMS in a participatory and transparent way and consistent with the ADB's environment principles and the environmental assessment and review framework. Once approved by the PMU and reviewed and concurred by ADB, the DSC will provide technical advice in the implementation of the approved IEE and EMP. The DSC will likewise provide capacity-building orientation and skills training, as needed, to concerned personnel of the PMU and PIU.

195 Together with the EA/IA and PIU, the DSC will supervise civil works activities to ensure that the contractors adhere with the terms of their contract relative to avoiding and/or minimizing environmental impacts, in addition to ensuring that contractors provide the necessary compensation and/or assistance to the affected households prior to and/or during construction activities. The DSC will assist the PIU in regular monitoring of EMP implementation

## **8.4 MONITORING AND REPORTING**

196 The PIUs, will monitor and measure the progress of EMP implementation. The monitoring activities will be corresponding with the project's risks and impacts and will be identified in the IEEs. Appendix 10 provides a content outline for monitoring reports. In addition to recording information of the work, deviation of work components from original scope, the PIUs will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

197 DSCs will submit monthly monitoring and implementation reports to the PIUs, who will take follow-up actions, if necessary. PIUs will submit the quarterly monitoring and implementation reports to the EAs/IAs. The EAs/IAs will submit semi-annual monitoring reports to ADB. Project budgets will reflect the costs of monitoring and reporting requirements. Monitoring reports will be posted in a location accessible to the public.

198 The EAs/IAs will document monitoring results, identify the necessary corrective actions, and reflect them in a corrective action plan. The EAs/IAs, in each quarter, will study the compliance with the action plan developed in the previous quarter. Compliance with grant covenants will be screened by the executing agency.

199 ADB will review project performance against the executing agency's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the Project's risks and impacts. Monitoring and supervising of environmental safeguards will be integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

- (i) conduct periodic site visits for projects with adverse environmental impacts;

- (ii) review the periodic monitoring reports submitted by the executing agency to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- (iii) work with executing agency to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
- (iv) prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

## **9 Grievance Redress Mechanism**

200 The objective the grievance redress mechanism (GRM) is to resolve complaints as quickly as possible and at the local level through a process of conciliation; and, if that is not possible, to provide clear and transparent procedures for appeal. A well-defined grievance redress and resolution mechanism will be established to resolve grievances and complaints in a timely and satisfactory manner. All affected persons will be made fully aware of their rights, and the detailed grievance redress procedures will be publicized through an effective public information campaign. The grievance redress process includes three levels:

### **9.1 FIRST LEVEL OF GRM**

201 The first level and most accessible and immediate contact for the fastest resolve of grievances are the contractors, with assistance from DSC on site. Prior to construction of any works, the PIU will ensure local community meetings are held to notify residents and businesses of any temporary disturbances, and to inform them of the Project and the GRM. If any complaints arise, the contractors, with assistance from DSC can immediately resolve the complaint on site. The contractor's and DSC's office phone number will be posted in public areas within the subproject areas and construction sites. Any person with a grievance related to the project works can contact the project to file a complaint. The contractor may seek the assistance of the DSC safeguards specialists (the environmental specialist or social safeguards specialist) to resolve the issue. The DSC safeguards (environment and resettlement) focal person will immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The DIU safeguards focal person will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location, and (v) how the complaint was resolved.

### **9.2 SECOND LEVEL OF GRM**

202 Should the grievance remain unresolved; the contractor with assistance from DSC will forward the complaint to the PIU safeguards focal person. The person filing the grievance will be notified by DSC safeguards focal person that the grievance was forwarded to the PIU safeguards focal person. The PIU will address the grievance. Grievances will be resolved through continuous interactions with affected persons, and the PIU will answer queries and resolve grievances regarding various issues including environmental or social impacts. Corrective measures will be undertaken at the field level by the PIU safeguards focal person within 7 days. He/she will fully document the following information: (i) name of the person; (ii) date complaint was received; (iii) nature of complaint; (iv) location and (v) how the complaint was resolved.

### **9.3 THIRD LEVEL OF GRM**

203 Should the grievance remain unresolved, the PIU's project director will activate the third level of the GRM by referring the issue (with written documentation) to a Grievance Redress Committee (GRC), which will, based on review of the grievances, address them in consultation with the PIU, contractor, DSC, and affected persons. The GRC will consist of Refugee Relief and Repatriation Commission (RRRC), as chairperson, EA/IA representative, camp-in-charge, and other relevant stakeholders. A meeting will be called with the GRC, if necessary, where the affected person can present his/her concern and issues. The process will promote conflict resolution through mediation. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 days. The functions of the GRC are as follows:



(i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (where required), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties' developments regarding their grievances and decisions of the GRC. The EA/IA safeguards focal person will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued, and the decisions carried out.

204 Safeguard monitoring reports will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third levels), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as affected person, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e. open, closed, pending).

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

206 Where an affected person is not satisfied with the outcomes of the 3 levels of the Project GRM, the affected person should make good faith efforts to resolve issues working with the South Asia Regional Department through ADB's Bangladesh Resident Mission. As a last resort, the affected person can access ADB's Accountability Mechanism (ADB's Office of Special Project Facility or Office of Compliance Review).<sup>20</sup> ADB's Accountability Mechanism, including information on how to file a complaint, will also be explained to affected households.

207 The grievance redress mechanism and procedure are depicted in **Figure 25**.

<sup>20</sup> Contact information on ADB's Bangladesh Mission is in <https://www.adb.org/countries/bangladesh/main>. Information on ADB's Accountability Mechanism is in [www.adb.org/site/accountability-mechanism/main](http://www.adb.org/site/accountability-mechanism/main).

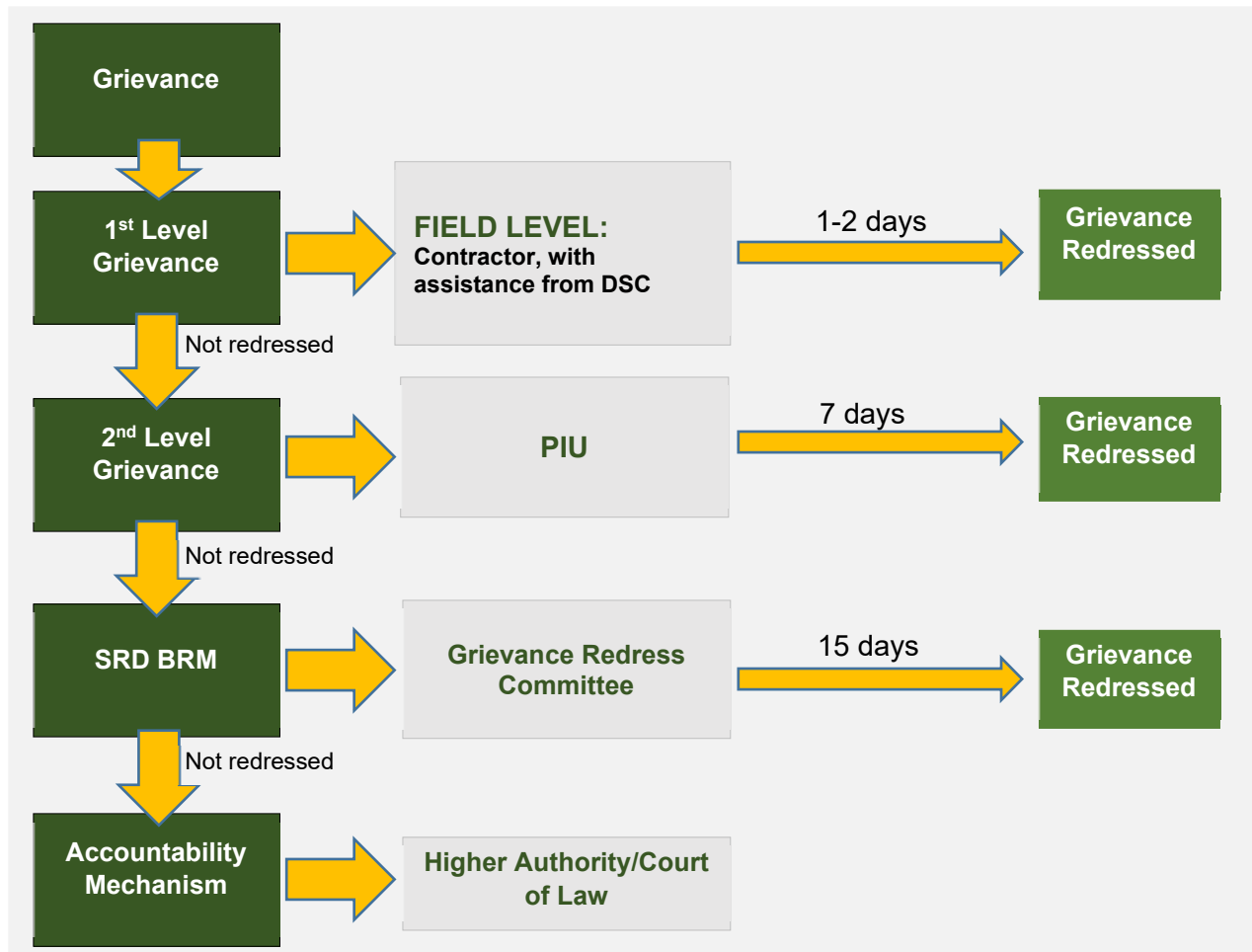


Figure 25 Grievance redress process

## **10 Stakeholder consultation and information disclosure**

### **10.1 STAKEHOLDER CONSULTATION**

210 Meaningful stakeholder consultation and participation is part of the project preparation and implementation strategy. Consultation, participation and will ensure information is provided and feedback is obtained and considered on the implementation of subprojects. Affected persons will be consulted at various stages of subproject preparation to ensure: (i) incorporation of views/concerns of affected persons, particularly the vulnerable, on environmental impacts and mitigation measures; (ii) identification of any help required by affected persons during rehabilitation; and (iv) avoidance of potential conflicts for smooth project implementation.

211 It will also provide adequate opportunities for consultation/participation of all stakeholders and inclusion of the vulnerable in subproject process. Relevant information on any major changes to the Project or subproject scope will be shared with beneficiaries, affected persons, vulnerable groups, and other stakeholders.

#### **10.1.1 Stakeholder consultation Strategy for Emergency Assistance Project**

212 At minimum, stakeholders will be consulted regarding the scope of an impact assessment before work is commenced and they will be informed of the likely impacts of the subproject and proposed mitigation once the draft IEE and EMP documents are prepared. The safeguards documents will record views of stakeholders and indicate how these have been taken into account in subproject development. Consultations will be held with a special focus on vulnerable groups.

#### **10.1.2 Key target stakeholders**

213 The key stakeholders to be consulted during subproject preparation, EMP implementation and subproject implementation include:

- (i) Beneficiaries;
- (ii) Elected representatives, community leaders, religious leaders and representatives of community based organizations;
- (iii) Local non-government organizations (NGOs);
- (iv) Local government and relevant government agency representatives, including local authorities responsible for land acquisition, protection and conservation of forests and environment, archaeological sites, religious sites, and other relevant government departments;
- (v) Residents, shopkeepers, business persons, and farmers who live and work alongside transport and education/district infrastructure which will be rehabilitated;
- (vi) Executing agency, implementing agency, PIU, staff and consultants; and
- (vii) ADB and Government.

#### **10.1.3 Public Consultation History**

214 Initial Public consultation has been carried out in the project area with the objectives of minimizing probable adverse impacts of the project and to achieve speedy implementation of the project through

bringing in awareness among the community on the benefits of the project. As part of the project consultations, efforts were made to consult with the public as well as a number of local authorities, to determine their thoughts, opinions and feedback on the impact of the proposed Shelter in their respective locations. Information and comments collected from the public early in the study process were of use.

215 Different stakeholders were consulted to give them the opportunity to express their views and concerns. As part of the process, they were also provided with relevant and sufficient information on the project prior to its start-up. These stakeholders include the central and local authorities, as well as the local population to determine their thoughts, opinions and feedback on the impact of the project. Attendees in the consultation meeting were apprised of the processes through which the project was to proceed toward implementation and the environmental impacts to arise out of such processes along with the steps to be taken toward mitigating the impacts. They were told about the impacts all of which could be easily mitigated. The audience expressed satisfaction of such mitigation measures (**Figure 26**). The public consultations were held during field visit in 19 August 2019. See participant list in **Annex 1 List of Participants in FGD**.



**Figure 26 Public consultation for the subproject**

#### 10.1.4 Findings of the Public Consultation

216 The people in the area Refugee Camp Dwellers. Most of the people were keen to know the possibility of employment in the project. There is a requirement of about 20 people during the peak period of the project. The employment is largely depending on the types of job and will be assessed on a case-to-case basis by the contractor according to needs. Findings of the public consultation summarized below (**Table 18**).

**Table 18 Summary of the public consultation**

Sl no.	Question	Answer
01	Will the people living by canals be safe during construction?	<ul style="list-style-type: none"> <li>All necessary precautions will be taken. Also, during construction the RRRC and ISCG will be informed so that they can react to any problems that may occur during excavation</li> </ul>
02	During labour recruitment, should the locals be given priority during construction?	<ul style="list-style-type: none"> <li>This largely depends on the types of job and will be assessed on a case-to-case basis by the contractor according to needs.</li> </ul>
03	People present at site suggested that the proposed road project will be beneficial to them all.	

Sl no.	Question	Answer
04	Wishes to speed up the subproject.	<ul style="list-style-type: none"> <li>It was explained that implementation would take place immediately after the rainy season.</li> </ul>

### 10.1.5 Information disclosure

217 Information is disclosed through public consultation and making available relevant documents in public locations. The following documents will be submitted to ADB for disclosure on its website:

- (iv) IEEs (including subproject EMP);
- (v) Updated IEEs (including EMP) and corrective action plan prepared during project implementation, if any; and
- (vi) Environmental monitoring reports.

218 The EAs/IAs will send a written endorsement to ADB for disclosing these documents on the ADB website. The PIUs will provide relevant safeguards information in a timely manner, in an accessible place and in a form and language understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used. Disclosure will follow ADB's Public Communication Policy, 2011.

## 11 Annex 1 List of Participants in FGD

**Emergency Assistance Project**  
 Focused Group Discussion (FGD)

Package Name: *Storm water Drainage: Canal 1 & 2*  
 Date: *17/08/2017* Time: *12:30 PM*  
 Location: *Kutubkhong Camp*  
 GPS Coordinates:

Sl no.	Participant's name	Age	Occupation	Phone no.	Signature
01	<i>Humayun Kabir Chy</i>	<i>45</i>	<i>Member</i>	<i>01819-608350</i>	<i>[Signature]</i>
02	<i>Jahangir Kabir Chy</i>	<i>41</i>	<i>Chairman</i>	<i>01819-608330</i>	<i>[Signature]</i>
03	<i>Abdul Haque</i>	<i>32</i>	<i>Member</i>	<i>01819-577757</i>	<i>[Signature]</i>
04	<i>Mafiz Miya</i>	<i>32</i>	<i>Contractor</i>	<i>01825-745262</i>	<i>[Signature]</i>
05	<i>Tawhidul Alam Tawhid</i>	<i>31</i>	<i>Businessman</i>	<i>01815-621556</i>	<i>[Signature]</i>
06	<i>Delwan Hossain</i>	<i>30</i>	<i>Businessman</i>	<i>01852900777</i>	<i>[Signature]</i>
07	<i>Shamgul Alam</i>	<i>35</i>	<i>Businessman</i>	<i>01815637189</i>	<i>[Signature]</i>
08	<i>Idris Miya</i>	<i>34</i>	<i>Businessman</i>	<i>01815621480</i>	<i>[Signature]</i>
09	<i>Ismail</i>	<i>34</i>	<i>Businessman</i>	<i>01818355046</i>	<i>[Signature]</i>
10	<i>Abdur Rahim</i>	<i>40</i>	<i>Businessman</i>	<i>01821469766</i>	<i>[Signature]</i>
11	<i>Babul Miya</i>	<i>29</i>	<i>Businessman</i>	<i>01819865481</i>	<i>[Signature]</i>
12	<i>Vulu Miya</i>	<i>36</i>	<i>Farmer</i>	<i>01821469761</i>	<i>[Signature]</i>

## **12 Annex 2 Traffic Management Plan**

### **A. Principles**

One of the prime objectives of the Contractor's **TMP** is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties; and
- (v) Addressing issues that may delay the project.

### **B. Operating Policies for TMP**

The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

- 1) Make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance.
- 2) Inhibit traffic movement as little as possible.
- 3) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
- 4) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
- 5) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
- 6) Train all persons that select, place, and maintain temporary traffic control devices.
- 7) Keep the public well informed.
- 8) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

Figure A1 to Figure A6 illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

### **C. Analyze the Impact Due to Street Closure**

Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- a) Approval from the ULB/CMC/Public Works Department (PWD) to use the local streets as detours;
- b) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- c) Determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;



- d) Determining if additional traffic control or temporary improvements are needed along the detour route;
- e) Considering how access will be provided to the worksite;
- f) Contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- g) Developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

If full road-closure of certain roads within the area is not possible, due to inadequate capacity of the detour arrangements, the full closure can be restricted to weekends with the construction commencing on Thursday night and ending on Sunday morning prior to the morning peak period. The traffic management guidelines are as follows:

- Review construction schedule and methods;
- Identify initial traffic recirculation and control policy;
- Identify routes for traffic diversions;
- Analyze adverse impact & mitigation at the detours;
- Begin community consultation for consensus;
- Finalize or determine alternate detours;
- Identify temporary parking (on and off -street);
- Discuss with CMC, owner, community for use;
- Coordinate with the Traffic Police to enforce traffic and diversions;
- Install traffic control devices (traffic cones, signs, lightings, etc);
- Conduct campaigns, publicity, and notify public about street closure; and
- Develop a mechanism to address public grievances regarding disruptors of traffic, utilities, etc.

#### **D. Public Awareness and Notifications**

As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

The PIU will also conduct an awareness campaign to educate the public about the following issues:

- a) Traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- b) defensive driving behavior along the work zones; and
- c) Reduced speeds enforced at the work zones and traffic diversions.

It may be necessary to conduct the awareness programs/campaigns on road safety during construction. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- a) Explain why the brochure was prepared, along with a brief description of the project;
- b) Advise the public to expect the unexpected;
- c) Educate the public about the various traffic control devices and safety measures adopted at the work zones;
- d) Educate the public about the safe road user behavior to emulate at the work zones;
- e) Tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- f) Indicate the office hours of relevant offices.

### **E. Install Traffic Control Devices at the Work Zones and Traffic Diversion Routes**

The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary "STOP" and "GO").

Figure A1 to Figure A6 illustrate typical set-ups for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics. The Contractor would need to consider such Traffic Management situations for these typical arrangements and others that may occur during road construction works. The Contractor would need to coordinate closely with the road management and road police authorities and submit their Traffic Management proposals, with not less than a month's prior notice, to the PIU for obtaining prior approval, before any closure of roads are considered.

- Work on Shoulder or Parking Area;
- Work with Lane Closure: Low Traffic;
- Work on Lane Closure With Yield Sign on Two Lane: Low Volume;
- Work on Lane Closure With Single Flag Operator on Two Lane : Low Volume;
- Lane Closure: Two Flag Operators on Two Lane Road; and
- Street Closure with Detour.

The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

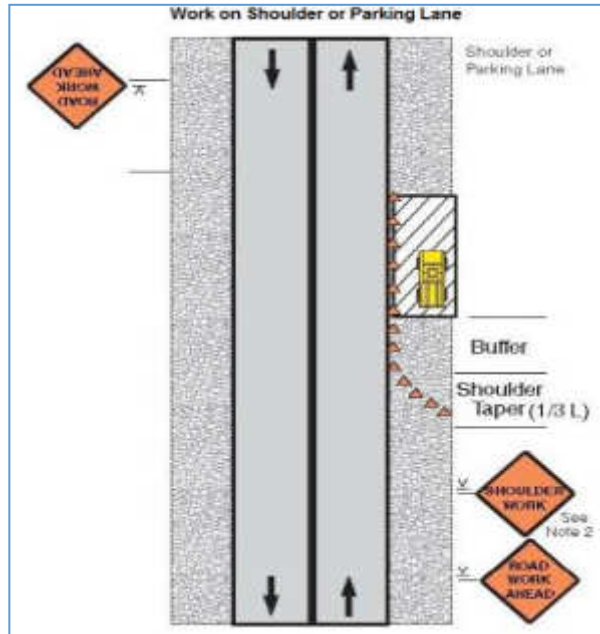


Figure A1 Work with shoulder or Parking area

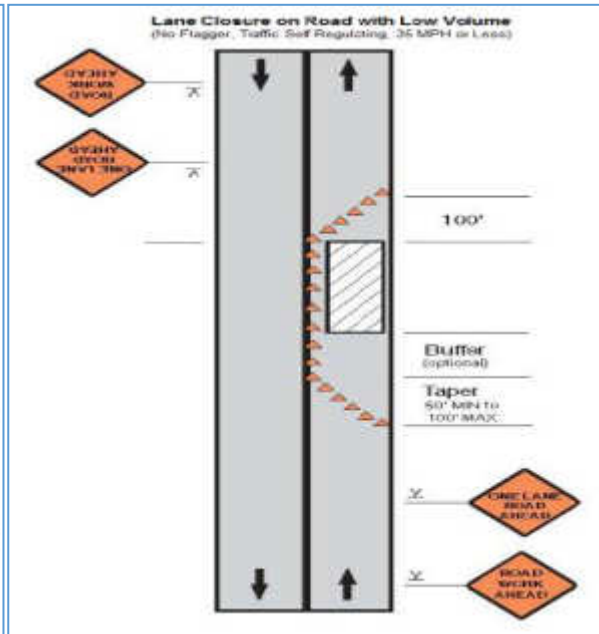


Figure A2 Work with lane closure: low traffic

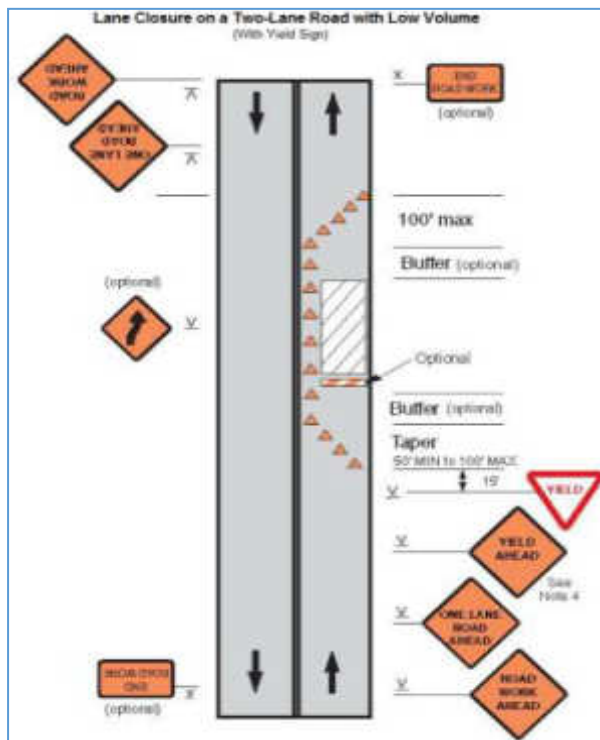


Figure A3 Work on Lane Closure with Yield Sign on Two Lane: Low Volume

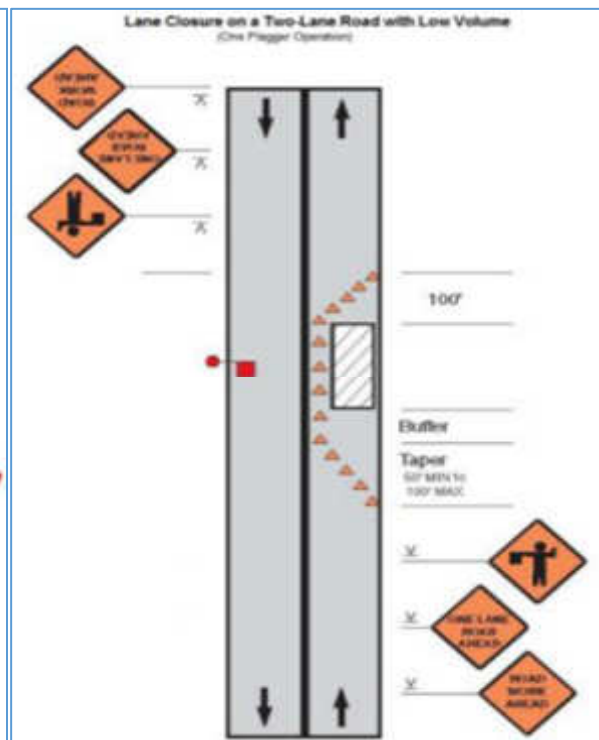


Figure A4 Work on Lane Closure With Single Flag Operator on Two Lane : Low Volume

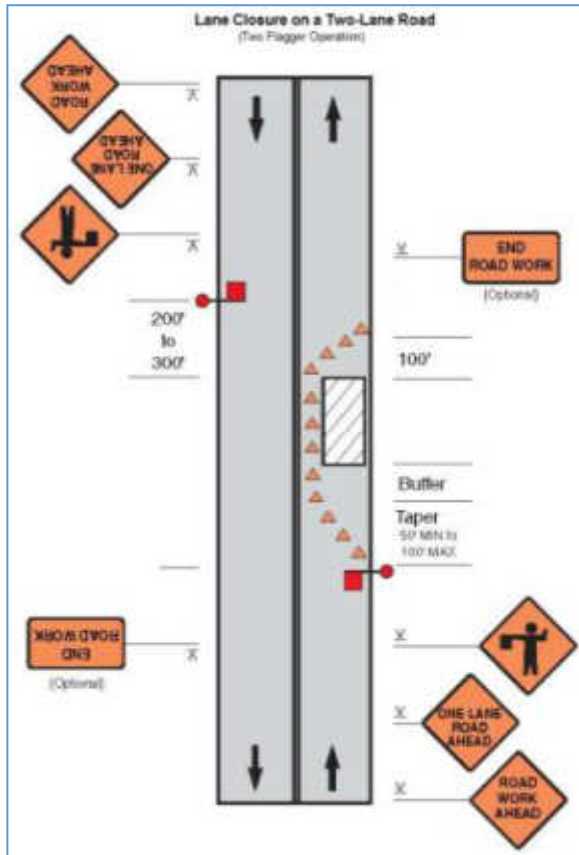


Figure A5 Lane Closure: Two Flag Operators on Two Lane Road

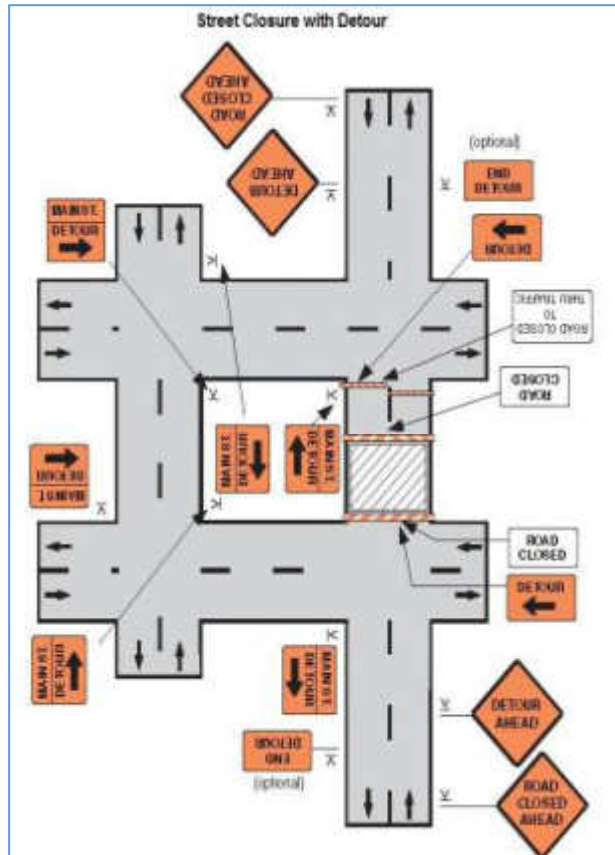


Figure A6 Street Closure with Detour

## 13 Annex 3 List of wildlife recorded in the subproject area

### MAMMALS:

SL	Scientific name	English name	Family
01	<i>Bandicota bengalensis</i>	Lesser Bandicoot Rat	Muridae
02	<i>Mus musculus</i>	Eastern House Mouse	Muridae
03	<i>Rattus rattus</i>	House Rat	Muridae
04	<i>Vandeleuria oleracea</i>	Asiatic Long-tailed Climbing Mouse	Muridae
05	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	Viverridae
06	<i>Viverra zibetha</i>	Large Indian Civet	Viverridae
07	<i>Felis chaus</i>	Jungle Cat	Felidae
08	<i>Herpestes auropunctatus</i>	Small Indian Mongoose	Herpestidae
09	<i>Canis aureus</i>	Golden Jackal	Canidae
10	<i>Suncus murinus</i>	Asian House Shrew	Soricidae
11	<i>Cynopterus sphinx</i>	Greater Short-nosed Fruit Bat	Pteropodidae
12	<i>Pteropus giganteus</i>	Indian Flying Fox	Pteropodidae
13	<i>Megaderma lyra</i>	Greater False Vampire Bat	Megadermatidae
14	<i>Pipistrellus tenuis</i>	Least Pipistrelle	Vespertilionidae
15	<i>Scotophilus heathi</i>	Greater Asiatic Yellow Bat	Vespertilionidae
16	<i>Scotophilus kuhlii</i>	Lesser Asiatic Yellow Bat	Vespertilionidae

### BIRDS:

SL	Scientific name	English name	Family
01	<i>Columba livia</i>	Rock Pigeon	Columbidae
02	<i>Spilopelia suratensis</i>	Western Spotted Dove	Columbidae
03	<i>Streptopelia decaocto</i>	Eurasian Collared-dove	Columbidae
04	<i>Streptopelia tranquebarica</i>	Red Turtle-dove	Columbidae
05	<i>Treron phoenicopterus</i>	Yellow-footed Green pigeon	Columbidae
06	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar	Caprimulgidae
07	<i>Cypsiurus balasensis</i>	Asian Palm-swift	Apodidae
08	<i>Cacomantis merulinus</i>	Plaintive Cuckoo	Cuculidae
09	<i>Clamator jacobinus</i>	Jacobin Cuckoo	Cuculidae
10	<i>Cuculus micropterus</i>	Indian Cuckoo	Cuculidae
11	<i>Eudynamys scolopaceus</i>	Western Koel	Cuculidae
12	<i>Hierococcyx varius</i>	Common Hawk-cuckoo	Cuculidae
13	<i>Ardeola grayii</i>	Indian Pond-heron	Ardeidae
14	<i>Bubulcus ibis</i>	Cattle Egret	Ardeidae
15	<i>Egretta garzetta</i>	Little Egret	Ardeidae
16	<i>Tyto alba Common</i>	Barn-owl	Tytonidae
17	<i>Merops orientalis</i>	Asian Green Bee-eater	Meropidae
18	<i>Dendrocopos macei</i>	Fulvous-breasted Woodpecker	Picidae
19	<i>Dicrurus leucophaeus</i>	Ashy Drongo	Dicruridae
20	<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae
21	<i>Corvus macrorhynchos</i>	Large-billed Crow	Corvidae
22	<i>Corvus splendens</i>	House Crow	Corvidae
23	<i>Acrocephalus dumetorum</i>	Blyth's Reed-warbler	Acrocephalidae
24	<i>Hirundo rustica</i>	Barn Swallow	Hirundinidae

SL	Scientific name	English name	Family
25	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Pycnonotidae
26	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	Pycnonotidae
27	<i>Acridotheres fuscus</i>	Jungle Myna	Sturnidae
28	<i>Acridotheres tristis</i>	Common Myna	Sturnidae
29	<i>Copsychus saularis</i>	Oriental Magpie-robin	Muscicapidae
30	<i>Motacilla alba</i>	White Wagtail	Motacillidae

**REPTILES:**

SL	Scientific name	English name	Family
01	<i>Calotes emma</i>	Forest Crested Lizard	Agamidae
02	<i>Calotes versicolor</i>	Common Garden Lizard	Agamidae
03	<i>Gekko gekko</i>	Tokay Gecko	Gekkonidae
04	<i>Hemidactylus frenatus</i>	Common House Gecko	Gekkonidae
05	<i>Eutropis carinata</i>	Keeled Grass Skink	Scincidae
06	<i>Eutropis macularia</i>	Bronze Grass Skink	Scincidae
07	<i>Sphenomorphus maculatus</i>	Spotted Litter Skink	Scincidae
08	<i>Varanus bengalensis</i>	Bengal Monitor	Varanidae
09	<i>Amphotyphlops braminus</i>	Common Blind Snake	Typhlopidae
10	<i>Lycodon aulicus</i>	Common Wolf Snake	Colubridae
11	<i>Xenochrophis piscator</i>	Checkered Keelback	Colubridae
12	<i>Naja naja</i>	Spectacled Cobra	Elapidae
13	<i>Duttaphrynus melanostictus</i>	Common Toad	Bufonidae
14	<i>Microhyla berdmorei</i>	Berdmore's Microhylid Frog	Microhylidae
15	<i>Euphlyctis cyanophlyctis</i>	Common Skipper Frog	Dicroglossidae
16	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog	Dicroglossidae
17	<i>Polypedates leucomystax</i>	Common Tree Frog	Rhacophoridae

**PLANTS:**

SL	Scientific name	English name	Family
01	<i>Pteris vittata</i>	Fern	Pteridaceae
02	<i>Microlepia speluncae</i>	Lacy Fern	Dennstaedtiaceae
03	<i>Thunbergia grandiflora</i>	Black Clock Vine	Acanthaceae
04	<i>Achyranthes aspera</i>	Prickly Chaff-flower	Amaranthaceae
05	<i>Alternanthera philoxeroides</i>	Alligator Weed	Amaranthaceae
06	<i>Amaranthus spinosus</i>	Spiny Amaranth	Amaranthaceae
07	<i>Centella asiatica</i>	Indian Pennywort	Apiaceae
08	<i>Calotropis gigantea</i>	Crown Flower	Asclepiadaceae
09	<i>Ageratum conyzoides</i>	Billy Goat Weed	Asteraceae
10	<i>Chromolaena odorata</i>	Triffid Weed	Asteraceae
11	<i>Crassocephalum crepidioides</i>	Redflower Rag leaf	Asteraceae
12	<i>Eclipta alba</i>	False Daisy	Asteraceae
13	<i>Sphaeranthus indicus</i>	East Indian Globe-thistle	Asteraceae
14	<i>Tridax procumbens</i>	Coat Button	Asteraceae
15	<i>Vernonia cinerea</i>	Little Ironweed	Asteraceae
16	<i>Bombax ceiba</i>	Red Silk Cotton Tree	Bombacaceae
17	<i>Heliotropium indicum</i>	Indian Heliotrop	Boraginaceae
18	<i>Senna occidentalis</i>	Coffee Senna	Caesalpiniaceae



SL	Scientific name	English name	Family
19	<i>Tamarindus indica</i>	Tamarind	Caesalpiniaceae
20	<i>Carica papaya</i>	Papaya	Caricaceae
21	<i>Terminalia catappa</i>	Indian Almond	Combretaceae
22	<i>Ipomoea aquatica</i>	Swamp Cabbage	Convolvulaceae
23	<i>Coccinia grandis</i>	Ivy Gourd	Cucurbitaceae
24	<i>Thladiantha cordifolia</i>	Golden Creeper	Cucurbitaceae
25	<i>Dipterocarpus turbinatus</i>	Garjan-oil Tree	Dipterocarpaceae
26	<i>Croton bonplandianus</i>	Bonplant's Croton	Euphorbiaceae
27	<i>Euphorbia hirta</i>	Snake Weed	Euphorbiaceae
28	<i>Phyllanthus reticulatus</i>	Reticulated Leaf-flaver	Euphorbiaceae
29	<i>Desmodium triflorum</i>	-	Fabaceae
30	<i>Leucas aspera</i>	-	Lamiaceae
31	<i>Abutilon Indicum</i>	Indian Mallow	Malvaceae
32	<i>Hibiscus rosa-sinensis</i>	China Rose	Malvaceae
33	<i>Malvastrum coromandelianum</i>	Coromandel Malva	Malvaceae
34	<i>Acacia auriculiformes</i>	Ear-pod Wattle	Mimosaceae
35	<i>Albizia lebbek</i>	Siris Tree	Mimosaceae
36	<i>Mimosa pudica</i>	Sensitive Plant	Mimosaceae
37	<i>Artocarpus heterophyllus</i>	Jackfruit	Moraceae
38	<i>Ficus benghalensis</i>	Banyan Tree	Moraceae
39	<i>Psidium guajava</i>	Guava	Myrtaceae
40	<i>Syzygium cumini</i>	Black Berry	Myrtaceae
41	<i>Oxalis corniculata</i>	Indian Sorrel	Oxalidaceae
42	<i>Piper betle</i>	Betel	Piperaceae
43	<i>Persicaria lapathifolia</i>	Green Smartweed	Polygonaceae
44	<i>Citrus aurantifolia</i>	Common Lime	Rutaceae
45	<i>Citrus maxima</i>	Pummelo	Rutaceae
46	<i>Laportea interrupta</i>	-	Urticaceae
47	<i>Phyla nodiflora</i>	Cape-weed	Verbenaceae
48	<i>Areca catechu</i>	Betel-nut Palm	Araceae
49	<i>Cocos nucifera</i>	Coconut Palm	Araceae
50	<i>Commelina benghalensis</i>	Blue Commelina	Commelinaceae
51	<i>Cyperus compressus</i>	Poorland Flat-sedge	Cyperaceae
52	<i>Cyperus difformis</i>	Small Flower Umbrella Plant	Cyperaceae
53	<i>Lemna perpusilla</i>	Minute Duckweed	Lemnaceae
54	<i>Bambusa balcooa</i>	Bhalku Bamboo	Poaceae
55	<i>Bambusa tulda</i>	Tulda Bamboo	Poaceae
56	<i>Chrysopogon aciculatus</i>	Love Grass	Poaceae
57	<i>Cynodon dactylon</i>	Bahama Grass	Poaceae

## **14 Annex 4 IUCN guideline for plantation in the camp**

This guideline has been prepared by the International Union of Nature Conservation (IUCN) in collaboration with UNHCR. IUCN carried out a study in August 2018 in Camp 4 of Kutupalong Extension Camp to identify suitable places for plantation, to select suitable species for plantation, and to outline management options for this plantation. Although the plantation guideline is intended for Camp 04, the generalized plantation process can be applied to other camp areas.

The following sections of this study draws the generalized plantation recommendation from the IUCN study. The original study should be cited as:

“UNHCR & IUCN. 2018. Plantation and Management Plan for Camp 4, Cox's Bazar. UNHCR, IUCN (International Union for Conservation of Nature), Dhaka, Bangladesh.” The report is available at: [https://www.iucn.org/sites/dev/files/content/documents/plantation\\_and\\_management\\_plan\\_for\\_camp\\_4\\_iucn-unhcr.pdf](https://www.iucn.org/sites/dev/files/content/documents/plantation_and_management_plan_for_camp_4_iucn-unhcr.pdf) (Accessed: November 26, 2018).

### **A. Site preparation**

Since the best time to plant is in August, the site should be well-prepared immediately for the plantations.

- The fallow forest sites with bushes of coppice shoots and weeds/grasses, shall be lightly slush, but the coppice shoots of native tree species, for example Puti jam, Kharullah, Suregada, Chatian, and Dumur should be left alone.
- Predetermine the planting position with appropriate spacing and stacking with bamboo sticks.
- On hills/hillocks, make stacking across the slopes for minimizing soil erosion.
- After stacking, make planting pit/hole of 30 cm x 30 cm x 30 cm dimension. Care should be taken to make pits in steep slopes for avoiding soil erosion and land slide. Augur may be use in those areas for making the pits.
- Put handful of decomposed cow dung and 20 g of TSP in each pit, mix well with top soil before planting the seedlings.
- For soil conservation and stabilization, only line planting of Vetiver/ Phuljaru/ Arahar should be done for minimal soil disturbance.

### **B. Planting Techniques**

#### **B 1 Spacing**

- Long-, medium- and short-rotation forest trees: 2 m x 2 m
- Shed trees: 4 m x 4 m or depending on suitable lands around homesteads

- Plants for soil stabilization with Vetiver, Phuljaru, Arahar: 40 cm x 40 cm
- Bamboo offset/seedlings/cuttings along creeks/chhara: 5 m x 5 m in alternate position

## **B 2 Plantation of seedlings**

- Distribute the seedlings according to the design of the plantations (short-, medium and long-rotation).
- Short-rotation, fast-growing species shall be planted in mix on the hill-tops.
- Slow-growing, long-rotation species shall be planted at the hill bottom and mid slope.
- Cut polybag with a sharp knife and remove it carefully so that the ball of earth does not break.
- Place the seedling with the ball of earth in the pit/ hole. Take proper care so that roots do not curl or bend in the holes.
- Make sure that root-collar region of the seedling is just below the soil surface. Tighten the soil by tramping with feet/hand around the seedlings, so that there does not remain any air-space inside the planting hole.
- In the low-lying areas, ensure that no water can stand at the root-collar zone. This may be achieved by slightly raising the soil surface in the seedling region.

## **C. Post-plantation management and maintenance**

### **C1 Weeding**

Weeding schedule is given below:

- 3 weeding in 1st year (August, October & April-May of next year).
- 2 weeding in 2nd year (July-August and May-June).
- 1 weeding in 3rd year (May-June depending on rainfall & severity of weed growth).

Note: Weeding pattern shall be circular (50 cm around the seedling/sapling) or line (50 cm all along). Complete weeding is not recommended for halting the soil erosion.

### **C2 Vacancy filling**

- If any vacancy occurs, have to fill it up at the end of the plantation programme (if rain exists).
- Priority shall be given for the same species for vacancy filling.

### **C3 Fertilizations**

- If the soil of the plantation area is fertile, generally fertilization is not essential.
- Since the camp plantation site is degraded, it needs adequate fertilizer application: Urea 30 g, TSP 20 g with a basal doze of 20 kg/ha of MP.
- Thoroughly mix full doze of TSP and half of urea with the soil of planting hole/pit.

- Apply the rest half of urea after 30-40 days of planting the seedlings (if drought starts, be careful about the application of urea).

#### **C4 Watering/ Irrigation**

- If watering/ irrigation is possible, seedlings must be benefited, and growth will be enhanced.

#### **C5 Mulching**

Mulching is useful to conserve soil moisture for the seedlings during the dry period and release nutrients after gradual decomposition.

- Mulching helps to conserve 20-25% soil moisture, thus helps the seedling further growth during dry period.
- Kitchen waste (biodegradable) and leaf-litter/grass may be used for mulching in the camp site.
- About 2" thick mulching may be given from 1-2" distance from the seedling.

#### **D. Records, Monitoring, and Evaluation**

- Make a register/plantation Journal for each site, indicating the details of plantation activities.
- Make a detailed map of the plantation indicating the ordinates, plantation type and species with topography of the site.
- Keep record of all activities, e.g. nursery raising, purchase of seedlings (species, prices and average height), field preparation and out-planting etc.
- Record the silvicultural treatments, e.g. weeding, cleaning, vacancy filling, mulching, irrigation and any damages, if happened, etc.
- Take photographs of the activities (before, during and after planting activities).
- Record the survival, height growth and diameter of the seedlings planted at each site.